IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

PRATT RETAIL SPECIALTIES, LLC, Plaintiff, v. PROAMPAC HOLDINGS INC., Defendant.	Case No.: 1:24-cv-01073-RGA **JURY TRIAL DEMANDED**

AMENDED JOINT CLAIM CONSTRUCTION CHART

Pursuant to the Scheduling Order (D.I. 23) governing this case, Plaintiff Pratt Retail Specialties, LLC ("Pratt" or "Plaintiff") and Defendant ProAmpac Holdings Inc. ("ProAmpac" or "Defendant") hereby provide this Amended Joint Claim Construction Chart for U.S. Patent No. 11,072,148 ("the '148 Patent") identifying for the Court: the terms/phrases of the claims in issue, including each party's proposed construction of the disputed claim language, with citations only to the intrinsic evidence in support of their respective proposed constructions, as well as an explanation of why resolution of the dispute makes a difference.[1] *See* D.I. 23 at ¶6.

Further pursuant to the Court's Scheduling Order (D.I. 23 at ¶6), a copy of the '148 Patent and those portions of the intrinsic record relied upon are submitted concurrently herewith:

1) U.S. Patent No. 11,072,148 ("the '148 Patent", Exhibit A);
2) U.S. Patent No. 11,072,148 Prosecution History ("the '148 Prosecution History," Exhibit B);

[1] In the parties' original Joint Claim Construction Chart (D.I. 75), the parties identified "recyclable packaging" and "emissivity" as terms at issue. *Id.* at 2. As indicated below, the parties have reached agreements on those terms, and they are no longer at issue.

3) U.S. Provisional Patent Application No. 62/614,568 File History ("the '568 File History," Exhibit C);

4) Patent Owner's Preliminary Response, *ProAmpac Holdings, Inc. v. Sigma Techs. Int'l, LLC*, IPR2025-01143, Paper 10 (PTAB Oct. 2, 2025) ("'148 POPR," Exhibit D); and

5) Declaration of Ruoxi Ma, Ph.D. in Support of Patent Owner's Response, *ProAmpac Holdings, Inc. v. Sigma Techs. Int'l, LLC*, IPR2025-01143, EX2020 (PTAB Oct. 2, 2025) ("Ma Declaration," Exhibit E).

Claim Terms at Issue

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
1	9	"outer surface"	**Proposal:** The plain and ordinary meaning, which is: an outwardly facing surface. **Intrinsic Evidence:** '148 Patent at Col. 1, lines 48-50; Col. 2, lines 65-67; Col. 3, lines 16-18; Col. 10, lines 28-31; Col. 15, lines 55-67 (Example 5), Col. 16, lines 1-16 (Example 6). Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** The plain and ordinary meaning of "outer surface."	**Proposal:** plain and ordinary, meaning "aluminum facing side" **Intrinsic Evidence:** '148 Patent at 1:15-22, 1:26-33, 1:48-54, 1:62-2:5, 2:18-27, 2:42-55, 2:63-3:22, 3:23-37, 4:20-22, 4:39-49, 6:34-38, 10:28-31, 12:27-67, Figs. 4-6, claim 9. '148 Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 11-13. '568 File History: '568 Provisional Application at [0014]. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** This term was identified by Pratt as needing construction. ProAmpac does not consider construction of this term to be necessary for resolution of any issues, including infringement or invalidity issues.
2	7, 9, 13, 14	"polymer layer"	**Proposal:** The plain and ordinary meaning, which is: a layer of polymer. **Intrinsic Evidence:** '148 Patent at Fig. 6; Col 1, lines 56-61; Col. 2, lines 30-34.	**Proposal:** "a continuous sheet of a polymer that forms a substantially uniform substrate" **Intrinsic Evidence:**

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
			Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** ProAmpac's construction is not supported by the intrinsic evidence.	'148 Patent at Abstract, 1:26-33, 1:56-61, 1:62-2:5, 2:28-34, 2:42-55, 2:63-3:11, 3:24-32, 4:20-22, 4:39-53, 6:50-51, 6:59-66, 7:66-8:60, 9:5-37, 12:27-67, 14:7-32, 16:20-27, 16:55-61, Figs. 4-6, claims 7, 9, 13, 14. '148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 10-12, 18. '568 File History: '568 Provisional Application at [0011], [0018], [0019], [0023], [0024]. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of this term impacts non-infringement. An accused product does not include a continuous sheet of a polymer that forms a substantially uniform substrate; rather, there are dots of glue between the paper layer and the aluminum layer.
3	7	"depositing an aluminum layer on the polymer layer"	**Proposal:** The plain and ordinary meaning, which is: placing an aluminum layer on the polymer layer. **Intrinsic Evidence:** '148 Patent at Col. 8, lines 44-46; Col. 17, lines 35-40.	**Proposal:** "vacuum depositing aluminum onto the polymer layer" **Intrinsic Evidence:** '148 Patent at Abstract, 1:26-33, 2:53-3:4, 3:24-34, 4:39-49, 7:31-8:38, 8:39-60, 9:5-37, 10:47-52, 12:27-43, 12:36-34; 12:51-67, 14:7-32, 16:20-27,

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
			Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** ProAmpac's construction is not supported by the intrinsic evidence.	16:39-42, 16:55-61, 17:25-29, Figs. 4-6, claims 7, 9, 14. '148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 11-12, 18. '568 File History: '568 Provisional Application at [0010], [0011], [0018], [0022]-[0024]. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of this term impacts non-infringement. In an accused product, the aluminum is attached to the paper layer using dots of glue and it is therefore not vacuum deposited onto the outer surface of the polymer layer to form an aluminum layer such that the polymer layer is in between the paper layer and the aluminum layer.
4	9, 14	"an aluminum layer deposited on the fourth surface"	**Proposal:** The plain and ordinary meaning, which is: an aluminum layer placed on the fourth surface. **Intrinsic Evidence:** '148 Patent at Col. 8, lines 44-46; Col. 17, lines 35-40. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac.	**Proposal:** "vacuum depositing aluminum onto the fourth surface" **Intrinsic Evidence:** '148 Patent at Abstract, 1:26-33, 2:53-3:4, 3:24-34, 4:39-49, 7:31-8:38, 8:39-60, 9:5-37, 10:47-52, 12:27-43, 12:36-34; 12:51-67, 14:7-32, 16:20-27, 16:39-42, 16:55-61, 17:25-29, Figs. 4-6, claims 7, 9, 14.

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
			Relevance: ProAmpac's construction is not supported by the intrinsic evidence.	'148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 11-12, 18. '568 File History: '568 Provisional Application at [0010], [0011], [0018], [0022]-[0024]. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of this term impacts non-infringement. In an accused product, the aluminum is attached to the paper layer using dots of glue and it is therefore not vacuum deposited onto the outer surface of the polymer layer to form an aluminum layer such that the polymer layer is in between the paper layer and the aluminum layer.
5	14	"the aluminum layer causes an emissivity of the recyclable packaging to be equal to or smaller than a first value of 0.10"	**Proposal:** The plain and ordinary meaning, which is: the recyclable packaging [as construed above] has an emissivity [as construed above] measurement of less than or equal to 0.10 as a result of the aluminum layer. **Intrinsic Evidence:** '148 Patent at Col. 6, lines 24-61; Claim 14. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac.	**Proposal:** "because of the aluminum layer, the recyclable packaging (not the aluminum layer alone) has an emissivity equal to or smaller than a first value of 0.10 when measured from the aluminum facing side" **Intrinsic Evidence:** '148 Patent at Abstract, 1:26-33, 1:48-54, 1:62-2:5, 2:18-27, 2:42-55, 2:63-3:22, 3:23-37, 3:57-4:3, 4:20-26, 4:39-60, 6:24-61, 7:13-24, 7:31-48, 7:49-58, 7:67-8:2, 8:15-27, 8:39-9:4, 9:47-52, 9:58-63, 10:20-31, 10:38-47, 11:47-54, 12:19-35,

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
			Relevance: ProAmpac's construction is not supported by the intrinsic evidence.	13:1-12, 13:13-26, 13:57-14:1, 16:28-38, 16:46-54, 16:65-17:20, 17:35-18:9; 18:54-57, Figs. 2, 4-6, claims 7, 8, 9, 10, 14. '148 Patent Prosecution History: Jan. 3, 2019 Application; June 25, 2020 Non-Final Rejection at 2-20; Dec. 22, 2020 Response A to Non-Final Office Action at 4-15, 18-19; Mar. 29, 2021, Final Office Action at 7; Apr. 28, 2021 Notice of Allowability at 2. '568 File History: '568 Provisional Application at [0007], [0022], [0024]; ASTM C1371 at 818-825 (also incorporated by reference into the '148 Patent). ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of this term impacts non-infringement. In an accused product, the recyclable packaging itself does not have an emissivity equal to or smaller than a first value of 0.10 when measured from the aluminum facing side.
6	7, 9	**ProAmpac Term:**	**Proposal:** The plain and ordinary meaning, which is: (Claim 7) the aluminum layer acquires an optical density (OD) of less than 0.09, indicated by	**Proposal:** The Stack Feature Term means "the entire aluminum layer becomes transparent and acquires optical density (OD) of less than 0.09."

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
		"said aluminum layer [is configured to acquire / acquires an] optical density (OD) of less than 0.09" ("the Stack Feature Term") (Claims 7 and 9) "with no visible aluminum present in a recyclable material that results from the recyclable packaging being subjected to a treatment" ("the Results Term") (claim 9) --- **Pratt Term**: "said aluminum layer [is configured to acquire / acquires an] optical density (OD) of less than 0.09 [with no visible aluminum present in a recyclable material that results	substantially all remaining aluminum in resulting recyclable material becoming substantially transparent; (Claim 9) the aluminum layer acquires an optical density (OD) of less than 0.09, indicated by substantially all remaining aluminum in resulting recyclable material becoming substantially transparent with aluminum being substantially not visible in the recyclable material that results from the recyclable packaging being subjected to a treatment. **Intrinsic Evidence:** '148 Patent at Col. 10, lines 47-67; Col. 11, lines 20-54; Col. 12, lines 5-14. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** ProAmpac's construction is not supported by the intrinsic evidence.	The Results Term means "aluminum has an optical density (OD) of less than 0.09 in a recyclable material that results from the recyclable packaging being subjected to a treatment." **Intrinsic Evidence:** '148 Patent at Abstract, 1:15-22, 1:33-45, 1:48-53, 2:5-13, 2:52-62, 2:63-3:11, 3:20-22, 3:24-49, 4:20-22, 4:39-63, 4:64-5:53, 5:54-6:9, 7:31-8:38, 9:5-57, 10:47-12:23, 12:27-67, 16:39-46, 17:40-55, Figs. 3-6, claims 7, 9. '148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 4-5, 9, 14-15, 18-19; Mar. 29, 2021, Final Office Action at 7; Apr. 28, 2021 Notice of Allowability at 2. '568 File History: Voluntary Standard for Repulping and Recycling at 3-9, 11 (also incorporated by reference into the '148 Patent). '148 POPR at 1-8, 15, 26-28, 30-32, 36-37. Ma Declaration at ¶¶51-58, 73-75. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of the term impacts non-infringement. In the accused products, the entire

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
		from the recyclable packaging being subjected to a treatment]" (Claims 7 and 9)		aluminum layer does not become transparent and/or does not acquire an optical density of less than 0.09 when it is subjected to the testing methods described in the claims.
7	14	**ProAmpac Term**: "said aluminum layer becomes fully oxidized" ("the Full Oxidation Term") "with no visible aluminum present in a recyclable material that results" ("the Results Term") --- **Pratt Term:** "said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results"	**Proposal:** The plain and ordinary meaning, which is: substantially all remaining aluminum becomes substantially transparent in a recyclable material that results. **Intrinsic Evidence:** '148 Patent at Col. 10, lines 47-67; Col. 11, lines 20-54; Col. 12, lines 5-14. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** ProAmpac's construction is not supported by the intrinsic evidence.	**Proposal:** The Full Oxidation Term means "all of the aluminum in the aluminum layer becomes transparent." The Results Term means "aluminum has an optical density (OD) of less than 0.09 in a recyclable material that results." **Intrinsic Evidence:** '148 Patent at Abstract, 1:15-22, 1:33-45, 1:48-53, 2:5-13, 2:52-62, 2:63-3:11, 3:20-22, 3:24-49, 4:20-22, 4:39-63, 4:64-5:53, 5:54-6:9, 7:31-8:38, 8:44-50, 9:5-57, 10:38-12:23, 12:27-67, 16:39-54, Figs. 3-6, claim 14. '148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 4-5, 9, 14-15, 18-19; Mar. 29, 2021, Final Office Action at 7; Apr. 28, 2021 Notice of Allowability at 2. '568 File History: Voluntary Standard for Repulping and Recycling at 3-9, 11 (also incorporated by reference into the '148 Patent).

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
				'148 POPR at 1-8, 15, 26-28, 30-32, 36-37. Ma Declaration at ¶¶51-58, 73-75. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Construction of this term impacts non-infringement. In the accused products, all of the aluminum in the aluminum layer does not become transparent when it is subjected to the testing methods described in the claims.
8	14	"placing a reflective insulation material in a pre-defined proximity with the good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good"	**Proposal:** The plain and ordinary meaning, which is: placing the recyclable packaging [as construed above] in a predefined proximity with the good, the predefined proximity being suitably chosen to provide adequate thermal insulation to the good. **Intrinsic Evidence:** '148 Patent at Col. 7, lines 13-30; Col. 18, lines 29-30 Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** The term is not indefinite.	**Proposal:** Indefinite. **Intrinsic Evidence:** '148 Patent at 2:37-42, 3:23-29, 17:25-34, 18:16-29, claim 14. '568 File History: '568 Provisional Application at [0028]. ProAmpac reserves the right to rely upon any intrinsic evidence cited by Pratt. **Relevance:** Resolution of this dispute impacts invalidity, particularly indefiniteness under 35 U.S.C. § 112 If this term is found to be indefinite, the asserted claim is invalid as a matter of law.

Claim Terms No Longer at Issue

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
1	7, 8, 9, 10, 11, 13, 14	"recyclable packaging"	**Proposal:** The plain and ordinary meaning, which is: packaging capable of being recycled. **Intrinsic Evidence:** '148 Patent at Abstract; Col. 1, lines 17-18; Col. 1, lines 26-27; Col. 1, lines 62-63. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** This plain and ordinary meaning makes clear that the packaging need only have the capability to be recycled.	**Proposal:** plain and ordinary, meaning is "recyclable packaging" **Intrinsic Evidence:** '148 Patent at Abstract, 1:15-22, 1:26-47, 1:62-2:13, 2:18-27, 2:35-37, 2:42-55, 2:42-62, 2:63-3:11, 3:23-49, 3:65-4:3, 4:20-22, 4:39-49, 4:60-63, 4:64-5:30, 5:66-6:4, 6:10-23, 9:14-21, 9:55-51, 11:29-34, 12:19-23, 14:49-16:16, 16:62-17:25, 18:34, 18:56, claims 7-11, 13, 14. **Relevance:** This term was identified by Pratt as needing construction. ProAmpac does not consider construction of this term to be necessary for resolution of any issues, including infringement or invalidity issues.[2]
2	7, 8, 9, 10, 14	"emissivity"	**Proposal:** The plain and ordinary meaning, which is: the ability of heat, received by a given surface, to radiate from the surface.[3]	**Proposal:** plain and ordinary, meaning is "the ability of heat to radiate from the surface"

[2] ProAmpac has agreed to Pratt's proposed construction based on its counsel's representations during a meet-and-confer held October 7, 2025. Pratt's counsel represented that it was seeking a construction of this term because it was concerned the jury may believe the accused products, which are paper bags, would need to have been previously recycled to meet the "recyclable packaging" limitation of the asserted claims. With that understanding of Pratt's position, ProAmpac agrees to Pratt's proposed construction. However, ProAmpac reserves the right to modify its position if a claim construction issue is later raised in these proceedings.

[3] Pratt has agreed to ProAmpac's proposed construction based on its understanding of ProAmpac's position in its Answering Claim Construction Brief. D.I. 82. That is, "'the ratio of the radiation given off by the surface of a body to the radiation given off by a perfect

Term No.	Claims	Terms	Pratt Proposal, Intrinsic Evidence, and Relevance	ProAmpac Proposal, Intrinsic Evidence, and Relevance
			Intrinsic Evidence: '148 Patent at Col. 6, lines 24-38. Pratt reserves the right to rely upon any intrinsic evidence cited by ProAmpac. **Relevance:** The '148 Patent expressly defines the term emissivity.	**Intrinsic Evidence:** '148 Patent at Abstract, 1:26-33, 1:48-54, 1:62-2:5, 2:18-27, 2:42-55, 2:63-3:22, 3:23-37, 3:57-4:3, 4:20-26, 4:39-60, 6:24-61, 7:13-24, 7:31-48, 7:49-58, 7:67-8:2, 8:15-27, 8:39-9:4, 9:47-52, 9:58-63, 10:20-31, 10:38-47, 11:47-54, 12:19-35, 13:1-12, 13:13-26, 13:57-14:1, 16:28-38, 16:46-54, 16:65-17:20, 18:54-57, Fig. 2, claims 7, 8, 9, 10, 14. '148 Patent Prosecution History: Dec. 22, 2020 Response A to Non-Final Office Action at 4-7, 9, 14-15, 18-19; Mar. 29, 2021, Final Office Action at 7. '568 File History: '568 Provisional Application at [0007], [0022], [0024]; ASTM C1371 at 818-825 (also incorporated by reference into the '148 Patent). **Relevance:** This term was identified by Pratt as needing construction. ProAmpac does not consider construction of this term to be necessary for resolution of any issues, including infringement or invalidity issues.

black body at the same temperature.'" *Id.* at 8 (quoting *id.* Ex. 7 at 211). Pratt reserves the right to modify its position if a claim construction issue is later raised in these proceedings.

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EXHIBIT A

US011072148B2

(12) **United States Patent**
Yializis et al.

(10) **Patent No.: US 11,072,148 B2**
(45) **Date of Patent: Jul. 27, 2021**

(54) **RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION**

(71) Applicant: **SIGMA TECHNOLOGIES INT'L., LLC**, Tucson, AZ (US)

(72) Inventors: **Steven Yializis**, Tucson, AZ (US); **Luke Rogers**, Tucson, AZ (US)

(73) Assignee: **SIGMA TECHNOLOGIES INT'L, LLC**, Tucson, AZ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 11 days.

(21) Appl. No.: **16/238,998**

(22) Filed: **Jan. 3, 2019**

(65) **Prior Publication Data**

US 2019/0210324 A1 Jul. 11, 2019

Related U.S. Application Data

(60) Provisional application No. 62/614,568, filed on Jan. 8, 2018.

(51) **Int. Cl.**
B32B 29/00 (2006.01)
B32B 15/085 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B32B 15/085*** (2013.01); ***B32B 5/02*** (2013.01); ***B32B 15/082*** (2013.01); ***B32B 15/09*** (2013.01); ***B32B 15/095*** (2013.01); ***B32B 15/20*** (2013.01); ***B32B 27/10*** (2013.01); ***B32B 27/302*** (2013.01); ***B32B 27/304*** (2013.01); ***B32B 27/32*** (2013.01); ***B32B 27/36*** (2013.01); ***B32B 27/40*** (2013.01); ***B32B 29/002*** (2013.01); ***B32B 29/06*** (2013.01); ***B32B 29/08*** (2013.01); ***B65D 65/403*** (2013.01); ***B65D 65/42*** (2013.01); ***B65D 81/38*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC B65D 1/0215; B32B 2439/00
USPC 53/473
See application file for complete search history.

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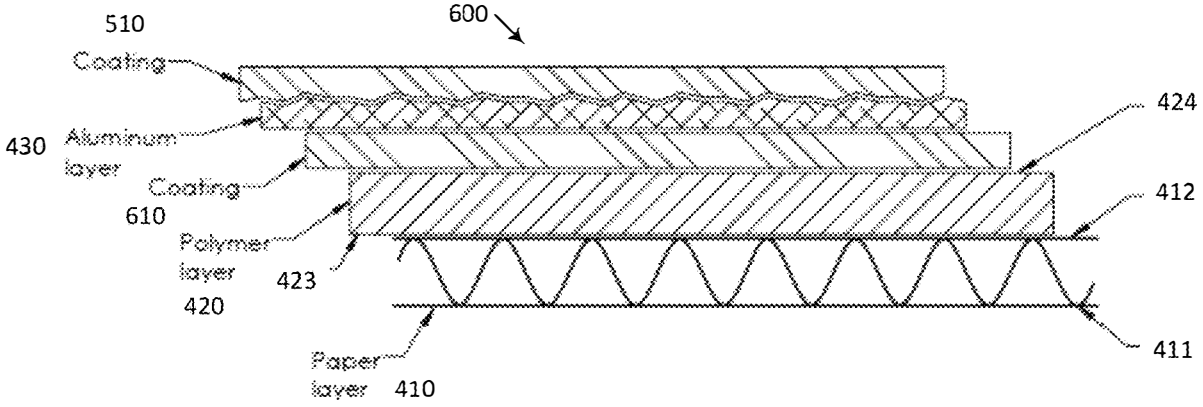
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(Continued)

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(57) **ABSTRACT**

Material for packaging—and package or receptacle made of such material—that contains a particular aluminized polymeric film with emissivity of equal to, or less than 0.10 and yet sufficiently thin to withstand and satisfy industrial requirements of the recycling process due to substantially complete oxidization of aluminum during the recycling. An optional protective coating (less than one micron in thickness) may be added to protect aluminum in the film from corrosion during the normal use of the packaging. Protective coating is configured to not raise emissivity of the aluminized surface above the 0.10 value and, at the same time, to still allow for the aluminum material it covers to be removed due to becoming fully oxidized and corroded in the heat and at humidity levels used in the recycling/repulping process. Proposed configuration permits the aluminum of the packaging material to be included in the recycled portion of the packaging material.

15 Claims, 5 Drawing Sheets



(51) **Int. Cl.**

B32B 29/06	(2006.01)
B32B 27/10	(2006.01)
B32B 27/30	(2006.01)
B32B 5/02	(2006.01)
B32B 15/082	(2006.01)
B32B 15/09	(2006.01)
B32B 15/095	(2006.01)
B32B 15/20	(2006.01)
B32B 27/32	(2006.01)
B32B 27/36	(2006.01)
B32B 27/40	(2006.01)
B32B 29/08	(2006.01)
B65D 65/40	(2006.01)
B65D 65/42	(2006.01)
B65D 81/38	(2006.01)

(52) **U.S. Cl.**

CPC *B32B 2255/06* (2013.01); *B32B 2255/10* (2013.01); *B32B 2255/205* (2013.01); *B32B 2255/26* (2013.01); *B32B 2255/28* (2013.01); *B32B 2262/0238* (2013.01); *B32B 2262/0253* (2013.01); *B32B 2262/0284* (2013.01); *B32B 2262/0292* (2013.01); *B32B 2307/30* (2013.01); *B32B 2307/732* (2013.01); *B32B 2439/00* (2013.01)

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Optical Density of Aluminum Polyester During Simulated Repulpability Test Conditions

Initial OD	After 20 min in Warm Water	After Drying 8 hours	After Drying 12 hours	After Drying 16 hours
3.00	0.93	0.33	0.03	0.03
2.00	1.50	0.33	0.03	0.03

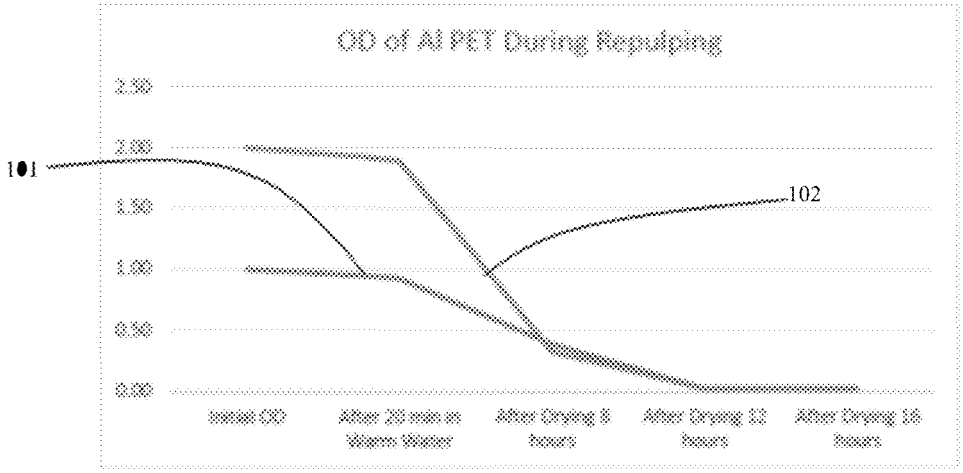


Fig. 1

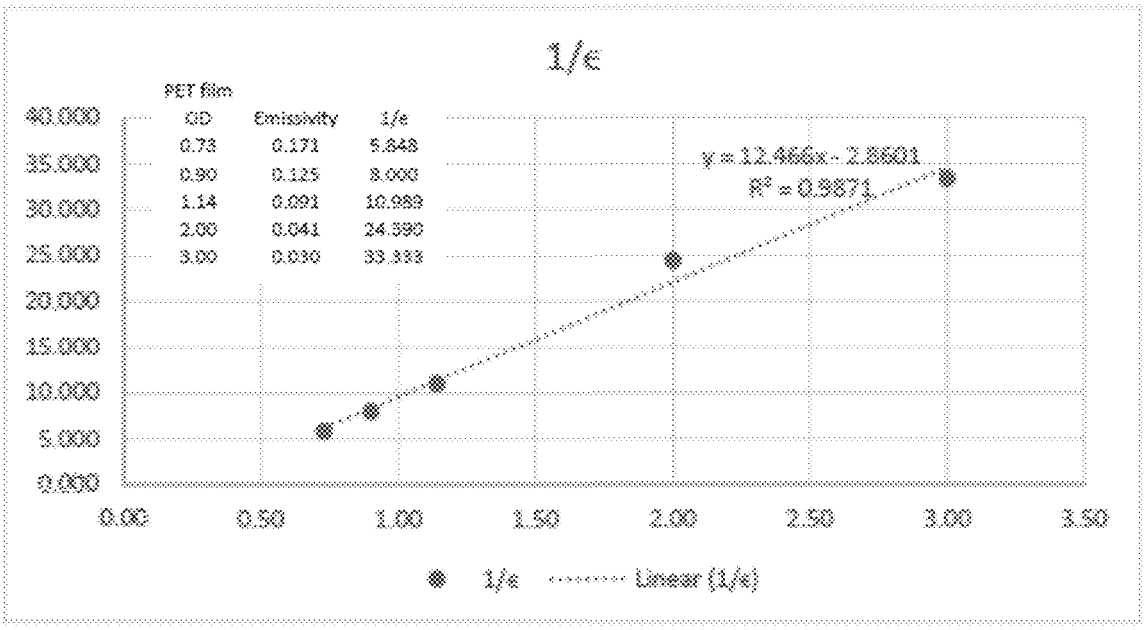


Fig. 2

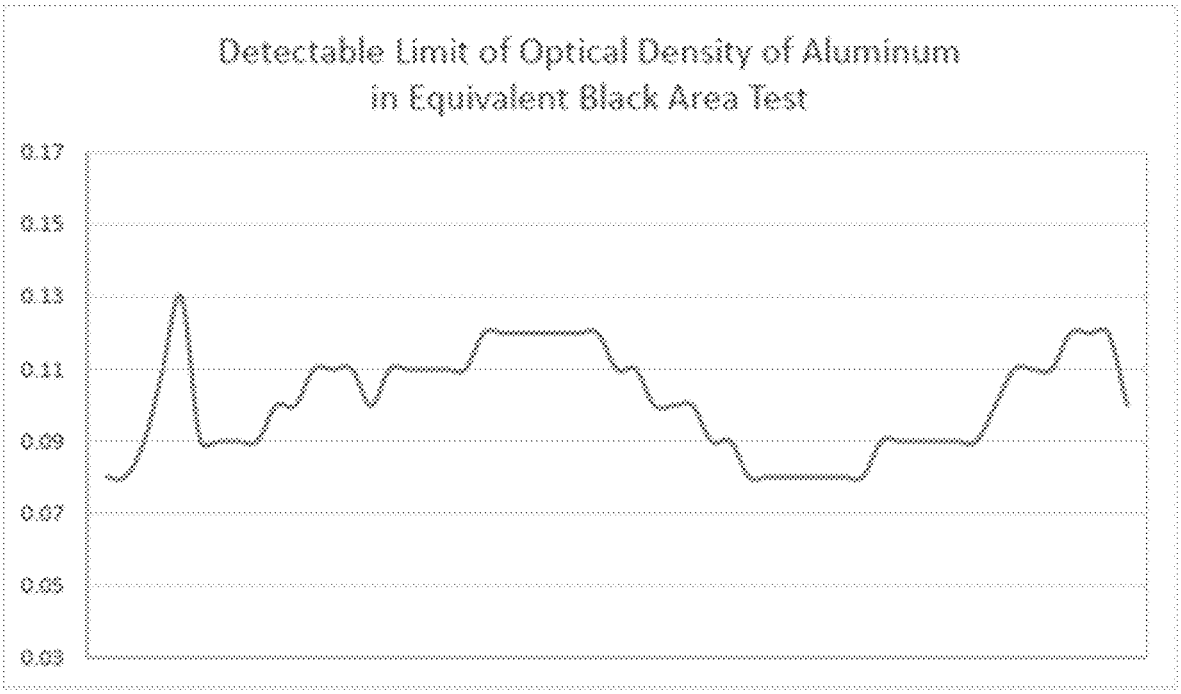

Detectable Limit of Optical Density of Aluminum
in Equivalent Black Area Test
0.17
0.15
0.13
0.11
0.09
0.07
0.05
0.03
High: 0.13
Low: 0.08
Avg: 0.10

Fig. 3

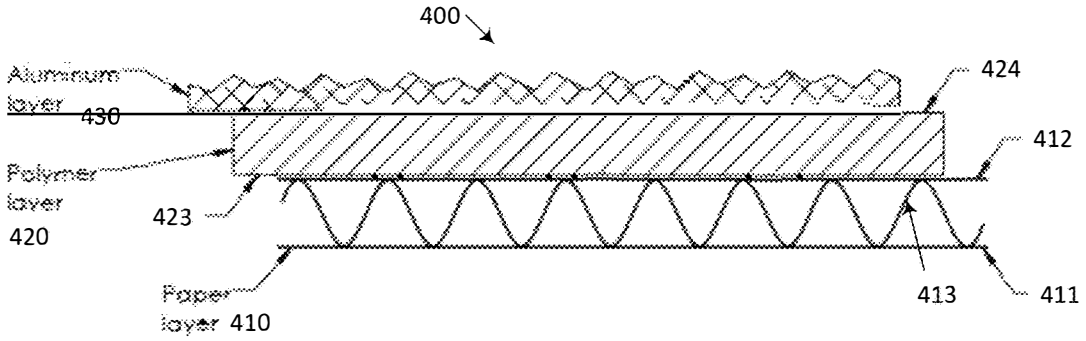


Fig. 4

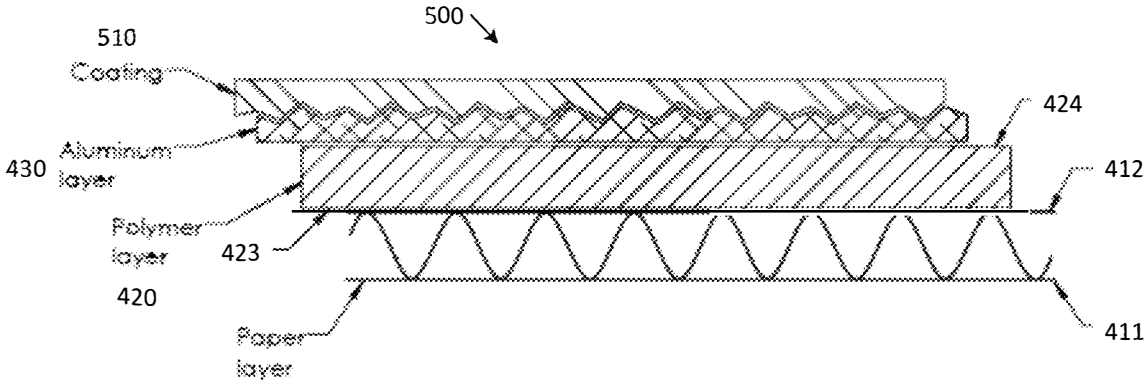


Fig. 5

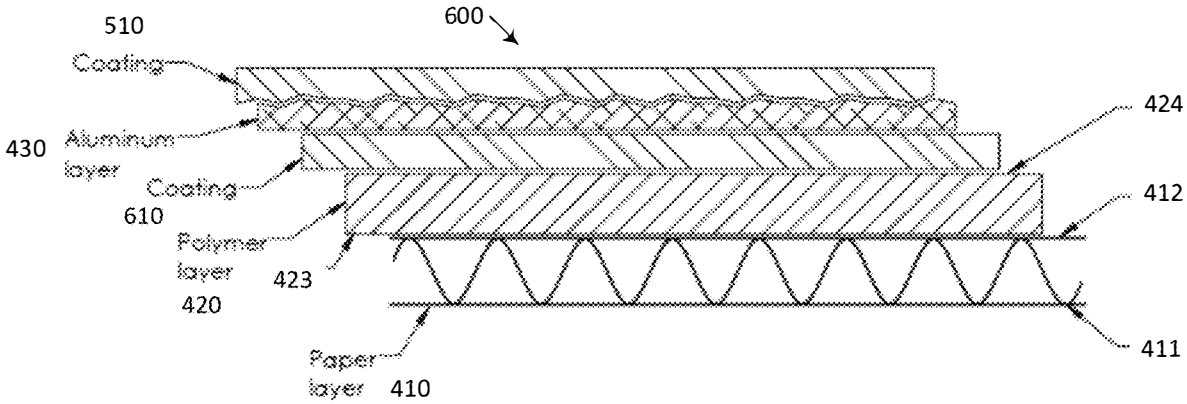


Fig. 6

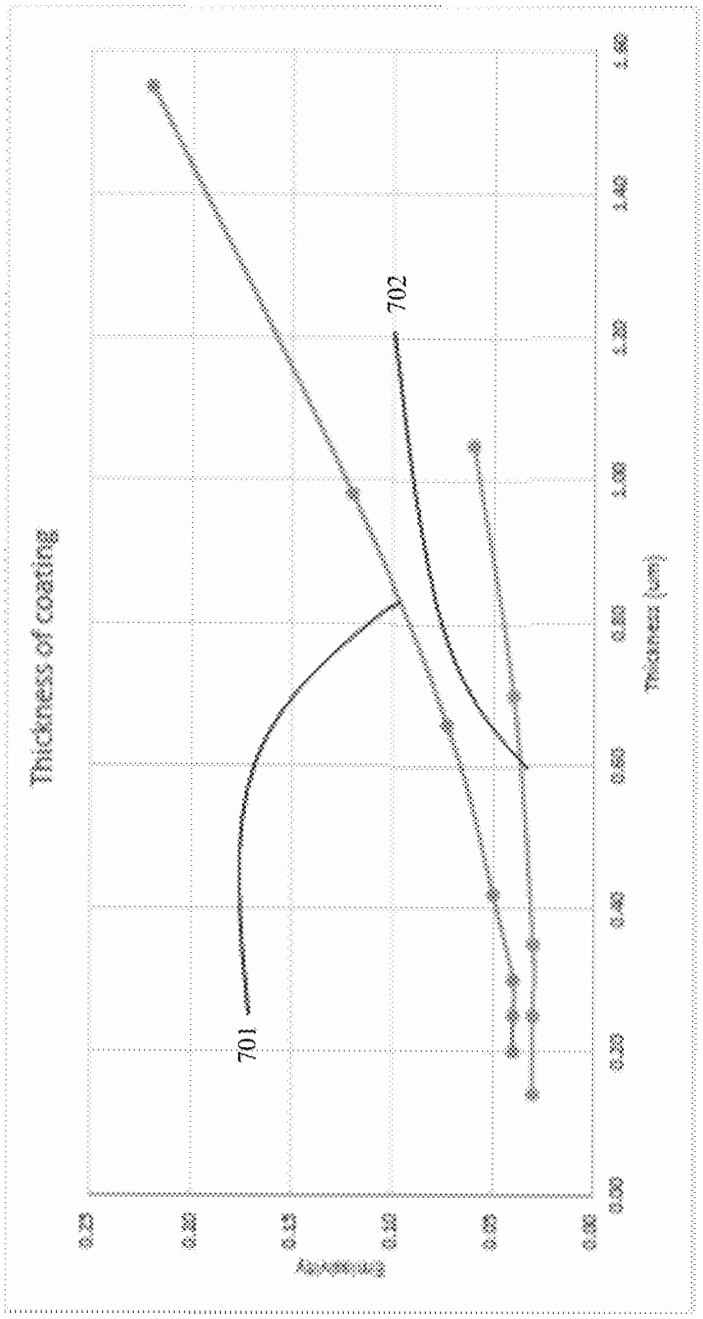
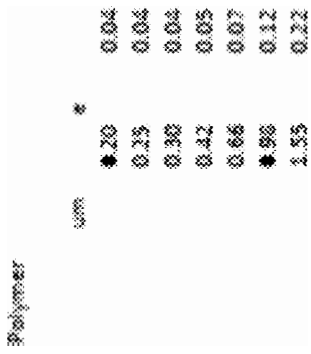

Thickness of coating
Thickness (μm)
Applications
701
702

Fig. 7


Polymer


Wax

Stickies Count on Pressed Pulp Sheets

Type of Coating Over Aluminum	# of Stickies
0.70 micron Fischer Tropsch Wax	3
1.05 micron Fischer Tropsch Wax	294
0.98 micron Thermoset Copolymer	0

Fig. 8

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

CROSS-REFERENCE TO RELATED APPLICATIONS

The present international application claims priority from and benefit of the U.S. Provisional Patent Application No. 62/614,568 filed on Jan. 8, 2018, the disclosure of which is incorporated by reference herein.

TECHNICAL FIELD

Embodiments of the present invention relate to radiant barrier insulation configured for use in paper-containing packaging, where such packaging is intended and structured to be recyclable and/or recycled as paper, and, in particular, to such radiant barrier insulation in which a radiant barrier material is used to facilitate thermal insulation in packaging intended to preserve temperature sensitive food or pharmaceutical goods.

SUMMARY

Embodiments of the invention provide a recyclable packaging that includes (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, where the third surface is affixed to the second surface; (iii) an aluminum layer deposited on the fourth surface (here, the aluminum layer has a first thickness of 200 nanometers or less to cause emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10). The aluminum layer is characterized by becoming fully oxidized with no visible aluminum present in (accepted for forming the recyclable packaging) material that results from the packaging being subjected to a particular treatment. Such particular treatment includes a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (±10) degrees F. at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F. In one embodiment, the recyclable packaging may additionally include a protective coating, over the aluminum layer, which has a second thickness of 1 micron or less. (The second thickness is defined to maintain the first value of the emissivity of the outer surface after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer caused by the treatment.) Alternatively or in addition, the protective coating may include a material selected from: wax, polymer, and lacquer. In any embodiment, the polymer layer may include a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene. In any embodiment, the polymer layer may include a material selected from film and fabric.

Embodiments of the invention additionally provide a recyclable packaging that contains (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; (iii) an intermediate coating applied to the fourth surface; (iv) an aluminum layer carried by the intermediate coating (where the aluminum layer has a first thickness of 200 nanometers or less and where the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10). Such aluminum layer is characterized by becoming fully oxidized with no visible aluminum present in a recyclable material (suitable for manufacture of the recyclable packaging) that results from the packaging being subjected to a treatment that includes a) blending in a Waring Blender; b) disintegrating into water with a British Disintegrator at about 125 (±10) degrees F. at 3000 rpm; c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes; and d) drying in an oven for 4 hours at 221 degrees F. In one implementation, the aluminum layer is disposed directly on the intermediate coating. In any implementation, the intermediate coating may have a thickness between 10 nm and 2000 nm and include a material selected from polymer and oligomer. In any implementation, the recyclable packaging may additionally include a protective coating over the aluminum layer (such protective coating having a second thickness of 1 micron or less, the second thickness being defined i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer as a result of the treatment). Alternatively or in addition, the protective coating may include a material selected from wax, polymer, and lacquer and/or the polymer layer may include a material selected from low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene. In any embodiment, the polymer layer may be configured as a film or fabric.

Embodiments of the invention additionally provide a method for thermally insulating a good within a recyclable packaging. The method includes placing a reflective insulation material at a pre-defined proximity distance from the good, where pre-defined proximity distance is chosen to provide adequate thermal insulation to the good. In one embodiment, the reflective insulation material is used to wrap or otherwise enclose the good. In any embodiment the reflective insulation material includes the recyclable packaging that contains: (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; (ii) an intermediate coating applied to the fourth surface; (iii) an aluminum layer carried by the intermediate coating, which aluminum layer has a first thickness of no more than 200 nanometers to cause an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10, and which aluminum layer becomes fully oxidized with no visible aluminum present in a material as a result of subjecting the recyclable packaging to a pre-defined treatment. The pre-defined treatment includes a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (±10) degrees F. at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F.

Embodiments further provide a method for manufacturing a recyclable packaging, the method containing steps of attaching a polymer layer to a paper layer (here, an inner surface of the polymer layer is affixed to a first surface of the paper layer); depositing an aluminum layer on the polymer

layer (with the aluminum layer having a first thickness of 200 nanometers or less and being configured to cause an outer surface of the polymer layer to have emissivity that is equal to or smaller than a first value of 0.10), which aluminum layer possesses a quality of becoming fully oxidized with no visible aluminum when the packaging is exposed to a treatment that includes: a) blending in a Waring Blender; b) disintegrating into water with a British Disintegrator at 125 (±10) degrees F. at 3000 rpm; c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes, and d) drying in an oven for 4 hours at 221 degrees F. Alternatively or in addition, the method may include a step of applying a protective coating over the aluminum layer (where the protective coating has a second thickness of 1 micron or less, and where the second thickness is defined a) to maintain the emissivity of the outer surface at the first value after the aluminum layer has been coated with the protective coating and b) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer as a result of the treatment.

Embodiments additionally provide a method for thermally insulating a good within a recyclable packaging. Such method involves placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes: —a paper layer with first and second surfaces; —a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; —an aluminum layer deposited on the fourth surface (where the aluminum layer has a first thickness of 200 nanometers or less and where the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10, which aluminum layer is characterized with a property of becoming fully oxidized with no visible aluminum present in a material that results from the packaging being subjected to a pre-determined treatment. The pre-determined treatment is defined to include a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (±10) degrees F. at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F.

BACKGROUND

A variety of thermal insulation materials are used for perishable and other temperature sensitive goods. Common types of thermal insulation include rigid and flexible foams, bags or batts of fibrous materials, and reflective insulation. Reflective Insulation is any type of insulation intended to insulate against heat gain and heat loss by reducing, reflecting, or not emitting radiant heat; this is accomplished by applying a low emissivity material, such as aluminum, to one or more surfaces. Simply incorporating a low emissivity material as part of the package could reduce the weight or dimensions of the total package, as compared for example to other types of insulation commonly used in packaging (such as foams or bulk fibrous insulation). However, current methods and applications of low-emissivity material impairs the recyclability of the total package, which understandably causes problems in related industries. Thus, there is a need for low-emissivity packaging material that is fully recyclable.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood by referring to the following Detailed Description of Specific Embodiments in conjunction with the not-to scale Drawings, of which:

FIG. **1** is a graphical representation of the variations of optical density of Aluminum Polyester as a function of time, during simulated repulpability test conditions.

FIG. **2** shows graphical and tabular representations of emissivity of Aluminum Polyester (PET) film as a function of the initial optical density of the film.

FIG. **3** is a plot of the detectable lower limit of optical density of Aluminum in an Equivalent Black Area (EBA) test.

FIGS. **4**, **5**, and **6** show various layers and combinations of layers of the fully recyclable low-emissivity packaging material.

FIG. **7** presents graphical and tabular representations of changes in emissivity values for different types of coatings (Polymer, 201; Wax, 202) in relation to the thicknesses of such coatings.

FIG. **8** contains plots illustrating changes in emissivity figure(s) as a function of thickness of protective coating layer(s) made of itemized materials.

The sizes and relative scales of elements in Drawings may be set to be different from actual size and scales to appropriately facilitate simplicity, clarity, and understanding of the Drawings. For the same reason, not all elements present in one Drawing may necessarily be shown and/or labeled in another.

DETAILED DESCRIPTION

Embodiments of the invention address the problem(s) caused by inability of the related art to fully recycle a low-emissivity packaging material, and solve such problem(s) by using a specifically structured packaging that contains a particular aluminized polymeric film characterized by emissivity of equal to, or less than 0.10, yet is thin enough such that when the packaging material is subjected to the recycling process, what little amount of aluminum is present is "crumbled" and fully oxidized (and, as a result, does not affect the recyclability of the packaging material as a whole). Such specifically-structured aluminized polymeric film may have an optional protective coating (which would be generally less than one micron in thickness) to protect the aluminum in the film from corrosion during the use of the packaging. However, this protective coating is judiciously configured to not raise the emissivity of the aluminized surface above the 0.10 value and, at the same time, to still allow for the aluminum material it covers to be removed in the repulping and recycling process such that the aluminum material in the stack of materials of the packaging is factually fully oxidized and corroded in the heat and at humidity levels used in the recycling process. It is this specific configuration that permits the aluminum of the packaging material to be included in the recycled portion of the packaging material.

Repulping is the first stage in paper recycling. Features of the method employed for testing the repulpability of a paper-based containers are summarized in Part I of the document titled "The Voluntary Standard For Repulping and

Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", published by the Fibre Box Association (available at fibrebox.org), the disclosure of which is incorporated herein by reference for all purposes. This test method is recognized in related industry—and, in particular, by the Fibre Box Association and Corrugated Packaging Alliance—and represents the commonly-used test, the exposure of a given container or packaging to which is required to be able to determine whether such given corrugated container or packaging can be classified as repulpable or recyclable. The first part of this test method addresses repulpability. In particular, a sample/portion of the container is blended in a Waring Blender and disintegrated into water with a British Disintegrator at 125 (±10) degrees F. at 3000 rpm, and separated in a 0.01" screen with a 1 inch water head for 20 minutes. The specimens of the resulting material are then dried in an oven for 4 hours at 221 degrees F. to remove water. The dried weights (of what passes through the screen after such a treatment) is compared to rejects (or what is rejected by the screen). The material that passed through is considered/defined to be repulpable, implying that such material can be used, according to industrial standards, to be reused/remade into paper at a mill. At the same time, the rejects that are left behind by the screen are considered to be the unusable waste and, generally, are rejected and sent to the landfill or otherwise disposed of. It is well recognized that in order for the container material to pass the first stage of this test, a portion of at least 85 weight-% of the total, overall amount of the initial container material has to be classified as repulpable.

The second stage of the test involves the use of the accepted pulp for making paper. Here, using a Carver press at 350 degrees F. at 500 psi, the accepted pulp (sometime referred to as "accepts") is pressed together to form hand sheets, and the excess moisture is blotted away. Then several (often—three) hand sheets of the so-formed new paper are inspected for defects or "spots". This inspection is aided by TAPPI-developed test methods. TAPPI is a registered, not-for-profit, international Non-Governmental Organization, see tappi.org, involved in research and development in the fields of pulp, paper, and packaging (such as corrugated fiberboard, flexible packaging, lamination, adhesives, coatings and extrusion). This organization, among other things, develops and provides industry standards and test methods. Guidance for identifying spots include assessment of visually-recognizable discoloration (according to TAPPI T-537 and TAPPI T-563, incorporated herein by reference and available at tappi.org/Publications-Standards/Standards-Methods/), and assessment of physical adhesion of a spot to pulp caused by melted plastic or "stickies" (according to TAPPI T-277, also incorporated herein by reference and available at tappi.org/Publications-Standards/Standards-Methods/).

For example, if a small amount of dirt or aluminum foil comes through the paper and makes its way into the pulp during the repulping phase, it could be made into paper, but could at the same time leave the paper with visual blemishes, and would be a cause for rejection of the final paper product. Alternatively, if a polymeric coating disposed over a paper layer is adhered to the pulp and makes it through the filter with the pulp during the repulping phase (in either a liquid form or in small enough pieces, for example), such piece of polymeric coating would be re-softened or re-melted in the paper-making process and could cause "sticky" areas or portions (referred to as "stickies"), in the newly-formed paper, that affect the physical properties of such paper. It is known in industry that for the newly-formed paper to be accepted and the final product to be considered recyclable according to this test, no more than 15 of either kind of spots can be present (when visually observed) in an area that is equal to or greater than 0.4 square mm. An inert material that is both visually transparent (therefore resulting in no visually-recognized defects) and that does not adhere to paper material at 350 degrees F. (thereby preventing the formation of sticky areas in the mater material) would not be a cause for rejection, according to such test.

Notably, practically all perishable or temperature sensitive goods shipped in small volumes are shipped with the use of corrugated cardboard boxes, which are easily and commonly recycled. According to the "Advancing Sustainable Materials Management: 2014 Fact Sheet", for example, published by the EPA (and available at epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management), cardboard boxes were recycled at a rate of 89.5%, whereas PET plastic bottles were recycled at a rate of 31.2%, and HDPE plastic bottles were recycled at a rate of 29.5%, with other plastic materials being recycled at lower rates. In practice, few insulating products are as easy to recycle as a corrugated cardboard box.

For the category of insulating products referred to as reflective insulation or radiant barrier, the thermal performance is highly dependent on the surface emissivity. Emissivity represents the ability for heat, provided by a given surface, to radiate from the surface into an adjacent air space. As used herein, the term emissivity (of the surface of a material) is generally referred to the effectiveness of such surface in emitting energy as thermal radiation, that is as the material's ability to emit energy as IR radiation (and not visible light), in the range between about 700 nm and about 1 micron wavelengths. Emissivity is commonly measured according to the test method discussed in ASTM C1371 (available at astm.org/Standards/C1371.htm and incorporated herein by reference), for example with the use of a tabletop portable emissometer. The value of emissivity is stated as a number between 0 and 1, where 0 represents the case of emission of no radiant heat and 1 represents the case of emission of all radiant heat from a given surface. The higher the emissivity value, the more heat is emitted; and the lower the emissivity, the less heat is emitted. For the purposes of the product comparison, the emissivity of typical brown paper used in corrugated cardboard boxes has a value between 0.80 and 0.90, aluminized paper has an emissivity value between 0.10 and 0.50, aluminum foil or aluminized film with a polymeric film applied to both sides of such film has emissivity between 0.20 and 0.70, and aluminized polymeric film without any protection over the aluminum has emissivity between 0.03 and 0.05. When insulating an object with a low emissivity surface facing the air space, the lower the emissivity of the surface, the better quality of the insulation. The ASTM C1313 (available at astm.org/Standards/C1313.htm and incorporated herein by reference) is the industry standard specification for a radiant barrier, and defines a radiant barrier as a material having an emissivity of 0.10 or less, used in the construction of an insulating system. (There currently appears to be no maximum value of emissivity for a material to be called a reflective insulation.)

The sizes of the air spaces, formed during the insulation of a given workpiece or good, also makes a difference for the quality of insulation of the workpiece of good. During the propagation of heat flow through a given air space, a certain percent of heat travels (is transferred) with moving air (or via convection), and a certain percent of heat propagates in

the form of infrared radiation. When the heat is transferred downward, convection is minimized and the predominant means of heat transfer is radiation. In this case, the larger the air space between the packaging and the good, the better the quality of insulation. Circumstances change, however, when the flow of heat is directed upward or sideways, as convection in this case has a greater impact. In these cases, practical balance must be found in that a sufficiently large air space (between the container or wrapper and the workpiece or good, which this container/wrapper protects) should be identified the size of which is, nevertheless, is judiciously limited to not allow for easy air movement inside the air space. In Chapter 26, Table 3 of the Handbook of Fundamentals by America Society of Heating, Refrigerating, and Air0Conditioning Engineers, or ASHRAE (available at ashrae.org/technical-resources/ashrae-handbook/ashrae-handbook-online), which is incorporated herein by reference, insulation values are provided for differently sized air spaces (ranging from ½ inch to 3.5 inches) and at different temperature settings, with surfaces of varying emissivities (from 0.03 to 0.82). In Table 1 of that document, surfaces with emissivities of 0.05 and 0.20 are given as examples of "reflective" and 0.90 is called out as an example of "non-reflective" surfaces. According to ASHRAE, a ¾ inch air space has a greater overall insulation value than a ½ inch air space for upward and sideways heat flow, but at 1 inch of space the insulation value diminishes. When it comes to insulated packaging and shipping, air spaces may conceivably be smaller than ½ inch, and multiple insulated liners could be used.

A person of skill in the art will readily recognize that a variety of different products may be used to reduce the emissivity of a given surface. The use of aluminum foil, for example, is a common approach, as aluminum foil is relatively inexpensive. Aluminum foil has very low mechanical strength, but is easy enough to handle when laminated to paper. In the lamination process, a foil with thickness of 6 to 18 microns is commonly preferred in industry (as at these thicknesses, the aluminum foil has some protection against oxidation and corrosion when exposed to high heat and moisture). Aluminum oxide develops on the outermost layer of the foil, but only in a "skin layer" of it—down to tens of nanometers at the thickest—and typically does not propagate deeper into the body of the foil. As a result, after the initial value of the foil's emissivity (of 0.03 to 0.05) increases to about 0.08 to 0.12, the value of emissivity of the oxidized surface of the aluminum foil remains relatively constant and stable.

Another industrial test, ASTM D3310 (the description of which is available at astm.org/Standards/D3310.htm and is incorporated herein by reference), is used to test resistance of a material to corrosion, and is specifically called out as the preferred test for a radiant barrier per ASTM C1313. (Emissivity testing after corrosion resistance testing is one method of testing, but the ASHRAE Handbook, Chapter 26, Table 2, specifically calls out a few specific surfaces and materials, including bright aluminum foil as having an emissivity of 0.05 and aluminum sheet as having an emissivity of 0.12.) A recognized disadvantage to using an aluminum foil in an insulating packaging container is that the aluminum foil is very difficult to remove from the paper if such a container is to be repulped or recycled. In particular, the aluminum foil is so soft that it can and often does break apart or crumble, and its crumbs or particles make their way into the paper pulp.

The use of aluminized paper is considered to be another approach. Here, using a vacuum deposition process, such as sputtering or electron beam evaporation, a low emissivity aluminum layer is applied to a paper. Since the amount of aluminum applied using this method is miniscule (200 nanometers or less in thickness), the weight of the aluminum layer is insignificant compared to the weight of the paper products. Therefore, it is generally assumed that when aluminized paper is submitted for repulping, it is easily able to meet the requirement that at least 85% is made into usable pulp, and that the exact weight of the aluminum is practically unmeasurable in the confines of the repulpability test. Since these papers may generally contain clay coatings, lacquer coatings, printed inks, and other materials that could contribute to a failure from "spots" or "stickies" in the recyclability test, the ratio of non-paper to paper products is minimized, aluminum included. Since the paper generally does not have a smooth, planar surface, the emissivity of the paper surface does not reach as low a value as that of aluminum foil. Depending on the type of paper, the amount of moisture in the paper, roughness of the paper surface and some other factors, we measured the emissivity of aluminized paper samples to be between 0.50 and 0.10. In fact, ASHRAE lists "Aluminum coated paper, polished" as having an emissivity of 0.20. Understandably, lower values of emissivity are always preferred for reflective insulation, and a range in emissivity values that large, and with emissivity values still not qualifying it as a radiant barrier, aluminized paper leaves much to be desired. Combined with the fact that paper naturally contains a certain amount of moisture and that the aluminum may be uncoated or unprotected, the aluminized paper remains susceptible to corrosion in the presence of steam or condensation, which may occur in the normal use of packaging perishable goods. All in all, while aluminized paper may arguably present a better (from the point of view of repulpability and recycling) option than paper with aluminum foil laminated on it, the operational properties of the aluminized paper are substantially sacrificed to achieve such improved repulpability/recycling properties.

Yet another material that can be considered to achieve low emissivity is a metalized polymeric film. Notably, because such film is not paper itself, it simply cannot be repulped for paper recycling, and instead must be separated from the paper to which it is affixed, beforehand, to allow the remaining paper portion to be recycled. The aluminum or other metal can be applied to a film by vacuum deposition, like sputtering or electron beam evaporation (by analogy with the process of formation of the aluminized paper), but the higher figure of flatness of the surface of the film facilitates the achievement of lower emissivity value even at thicknesses of metallic material of 200 nanometers or less. For example, it was empirically shown in one of our studies that the aluminized polyethylene terephthalate film can achieve an emissivity value of 0.03, while the aluminized low density polyethylene film can achieve an emissivity value of 0.05. The advantage of using a polymeric film for intended purposes is that such film contains little to no moisture, can be coated onto the chosen surface prior to metallization to further smooth the surface, and the metallic material can even be further covered with a coating or film after metallization to further protect it from corrosion. A light top coating, less than one micron, may increase the emissivity over the level of 0.03 but still keep it below 0.10, while a thick 6 micron to 24 micron polymer film laminated over the aluminum can increase the emissivity to 0.20 to 0.70 (depending on the film thicknesses and types of polymers). (As a comparison, plain brown kraft paper has an emissivity of 0.80, and regular glass has an emissivity of 0.84.) If a

metalized film is going to be coated for corrosion protection though, the coating must be thin enough for it to not absorb significant radiant heat and significantly increase the emissivity.

There are a few metalized film products on the insulated packaging market. One such product is a low density polyethylene bubble packaging material with an aluminized polyethylene terephthalate film facer on one or both sides, making an insert, pouch, or envelope to contain perishable goods. One challenge with this product is that it is a mixed polymer. The Society of the Plastics Industry (SPI) Resin Identification Code and ASTM D7611 (available at astm.org/Standards/D7611.htm) put mixed polymers in the category of "other", numbered with a 7. Blue Apron explains says their bubble liner is "fully recyclable" but as a category 7, would be very difficult to recycle and would often be excluded from recycling streams altogether, ending up in the landfill. It can vary by the community to community whether or not it can be collected and how it can be handled. The State of California has a "CA Cash Refund" program in place to take such items, but other states do not.

An example of a product that advertises sustainability and uses a reflective insulation is a box liner called "northbox" made by Cascades Inc. Each wall of the liner includes two aluminized layers, each between two layers of polymeric films, with each of those polymeric film/aluminum/polymeric film layer structure separated by a honeycomb paper structure, and the entire assembly is inserted into the shipper box. The Cascades Inc. describes the reason for applying a polymeric film to both sides of the aluminum as "eliminating the risk of crumbling in the pulp during the recycling process", similar to the problems incurred with aluminum foil/paper laminates described above. As was already alluded to above, however, thin aluminum is especially vulnerable when exposed to water and humidity and corrodes easily if not adequately protected. The polymeric film on both sides of the aluminum serves dual purposes of both preventing the aluminum from crumbling off and getting into the pulp in the recycling process, and preventing corrosion that might occur with an unprotected aluminized film in use during the life of the packaging product. A benefit to the "northbox" product is that it is described as being "pulper-safe" and is illustrated in the Cascade's literature as the film/aluminum/film assembly being fully removed in the pulping process without the aluminum ever making its way into the pulp. There are two problematic issues with a Cascade's product and similar products, however. First, the polymeric films used to protect the aluminum dramatically increase the emissivity, resulting in a product that—while being reflective to visual light—is not nearly as heat-reflective as bare aluminum, and simply does not qualify as a radiant barrier. Second, the films add additional plastic weight, which when processed at the paper recycling mill, is additional waste destined for the landfill instead of being repulped. The ratio of weight of paper to weight of non-paper in a product is one factor in determining if a product can be called repulpable or recyclable as paper.

When a radiant barrier/reflective insulation is to be repulped and recycled as paper, the preferred/ideal product or material from which such radiant barrier/reflective insulation is made would be one in which:

The emissivity of at least one surface is 0.10 or less for optimum performance;

The aluminum present in the preferred material is prevented or protected from corrosion or otherwise unlikely to corrode in normal use, where the normal use is defined as the conditions that the product could reasonably be expected to be subjected to during shipping. For example, if the material is on the inside of a cardboard box and the goods being insulated are within that box, the normal use would be having that box ship across the country. Whereas, if the material is not on the inside surface of the box, but instead located as an insert within the box, then the outside box may provide additional protection from the elements, from temperature variations, from humidity, etc. If the material is instead configured as a mailer or envelope, then it may not be protected as well as if it were in a box.

The process of protecting the aluminum in the material or product does not result in excess ratio of the weight of the protective layer to paper, so as to more easily meet the 85%/15% ratio of repulped material to rejected material when tested according to the "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" repulpability test. Additionally, the protective layer should be sufficiently thin to maintain the desired emissivity of the aluminum surface of the material, and be sufficiently thick to prevent oxidation of the aluminum surface during normal use of the packaging, but does not impede oxidization of the aluminum surface as a result of the treatment. The amount of protection the protective layer or coating needs to provide will depend on the products normal and expected use. Overall, the protective coating needs to ensure that the outer surface of the material used for packaging maintains the required emissivity;

Any material that does make it through the repulping process is able to be made into paper without excess "spots" or "stickies" per "The Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" recyclability test.

While flakes, specs or spots of reflective material would certainly contribute to a product's disqualification in the recyclability portion of the test, we discovered surprisingly that the use of a very thin coating over the aluminum as protection against corrosion (as opposed to the use of an aluminum foil or a aluminized layer encapsulated within polymeric film) allows to maintain the low level of emissivity while offering the protection against corrosion and, at the same time, minimizing the weight of a portion of the material that is unable to be made into usable pulp. Because the thickness of the aluminum used in an embodiment of the invention is so thin, any aluminum that does make it into (is processed into) the accepts portion produced by the repulping process ends up being fully oxidized and corroded in the heat and humidity levels used in the process. Aluminum oxide is visually transparent, when observed with the human eye (that is, substantially not visible or not visually-perceivable), and thus, for the purposes of this disclosure and the claims, the aluminum is considered fully oxidized when the aluminum is substantially transparent instead of silver-colored, for example. Using an optical densitometer, the optical density of the aluminum can be measured. Optical density is a measurement of transparency/opacity of the material, and is often defined as the logarithmic ratio of the radiation incident on the material to the radiation transmitted by the medium (at a given wavelength). Since aluminum oxide is transparent and un-oxidized aluminum has varying opacity depending on its thickness, the aluminum is considered to be transparent, for the purposes of this disclosure, when the optical density (OD) is less than 0.09. This

threshold value was determined based on the following observations. Bright white paper or pulp, which would result in aluminum sticking out the most, had a maximum of 253 lumens, a minimum of 219 lumens, and a mode of 248 lumens. According to TAPPI T-563, the software will count as a spot anything darker (lower) than 30 lumens below the chosen mode. This means that while darker areas may be detected, they are not counted if they are close enough in optical properties to the background. In this case, 30 below the mode would be 218 lumens.

In one case, a sample of bright white paper with a gradient of aluminum (analyzed according to TAPPI T 563) had a brightness of a maximum of 251 lumens, a minimum of 168 lumens, and a mode of 247 lumens. This sample allowed the software to plot a curve of the areas 30 below the mode. By looking at the curve on the identical film sample, we could determine that the average optical density across the curve was 0.092. Since the accuracy of the a typical optical densitometer is limited at about 0.001, the performed measurements allowed us to conclude with confidence that the optical density of aluminum required to pass the TAPPI T 563 test should be less than OD 0.09.

Contrary to the prevailing, in related industry, opinion that an aluminum component of the radiant barrier or reflective insulation (as well as other non-paper products) must be prevented from being collected in the pulp for fear of contamination of the paper in the paper repulping and recycling processes, small amounts of aluminum are both undetectable and harmless to the paper being made. We have empirically found that actually allowing and not actively preventing small amounts of aluminum to enter the pulp is not detrimental to the process, and is a way of allowing a paper-containing radiant barrier material to be recyclable as paper. This result is achieved, according to an implementation of the idea of the invention, because the present aluminum is allowed to fully oxidize at the temperatures and humidity levels used in the test. The resulting aluminum oxide is transparent in visual "spot" testing and does not adhere to pulp in the mechanical "stickies" testing. To this end, FIG. **1** illustrates the optical density of Aluminum Polyester during simulated repulpability test conditions. Here, the reference numeral **101** indicates the graphical line for aluminum polyester with an initial optical density of 1.00 and reference numeral **102** indicates the graphical line for aluminum polyester with an initial optical density of 2.00. As the aluminum material corrodes, the optical density falls. FIG. **2** shows a graphical and tabular representation of the emissivity levels of Aluminum Polyester (PET) film as a function of the initial optical density of the film. As aluminum material corrodes, and the optical density falls, a new (current) value of emissivity can be assessed based on the new (current) value of the optical density. The linear fit allows for extrapolation of an optical density value for a target emissivity value along the fit line.

Appendix B of the "Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" (available at corrugated.org/wp-content/uploads/PDFs/Recycling/and incorporated herein by reference) discusses causes for rejection of the pulp. Once the pulp is produced, "spots" are evaluated. There are three methods it specifically calls out to identify "spots": TAPPI T 537 is a dirt count estimator, TAPPI T 277 is a method of identifying a sticky substance that adheres to the pulp, and TAPPI T 563 uses image analysis to measures visual discoloration over an area. (The description of each of these methodologies is available, for example, at standards.globalspec.com/std/1359444/tappi-t-537, standards.globalspec.com/std/1682094/tappi-t-277, and standards.globalspec.com/std/9918295/tappi-t-563, respectively, and is incorporated by reference herein.)

Specifically, according to the TAPPI T 563 method, a scanner is used to analyze the EBA (equivalent black area) or a dark-colored area on a background of white paper or pulp. Since un-oxidized aluminum is silver-ish or grey-ish in color, and oxidized aluminum is substantially colorless and transparent, the aluminum content of the embodiment of the invention is judiciously chosen such as to be fully oxidized (~oxidized to the extent beyond the limits of the registration/detection capability of the used scanner to recognize such aluminum content as "spot(s)". To this end, FIG. **3** demonstrate a graphical representation of the empirically-determined detectable lower limit of optical density of aluminum in an EBA test.

Aluminum is likely not the only material that would provide a low level of emissivity in use while remaining visually transparent and not pulp-adhering after repulpability and recyclability testing, but aluminum would likely be the most practical in use. For example, silver or indium tin oxide could also satisfy the requirements of the present embodiment, but would likely be prohibitively expensive as compared to aluminum.

Implementation of the present idea includes the use of an aluminized polymeric film—either with a coating less than about one micron in thickness to protect the aluminum from corrosion in use and not raise the emissivity of the aluminized surface greater than 0.10, or with no coating at all if it is not required for normal operation of a packaging article—to keep the emissivity as low as possible. The various layers and combination of layers are shown in FIGS. **4**, **5**, and **6**.

The embodiment **400** of FIG. **4** contains a paper layer **410** with a first surface **411** and a second surface **412**; a polymer layer **420** with a third surface **423** and a fourth surface **424**, where the third surface **4233** is affixed to the second surface **412**; and an aluminum layer **430** is deposited on the fourth surface **424**. The corrugation sub-layer of the paper layer indicated between the surfaces **411**, **412** with the line **413**, is generally optional.

FIG. **5** shows a related structure **500**, which, in comparison with the structure **400**, additionally contains a protective coating **5** over the aluminum layer **430**, where the coating layer **510** is generally less than one micron in thickness.

Similarly, FIG. **6** shows a structure **600** that additionally includes a second coating layer **610** disposed between the polymer layer **420** and the aluminum layer **430**.

Each of these various layered structures **400**, **500**, and **600** is configured to ensure that the aluminum-containing portion of the structure is removable during the repulping and recycling process, while the aluminum material on the aluminized film is actually allowed to "crumble" into the pulp as the blender and disintegrator scratches, scrapes and otherwise removes and separates the paper products from the non-paper products, thereby facilitating the propagation of the aluminum material towards and into the accepts area for the pulp—against the conventional wisdom of keeping non-paper components and/or materials out of the pulp. Overall, the result will be a material product configured such that achieves a degree of insulation comparable or better than that of a reflective insulation and that does, when applied to a paper product or component, increase the probability of the final, multilayer product being repulpable and recyclable as regular paper.

It was empirically found that there are two requirements that any coating covering the aluminum material of an embodiment of the invention would need to meet. First, such coating has to be such that the coated aluminum material meets the appropriate emissivity requirement to be considered a radiant barrier, (in other words, to demonstrate emissivity of less than or equal to 0.10 when tested to ASTM C1371). FIG. **7** shows how the emissivity of different types of coatings change in relation to the thicknesses of the coatings, where the polymer graph line is indicated with reference numeral **701**, and the wax graph line is indicated by reference numeral **702**.

Second, the coating must pass the TAPPI T 277 test method, as called out in the "Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" to detect sticky "spots" which would be cause for failure of the standard. For example, during the deposition of fischer tropsch wax (with a 221 F melting point) onto an aluminized film with an initial emissivity of 0.03 (empirically obtained as a result of testing according to the requirements of ASTM C1371), as the thickness of the wax increases from 0.14 microns to 1.05 microns, the emissivity does not increase or otherwise change abruptly, only reaching the value of 0.06 when the wax-coating thickness reaches 1.05 microns. However, the 1.05 micron thick wax is believed to be too thick a layer to pass the "Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", because the presence of the wax material resulted in "stickies" when tested according to TAPPI T 277.

It was discovered that, in order to comply with the "Voluntary Standard for Repulping and Recycling . . . .", the layer of wax should be less than 0.70 microns thick. A sample with a 0.7 micron thick layer of deposited wax was subjected to testing according to the TAPPI T 277 test method. It will be appreciated that a given product can fail the TAPPI T 227 (the "stickies" test) in one of two ways: if a stickie spot count is greater than 15, and if the spot counts are greater than 30% of the control group. Since the results of the conducted test demonstrated on an average just one spot per sheet, it was concluded that, when the thickness of this type of coating is chosen to be less than 0.7 microns, this coating does not contribute to generation of the defects resulting in rejection of the material from the repulpability/recyclability point of view. If a control figure of merit is set at zero spots per sheet, even one per sheet would result in failing the test, so keeping the thickness of the wax coating under 0.7 micron would result in satisfying (meeting) the "Voluntary Standard for Repulping and Recycling . . . ". To this end, FIG. **8** contains a table illustrating the number of "stickies" defects empirically determined when various embodiments of the invention containing coatings made of materials listed in this table were tested according to TAPPI T 277.

Another example of a protective coating would be a radiation-cured acidic acrylic copolymer. This copolymer, when deposited onto an aluminized film with an initial emissivity of 0.03, behaves very different from the wax. As the thickness of the copolymer is increased from 0.20 microns to 1.55 microns (see curve **701** of FIG. **7**), the emissivity of the so-coated aluminized film rises at a significantly greater rate than in the case of the wax-coated aluminized film (compare with the curve **702**). At a polymer thickness of 0.98 microns, the coated surface has emissivity of 0.12 and, therefore, no longer meets the emissivity requirement that must be met by a radiant barrier. Because the copolymer is a thermoset and not a thermoplastic, it does not soften, melt, or contribute to "stickies" when subjected to testing at 221 F at 100% RH for 4 hours, per the "Voluntary Standard For Repulping and Recycling . . . " and, therefore, passes the required test.

Examples of a reflective insulation packaging product comprising an embodiment of the present invention are various and diverse, and some of such examples are listed below:

- A box liner with the thin coated aluminized film facing outward, designed in such a way that when fold and closed has tabs or flanges between ½ and ¾ inches, protruding out from all six sides so that when inserted into a corrugated shipper box, the coated and protected metalized film is facing into air spaces between ½ and ¾ inches;
- A standard box with thin coated aluminized film on the outside of the entire box, designed to fit inside a slightly larger box with separate spacers between the inner and outer box;
- A single panel of corrugated paper or cardboard with thin coated aluminized film on one side, designed to fit snugly inside a box containing goods where the height of the goods does not reach all the way to the top of the box, and the panel can be inserted with the coated metalized film facing into the above air space;
- A standard box where the inside of the box is lined with a thin coated aluminized film, where the goods do not completely fill the box and an air space is created by the size and shape of the goods themselves in relation to the walls of the box.

Examples of normal use of the embodiments of the packaging product of the present invention are substantially dependent on the type of good that is shipped in such packaging product. In one example, if the good is perishable food that needs to remain fresh, the good may require to be at 40 degrees F. on the interior of the packaging while the exterior may be at the ambient in the summer, and while the good would need to maintain its temperature anywhere from 24 to 72 hours (depending on the mode of shipping). On the other hand, if the good is a frozen perishable good, then the internal temperature (in the container or packaging) could be required to be anywhere from 0° to 32° F. If the good is candy or chocolate, then the temperature inside the packaging would be above 32° F. but below 65° F. If the good is a pharmaceutical, then it may be subject to its own unique temperature requirements.

Specific examples of normal use include, but are not limited to, the following examples:

(1) A recyclable cardboard radiant barrier box liner is made with the aluminum surface facing into an airspace between the cardboard liner and the cardboard box. The liner is packaged with 12 lbs. of dry ice and 10 lbs. of frozen beef. The frozen beef starts off at −5° F. and the dry ice at −109° F. The box is shipped through a standard ground service from Los Angeles to Phoenix (48 hours), in the middle of July, when the outside temperature is approximately 75° F. in Los Angeles and 110° F. in Phoenix. The added condensation created by the dry ice may cause an aluminum portion of the packaging to corrode if not coated, so a protective polymer or wax coating may be necessary. Either the recyclable liner itself must be able to insulate against the temperature difference between the goods and the outside air, or else additional insulation would preferably be used (such as foam, cellulose insulation, or perhaps a second recyclable radiant barrier box liner).

(2) A recyclable radiant barrier box is made with the aluminum surface facing inward, toward the goods. The box contains 9 lbs. of chocolate and 5 lbs. of frozen gel packs. The chocolate starting off at 65° F. and the frozen gel packs at 5° F. The box of chocolate is shipped via overnight air transport (24 hours) from Los Angeles to New York, in December. The temperature of outside air starts off at 55° F. in Los Angeles, decreases to about 45° F. in the cargo area of the plane, and is at 35° F. when the shipment arrives in New York. The temperature differences being smaller than in the previous example, and the aluminum facing the inside instead of the outside, means that vapor condensation on the aluminum surface would be unlikely, and a protective coating over the aluminum material in the embodiment of this packaging may not be necessary. The goods, only needing to arrive at or below 65° F., and the external air temperature not being as extreme, means that the insulation required to maintain the required temperature of the goods may be achieved with the recyclable radiant barrier box alone.

(3) A recyclable cardboard radiant barrier insert component is placed at the bottom of a box, which is otherwise insulated with a cotton insulation on the walls and under the lid which would compress under the weight if it was on the bottom. The cardboard radiant barrier insert component is folded or constructed in such a way as to both hold the weight of the payload without compressing and maintain an airspace facing the radiant barrier surface. This insulated box is packed with 8 bottles of juice at 12 oz. each against the insulation on the walls and a 24 oz. frozen gel pack in the center. The juice starts off at 40° F. with the frozen gel pack at 10° F. The insulated box is shipped from San Diego, Calif. to San Francisco, Calif. in early January. The radiant barrier cardboard insert component holds up the weight of the juice, preventing crushing or collapsing of insulation, while at the same time providing reflective insulation to prevent heat gain from the bottom of the box. The air temperature that day in San Diego is 80° F., the overnight the temperature drops to 60° F., and the packaged good arrives in San Francisco where the temperature is 60° F. The juice arrives safely at its destination at a refrigerated temperature of less than 40° F.

(4) A recyclable radiant barrier heavy paper bag, with a radiant barrier facing toward the inside, is enclosed around 9 lbs. of food and 6 lbs. of frozen gel packs, and inserted into a large box as a meal delivery kit. Of the 9 lbs. of food, 3 lbs. are frozen meats that start off at 20° F., and 6 lbs. are fresh fruits and vegetables that start off at 35° F., with 6 lbs. of frozen gel packs placed surrounding the meats. This meal kit ships in the winter from Dallas, Tex. where the temperature is 60° F. and travels by ground to Tulsa, Okla. where the temperature drops down to 40° F. at night and is back up to 60° during the day. The meats arrive at a refrigerated temperate of under 40° F., and the fresh fruits and vegetables are still cool to the touch.

(5) A recyclable radiant barrier box is constructed with outward facing tabs to create air space between it and a larger shipper box, with one radiant barrier surface facing into that air space. The radiant barrier box is filled with 8 frozen tamales at 25° F. No other refrigerant is added. The box ships from Tucson, Ariz. in early February to New York, N.Y. via two day air transportation. The temperature in Tucson is 70° F. the afternoon the package leaves for the terminal and 70° F. the next day before boarding the plane. The temperature decreases to 45° F. in the cargo area of the plane, and the package arrives in New York where the temperature is 40° F. The tamales arrive at a temperature under 40° F.

(6) A recyclable radiant barrier cardboard insert comprises a radiant barrier surface on both sides. The box is constructed with tabs to separate it from an exterior shipping box so that the outward radiant barrier is facing into the air space between it and the shipper box, and the inward radiant barrier is facing into the air space of the interior of the box and any intermittent air spaces created by the positioning of the goods. The good in this case are 32 oz. of refrigerated yogurt and 3 lbs. of frozen gel packs. The frozen gel packs start off at 25° F. and the yogurt starts off at 35° F. The package is shipped from Los Angeles, Calif. to Sacramento, Calif. in the summer via one-day ground shipment. The outside air temperature across the trip is at about 80° F. with little variation. The yogurt is partially frozen for the first 12 hours, but thaws and arrives in Sacramento under 40° F.

In stark contradistinction with technologies of related art, an embodiment of the present invention complies with the repulpability requirement, yet still provides insulation with very low emissivity figure(s). An embodiment may have a metalized film on one side and paper on the other, with the metal facing outwardly. Optionally, a protective top coating can be added, if required. Thus, an embodiment of the invention includes a paper layer with first and second surfaces; a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface and an aluminum layer is deposited on the fourth surface. Optionally, an embodiment of the invention may include an intermediate layer, where the purpose of the intermediate layer may be to smooth the fourth surface prior to applying the aluminum in order to achieve better emissivity, or it may serve the purpose of being easily removable in order to separate the aluminum from the fourth surface after use. The intermediate layer may, for example, be a polymer or an oligomer.

The packaging product would possess the emissivity of well under 0.10, and typically closer to 0.05. This would give it superior insulating performance.

The packaging product would pass the "Voluntary Standard . . . ", as empirical discovery of how vacuum deposited aluminum behaves during the "Voluntary Standard . . . " test. If the aluminum is allowed to oxidize under the conditions of the test, then the transparent aluminum oxide can be mixed in the pulp and not be cause for failure.

As is well known in related art, the industry has been so concerned with aluminum showing up in the pulp (which does happen in the case of the use of aluminum foil) that either the aluminized plastic is not used at all, or else the aluminum portion is fully encapsulated, which solution both adds weight (which could still cause a failure of the Voluntary Standard) and increases emissivity (which significantly diminishes the insulation performance).

However, in contradistinction with the products of related art, when applied to 60 lb. kraft paper, as might be configured to make an insulated pouch for example, the single layer of 48 gauge PET complemented with the aluminum and top coating layers as proposed in this disclosure results in meeting the 85%/15% weight criteria for the repulpability test according to the Voluntary Standard.

A summary of the comparison between the existing technologies and an embodiment of the present invention is shown with reference to two possible products:

Product 1: An insulating pouch using a strong and heavy paper, with a reflective surface on one side, where the reflective surface is:

The film/aluminum/film product—neither low emissivity nor recyclable;

Aluminum foil—very low emissivity but is not recyclable;

Metalized paper—recyclable and somewhat low emissivity;

An embodiment of the present invention—both recyclable and very low emissivity.

Product 2: An insulating box or insert for a box, using cardboard, with a reflective surface on one side where the reflective surface is:

The film/aluminum/film product—not low emissivity, but may be recyclable depending on the weight and type of cardboard used;

Aluminum foil—very low emissivity but is not recyclable;

Metalized paper—recyclable and somewhat low emissivity;

An embodiment of the present invention—both recyclable and very low emissivity.

Thus, as illustrated in the above examples, an embodiment of the present invention may be successfully used to effectively insulate an object during shipment, mail delivery, etc. with the added benefit that the packaging may then be recycled once it has served its purpose. The method of packaging an object that is perishable, or may otherwise be temperature sensitive, comprises placing the object in suitable proximity to an embodiment of the invention such that adequate thermal insulation is provided. Adequate thermal insulation (of an object or good) is defined as protection (of such good) from heat, cold, or changes between heat and cold, such that the desired temperature range of such object is maintained during and throughout the shipment, mail delivery, etc. time frame.

As broadly used and described herein, the reference to a material layer being "carried" on a surface of a chosen element refers to a material layer that is disposed directly on the surface of such chosen element or disposed on another coating, layer or layers that are disposed directly on the surface of the chosen element. For the purposes of this disclosure and the appended claims, the use of the terms "substantially", "approximately", "about" and similar terms in reference to a descriptor of a value, element, property or characteristic at hand is intended to emphasize that the value, element, property, or characteristic referred to, while not necessarily being exactly as stated, would nevertheless be considered, for practical purposes, as stated by a person of skill in the art. These terms, as applied to a specified characteristic or quality descriptor means "mostly", "mainly", "considerably", "by and large", "essentially", "to great or significant extent", "largely but not necessarily wholly the same" such as to reasonably denote language of approximation and describe the specified characteristic or descriptor so that its scope would be understood by a person of ordinary skill in the art. In one specific case, the terms "approximately", "substantially", and "about", when used in reference to a numerical value, represent a range of plus or minus 20% with respect to the specified value, more preferably plus or minus 10%, even more preferably plus or minus 5%, most preferably plus or minus 2% with respect to the specified value. As a non-limiting example, two values being "substantially equal" to one another implies that the difference between the two values may be within the range of +/−20% of the value itself, preferably within the +/−10% range of the value itself, more preferably within the range of +/−5% of the value itself, and even more preferably within the range of +/−2% or less of the value itself. The use of these term in describing a chosen characteristic or concept neither implies nor provides any basis for indefiniteness and for adding a numerical limitation to the specified characteristic or descriptor. As understood by a skilled artisan, the practical deviation of the exact value or characteristic of such value, element, or property from that stated falls and may vary within a numerical range defined by an experimental measurement error that is typical when using a measurement method accepted in the art for such purposes.

While the invention is described through the above-described exemplary embodiments, it will be understood by those of ordinary skill in the art that modifications to, and variations of, the illustrated embodiments may be made without departing from the inventive concepts disclosed herein.

For example, related embodiments provide a receptacle (that is, a container or device configured to receive and hold contents in a cavity defined by the walls of the container) that includes (i) a first shell made from a first material and defining a first cavity therein, the cavity having a first volume, the shell having a first surface facing outwardly and a second surface facing inwardly towards the cavity, said first and second surfaces being separated by a thickness of the shell, and (ii) at least one piece of second material having a third surface and disposed inside the first volume with the third surface facing the second surface and separated from the second surface by a target separation distance. Here, the target separation distance is greater than 3 millimeters; any of the second and third surfaces is metallized. A metallized surface of the receptacle is characterized by an energy-radiating parameter of no greater than 0.1, while an energy-radiating parameter of the first surface is no less than 0.50. The receptacle is recyclable. In one implementation, the at least one piece of the second material is configured as a second shell defining a second cavity therein, the second cavity having a second volume, the second shell having the third surface facing outwardly towards the second surface and a fourth surface facing inwardly towards the second cavity. In a specific case of such implementation, any of the third and fourth surfaces is metallized.

Embodiments also provide a receptacle that includes (i) a first shell made from a first material and defining a first cavity therein, the cavity having a first volume, the shell having a first surface facing outwardly and a second surface facing inwardly towards the cavity, the first and second surfaces being separated by a thickness of the shell, and (ii) at least one piece of second material having a third surface and disposed inside the first volume with the third surface facing the second surface and separated from the second surface by a target separation distance of greater than 3 millimeters. Here, any of the second and third surfaces is metallized, and an emissivity of a metallized surface of the receptacle is no greater than 0.1 while an emissivity of the first surface is no less than 0.50. The receptacle is recyclable. In one implementation, any of the second and third surfaces is metallized while the first surface is not metallized. Alternatively or in addition, at least one piece of the second material is configured as a second shell defining a second cavity therein, the second cavity having a second volume, the second shell having the third surface facing outwardly towards the second surface and a fourth surface facing inwardly towards the second cavity.

Accordingly, the invention should not be viewed as being limited to the disclosed embodiment(s).

What is claimed is:

1. A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating layer, wherein the aluminum layer has a first thickness of 200 nanometers or less;

wherein said stack has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface of the aluminum layer; and

wherein, when said packaging is subjected to treatment that includes

a) blending the packaging in a blender;

b) disintegrating into water with a British Disintegrator at a temperature within a range from about 115 degrees F. to about 135 degrees F. at 3000 rpm;

c) separating in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes; and

d) drying in an oven for 4 hours at 221 degrees F.

to form a recyclable material, said aluminum layer becomes fully oxidized with no visible aluminum present in said recyclable material,

and further comprising

a protective coating layer disposed over the aluminum layer, wherein the protective coating layer has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while not impeding oxidation of the aluminum layer as a result of the treatment.

2. The recyclable packaging of claim 1, wherein the aluminum layer is disposed directly on the intermediate coating.

3. The recyclable packaging of claim 1, wherein the intermediate coating has the intermediate coating thickness between 10 nm and 2000 nm and includes a material selected from polymer and oligomer.

4. The recyclable packaging of claim 1, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

5. The recyclable packaging of claim 1, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

6. The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

7. A method for manufacturing a recyclable packaging, the method comprising:

forming a packaging layer stack by:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a first thickness of 200 nanometers or less, and wherein the aluminum layer causes said packaging layer stack to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 when the packaging layer stack is exposed to a treatment that includes:

a) blending the packaging stack in a blender;

b) disintegrating into water with a British Disintegrator at a temperature within a range from about 115 degrees F. to about 135 degrees F. at 3000 rpm,

c) separating an output from step b) in a 0.01 aperture inch screen with a 1 inch water head for 20 minutes, and

d) drying in an oven for 4 hours at 221 degrees F.

8. The method of manufacturing a recyclable packaging of claim 7, further comprising:

applying a protective coating over the aluminum layer to form a coated packaging layer stack, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is defined

a) to maintain the emissivity of the packaging layer stack at the first value after the aluminum layer has been coated with the protective coating and

b) to prevent oxidation of the aluminum layer during normal use of the recyclable packaging, while the protective coating does not impede oxidation of the aluminum layer during the treatment.

9. A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer acquires an optical density (OD) of less than 0.09 with no visible aluminum present in a recyclable material that results from the recyclable packaging being subjected to a treatment, the treatment including

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F. to about 135 degrees F. at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

10. The recyclable packaging of claim 9, further comprising:

a protective coating over the aluminum layer,

wherein the protective coating has a second thickness of 1 micron or less,

wherein the second thickness is defined to maintain the first value of the emissivity of the recyclable packaging after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,

wherein the protective coating does not impede oxidation of the aluminum layer during the treatment.

11. The recyclable packaging of claim 10, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

12. The recyclable packaging of claim 9, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

13. The recyclable packaging of claim 9, wherein the polymer layer includes a material selected from: film and fabric.

14. A method for thermally insulating a good within a recyclable packaging, the method comprising:

placing a reflective insulation material in a pre-defined proximity with the good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the recyclable packaging being subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F. to about 135 degrees F. at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

15. A method for thermally insulating a good within a recyclable packaging, the method comprising:

placing a reflective insulation material at a pre-defined proximity distance from the good, said pre-defined proximity distance chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of no more than 200 nanometers to cause the recyclable packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 and become fully oxidized with no visible aluminum present in a recyclable material when the recyclable packaging is subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British at a temperature within a range from about 115 degrees F. to about 135 degrees F. at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

* * * * *

EXHIBIT B

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16238998 Document Date: 01/03/2019

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

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Form Revision Date: August 26, 2013

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Steven		Yializis	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Tucson	AZ	US

Mailing Address of Inventor:

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Address 2	

City	State/Province	Postal Code	Country
Tucson	AZ	85737	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Luke		Rogers	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Tucson	AZ	US

Mailing Address of Inventor:

Address 1	10960 N. Stallard Place
Address 2	

City	State/Province	Postal Code	Country
Tucson	AZ	85737	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	34282		
Email Address	pat-dept@quarles.com	Add Email	Remove Email
Email Address	yakov.sidorin@quarles.com	Add Email	Remove Email

Application Information:

Title of the Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION		
Attorney Docket Number	861133.00068	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	34282		

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status [ ] Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62614568	2018-01-08

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor

● Person to whom the inventor is obligated to assign. | Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	SIGMA TECHNOLOGIES INT'L., LLC		
Mailing Address Information For Applicant:			
Address 1	10960 N. Stallard Place		
Address 2			
City	Tucson	**State/Province**	AZ
Country	US	Postal Code	85737
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Yakov S. Sidorin/			Date (YYYY-MM-DD)	2019-01-03
First Name	Yakov	Last Name	Sidorin	Registration Number	63507

Additional Signature may be generated within this form by selecting the Add button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00068
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present international application claims priority from and benefit of the U.S. Provisional Patent Application No. 62/614,568 filed on January 08, 2018, the disclosure of which is incorporated by reference herein.

TECHNICAL FIELD

[0002] Embodiments of the present invention relate to radiant barrier insulation configured for use in paper-containing packaging, where such packaging is intended and structured to be recyclable and/or recycled as paper, and, in particular, to such radiant barrier insulation in which a radiant barrier material is used to facilitate thermal insulation in packaging intended to preserve temperature sensitive food or pharmaceutical goods.

SUMMARY

[0003] Embodiments of the invention provide a recyclable packaging that includes (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, where the third surface is affixed to the second surface; (iii) an aluminum layer deposited on the fourth surface (here, the aluminum layer has a first thickness of 200 nanometers or less to cause emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10). The aluminum layer is characterized by becoming fully oxidized with no visible aluminum present in (accepted for forming the recyclable packaging) material that results from the packaging being subjected to a particular treatment. Such particular treatment includes a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F. In one embodiment, the recyclable packaging may additionally include a protective coating, over the aluminum layer, which has a second thickness of 1 micron or less. (The second thickness is defined to maintain the first value of the emissivity of the outer surface

after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer caused by the treatment.) Alternatively or in addition, the protective coating may include a material selected from: wax, polymer, and lacquer. In any embodiment, the polymer layer may include a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene. In any embodiment, the polymer layer may include a material selected from film and fabric.

[0004] Embodiments of the invention additionally provide a recyclable packaging that contains (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; (iii) an intermediate coating applied to the fourth surface; (iv) an aluminum layer carried by the intermediate coating (where the aluminum layer has a first thickness of 200 nanometers or less and where the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10). Such aluminum layer is characterized by becoming fully oxidized with no visible aluminum present in a recyclable material (suitable for manufacture of the recyclable packaging) that results from the packaging being subjected to a treatment that includes a) blending in a Waring Blender; b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm; c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes; and d) drying in an oven for 4 hours at 221 degrees F. In one implementation, the aluminum layer is disposed directly on the intermediate coating. In any implementation, the intermediate coating may have a thickness between 10 nm and 2000 nm and include a material selected from polymer and oligomer. In any implementation, the recyclable packaging may additionally include a protective coating over the aluminum layer (such protective coating having a second thickness of 1 micron or less, the second thickness being defined i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer as a result of the treatment). Alternatively or in addition, the protective coating may include a material selected from wax, polymer, and lacquer and/or the polymer layer may

include a material selected from low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene. In any embodiment, the polymer layer may be configured as a film or fabric.

[0005] Embodiments of the invention additionally provide a method for thermally insulating a good within a recyclable packaging. The method includes placing a reflective insulation material at a pre-defined proximity distance from the good, where pre-defined proximity distance is chosen to provide adequate thermal insulation to the good. In one embodiment, the reflective insulation material is used to wrap or otherwise enclose the good. In any embodiment the reflective insulation material includes the recyclable packaging that contains: (i) a paper layer with first and second surfaces; (ii) a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; (ii) an intermediate coating applied to the fourth surface; (iii) an aluminum layer carried by the intermediate coating, which aluminum layer has a first thickness of no more than 200 nanometers to cause an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10, and which aluminum layer becomes fully oxidized with no visible aluminum present in a material as a result of subjecting the recyclable packaging to a pre-defined treatment. The pre-defined treatment includes a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F.

[0006] Embodiments further provide a method for manufacturing a recyclable packaging, the method containing steps of attaching a polymer layer to a paper layer (here, an inner surface of the polymer layer is affixed to a first surface of the paper layer); depositing an aluminum layer on the polymer layer (with the aluminum layer having a first thickness of 200 nanometers or less and being configured to cause an outer surface of the polymer layer to have emissivity that is equal to or smaller than a first value of 0.10), which aluminum layer possesses a quality of becoming fully oxidized with no visible aluminum when the packaging is exposed to a treatment that includes: a) blending in a Waring Blender; b) disintegrating into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm; c) separating in a 0.01 inch screen with a 1

inch water head for 20 minutes, and d) drying in an oven for 4 hours at 221 degrees F. Alternatively or in addition, the method may include a step of applying a protective coating over the aluminum layer (where the protective coating has a second thickness of 1 micron or less, and where the second thickness is defined a) to maintain the emissivity of the outer surface at the first value after the aluminum layer has been coated with the protective coating and b) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer as a result of the treatment.

[0007] Embodiments additionally provide a method for thermally insulating a good within a recyclable packaging. Such method involves placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes: - a paper layer with first and second surfaces; - a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; - an aluminum layer deposited on the fourth surface (where the aluminum layer has a first thickness of 200 nanometers or less and where the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10, which aluminum layer is characterized with a property of becoming fully oxidized with no visible aluminum present in a material that results from the packaging being subjected to a pre-determined treatment. The pre-determined treatment is defined to include a) blending the packaging in a Waring Blender to form a first material; b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material; c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and d) drying the fourth material in an oven for 4 hours at 221 degrees F.

BACKGROUND

[0008] A variety of thermal insulation materials are used for perishable and other temperature sensitive goods. Common types of thermal insulation include rigid and flexible foams, bags or batts of fibrous materials, and reflective insulation. Reflective Insulation is any type of insulation intended to insulate against heat gain and heat loss by reducing, reflecting, or not emitting radiant heat; this is accomplished by applying a low emissivity material, such as aluminum, to one or more surfaces. Simply incorporating a low emissivity material as part of the package

could reduce the weight or dimensions of the total package, as compared for example to other types of insulation commonly used in packaging (such as foams or bulk fibrous insulation). However, current methods and applications of low-emissivity material impairs the recyclability of the total package, which understandably causes problems in related industries. Thus, there is a need for low-emissivity packaging material that is fully recyclable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will be more fully understood by referring to the following Detailed Description of Specific Embodiments in conjunction with the not-to scale Drawings, of which:

[0010] Fig. 1 is a graphical representation of the variations of optical density of Aluminum Polyester as a function of time, during simulated repulpability test conditions.

[0011] Fig. 2 shows graphical and tabular representations of emissivity of Aluminum Polyester (PET) film as a function of the initial optical density of the film.

[0012] Fig. 3 is a plot of the detectable lower limit of optical density of Aluminum in an Equivalent Black Area (EBA) test.

[0013] Figs. 4, 5, and 6 show various layers and combinations of layers of the fully recyclable low-emissivity packaging material.

[0014] Fig. 7 presents graphical and tabular representations of changes in emissivity values for different types of coatings (Polymer, 201; Wax, 202) in relation to the thicknesses of such coatings.

[0015] Fig. 8 contains plots illustrating changes in emissivity figure(s) as a function of thickness of protective coating layer(s) made of itemized materials.

[0016] The sizes and relative scales of elements in Drawings may be set to be different from actual size and scales to appropriately facilitate simplicity, clarity, and understanding of the Drawings. For the same reason, not all elements present in one Drawing may necessarily be shown and/or labeled in another.

DETAILED DESCRIPTION

[0017] Embodiments of the invention address the problem(s) caused by inability of the related art to fully recycle a low-emissivity packaging material, and solve such problem(s) by using a specifically structured packaging that contains a particular aluminized polymeric film

characterized by emissivity of equal to, or less than 0.10, yet is thin enough such that when the packaging material is subjected to the recycling process, what little amount of aluminum is present is "crumbled" and fully oxidized (and, as a result, does not affect the recyclability of the packaging material as a whole). Such specifically-structured aluminized polymeric film may have an optional protective coating (which would be generally less than one micron in thickness) to protect the aluminum in the film from corrosion during the use of the packaging. However, this protective coating is judiciously configured to not raise the emissivity of the aluminized surface above the 0.10 value and, at the same time, to still allow for the aluminum material it covers to be removed in the repulping and recycling process such that the aluminum material in the stack of materials of the packaging is factually fully oxidized and corroded in the heat and at humidity levels used in the recycling process. It is this specific configuration that permits the aluminum of the packaging material to be included in the recycled portion of the packaging material.

[0018] Repulping is the first stage in paper recycling. Features of the method employed for testing the repulpability of a paper-based containers are summarized in Part I of the document titled "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", published by the Fibre Box Association (available at fibrebox.org), the disclosure of which is incorporated herein by reference for all purposes. This test method is recognized in related industry - and, in particular, by the Fibre Box Association and Corrugated Packaging Alliance - and represents the commonly-used test, the exposure of a given container or packaging to which is required to be able to determine whether such given corrugated container or packaging can be classified as repulpable or recyclable. The first part of this test method addresses repulpability. In particular, a sample / portion of the container is blended in a Waring Blender and disintegrated into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm, and separated in a 0.01" screen with a 1 inch water head for 20 minutes. The specimens of the resulting material are then dried in an oven for 4 hours at 221 degrees F to remove water. The dried weights (of what passes through the screen after such a treatment) is compared to rejects (or what is rejected by the screen). The material that passed through is considered / defined to be repulpable, implying that such material can be used, according to industrial standards, to be reused / remade into paper at a mill. At the

same time, the rejects that are left behind by the screen are considered to be the unusable waste and, generally, are rejected and sent to the landfill or otherwise disposed of. It is well recognized that in order for the container material to pass the first stage of this test, a portion of at least 85 weight-% of the total, overall amount of the initial container material has to be classified as repulpable.

[0019] The second stage of the test involves the use of the accepted pulp for making paper. Here, using a Carver press at 350 degrees F at 500 psi, the accepted pulp (sometime referred to as "accepts") is pressed together to form hand sheets, and the excess moisture is blotted away. Then several (often - three) hand sheets of the so-formed new paper are inspected for defects or "spots". This inspection is aided by TAPPI-developed test methods. TAPPI is a registered, not-for-profit, international Non-Governmental Organization, see tappi.org, involved in research and development in the fields of pulp, paper, and packaging (such as corrugated fiberboard, flexible packaging, lamination, adhesives, coatings and extrusion). This organization, among other things, develops and provides industry standards and test methods. Guidance for identifying spots include assessment of visually-recognizable discoloration (according to TAPPI T-537 and TAPPI T-563, incorporated herein by reference and available at tappi.org/Publications-Standards/Standards-Methods/), and assessment of physical adhesion of a spot to pulp caused by melted plastic or "stickies" (according to TAPPI T-277, also incorporated herein by reference and available at tappi.org/Publications-Standards/Standards-Methods/).

[0020] For example, if a small amount of dirt or aluminum foil comes through the paper and makes its way into the pulp during the repulping phase, it could be made into paper, but could at the same time leave the paper with visual blemishes, and would be a cause for rejection of the final paper product. Alternatively, if a polymeric coating disposed over a paper layer is adhered to the pulp and makes it through the filter with the pulp during the repulping phase (in either a liquid form or in small enough pieces, for example), such piece of polymeric coating would be re-softened or re-melted in the paper-making process and could cause "sticky" areas or portions (referred to as "stickies"), in the newly-formed paper, that affect the physical properties of such paper. It is known in industry that for the newly-formed paper to be accepted and the final product to be considered recyclable according to this test, no more than 15 of either kind of spots can be present (when visually observed) in an area that is equal to or greater than 0.4 square

mm. An inert material that is both visually transparent (therefore resulting in no visually-recognized defects) and that does not adhere to paper material at 350 degrees F (thereby preventing the formation of sticky areas in the mater material) would not be a cause for rejection, according to such test.

[0021] Notably, practically all perishable or temperature sensitive goods shipped in small volumes are shipped with the use of corrugated cardboard boxes, which are easily and commonly recycled. According to the "Advancing Sustainable Materials Management: 2014 Fact Sheet", for example, published by the EPA (and available at epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management), cardboard boxes were recycled at a rate of 89.5%, whereas PET plastic bottles were recycled at a rate of 31.2%, and HDPE plastic bottles were recycled at a rate of 29.5%, with other plastic materials being recycled at lower rates. In practice, few insulating products are as easy to recycle as a corrugated cardboard box.

[0022] For the category of insulating products referred to as reflective insulation or radiant barrier, the thermal performance is highly dependent on the surface emissivity. Emissivity represents the ability for heat, provided by a given surface, to radiate from the surface into an adjacent air space. As used herein, the term emissivity (of the surface of a material) is generally referred to the effectiveness of such surface in emitting energy as thermal radiation, that is as the material's ability to emit energy as IR radiation (and not visible light), in the range between about 700 nm and about 1 micron wavelengths. Emissivity is commonly measured according to the test method discussed in ASTM C1371 (available at astm.org/Standards/C1371.htm and incorporated herein by reference), for example with the use of a tabletop portable emissometer. The value of emissivity is stated as a number between 0 and 1, where 0 represents the case of emission of no radiant heat and 1 represents the case of emission of all radiant heat from a given surface. The higher the emissivity value, the more heat is emitted; and the lower the emissivity, the less heat is emitted. For the purposes of the product comparison, the emissivity of typical brown paper used in corrugated cardboard boxes has a value between 0.80 and 0.90, aluminized paper has an emissivity value between 0.10 and 0.50, aluminum foil or aluminized film with a polymeric film applied to both sides of such film has emissivity between 0.20 and 0.70, and aluminized polymeric film without any protection over the aluminum has emissivity between

0.03 and 0.05. When insulating an object with a low emissivity surface facing the air space, the lower the emissivity of the surface, the better quality of the insulation. The ASTM C1313 (available at astm.org/Standards/C1313.htm and incorporated herein by reference) is the industry standard specification for a radiant barrier, and defines a radiant barrier as a material having an emissivity of 0.10 or less, used in the construction of an insulating system. (There currently appears to be no maximum value of emissivity for a material to be called a reflective insulation.)

[0023] The sizes of the air spaces, formed during the insulation of a given workpiece or good, also makes a difference for the quality of insulation of the workpiece of good. During the propagation of heat flow through a given air space, a certain percent of heat travels (is transferred) with moving air (or via convection), and a certain percent of heat propagates in the form of infrared radiation. When the heat is transferred downward, convection is minimized and the predominant means of heat transfer is radiation. In this case, the larger the air space between the packaging and the good, the better the quality of insulation. Circumstances change, however, when the flow of heat is directed upward or sideways, as convection in this case has a greater impact. In these cases, practical balance must be found in that a sufficiently large air space (between the container or wrapper and the workpiece or good, which this container / wrapper protects) should be identified the size of which is, nevertheless, is judiciously limited to not allow for easy air movement inside the air space. In Chapter 26, Table 3 of the Handbook of Fundamentals by America Society of Heating, Refrigerating, and Air0Conditioning Engineers, or ASHRAE (available at ashrae.org/technical-resources/ashrae-handbook/ashrae-handbook-online), which is incorporated herein by reference, insulation values are provided for differently sized air spaces (ranging from 1/2 inch to 3.5 inches) and at different temperature settings, with surfaces of varying emissivities (from 0.03 to 0.82). In Table 1 of that document, surfaces with emissivities of 0.05 and 0.20 are given as examples of "reflective" and 0.90 is called out as an example of "non-reflective" surfaces. According to ASHRAE, a 3/4 inch air space has a greater overall insulation value than a 1/2 inch air space for upward and sideways heat flow, but at 1 inch of space the insulation value diminishes. When it comes to insulated packaging and shipping, air spaces may conceivably be smaller than 1/2 inch, and multiple insulated liners could be used.

[0024] A person of skill in the art will readily recognize that a variety of different products may be used to reduce the emissivity of a given surface. The use of aluminum foil, for example, is a common approach, as aluminum foil is relatively inexpensive. Aluminum foil has very low mechanical strength, but is easy enough to handle when laminated to paper. In the lamination process, a foil with thickness of 6 to 18 microns is commonly preferred in industry (as at these thicknesses, the aluminum foil has some protection against oxidation and corrosion when exposed to high heat and moisture). Aluminum oxide develops on the outermost layer of the foil, but only in a "skin layer" of it - down to tens of nanometers at the thickest - and typically does not propagate deeper into the body of the foil. As a result, after the initial value of the foil's emissivity (of 0.03 to 0.05) increases to about 0.08 to 0.12, the value of emissivity of the oxidized surface of the aluminum foil remains relatively constant and stable.

Another industrial test, ASTM D3310 (the description of which is available at astm.org/Standards/D3310.htm and is incorporated herein by reference), is used to test resistance of a material to corrosion, and is specifically called out as the preferred test for a radiant barrier per ASTM C1313. (Emissivity testing after corrosion resistance testing is one method of testing, but the ASHRAE Handbook, Chapter 26, Table 2, specifically calls out a few specific surfaces and materials, including bright aluminum foil as having an emissivity of 0.05 and aluminum sheet as having an emissivity of 0.12.) A recognized disadvantage to using an aluminum foil in an insulating packaging container is that the aluminum foil is very difficult to remove from the paper if such a container is to be repulped or recycled. In particular, the aluminum foil is so soft that it can and often does break apart or crumble, and its crumbs or particles make their way into the paper pulp.

The use of aluminized paper is considered to be another approach. Here, using a vacuum deposition process, such as sputtering or electron beam evaporation, a low emissivity aluminum layer is applied to a paper. Since the amount of aluminum applied using this method is miniscule (200 nanometers or less in thickness), the weight of the aluminum layer is insignificant compared to the weight of the paper products. Therefore, it is generally assumed that when aluminized paper is submitted for repulping, it is easily able to meet the requirement that at least 85% is made into usable pulp, and that the exact weight of the aluminum is practically unmeasurable in the confines of the repulpability test. Since these papers may generally contain

clay coatings, lacquer coatings, printed inks, and other materials that could contribute to a failure from "spots" or "stickies" in the recyclability test, the ratio of non-paper to paper products is minimized, aluminum included. Since the paper generally does not have a smooth, planar surface, the emissivity of the paper surface does not reach as low a value as that of aluminum foil. Depending on the type of paper, the amount of moisture in the paper, roughness of the paper surface and some other factors, we measured the emissivity of aluminized paper samples to be between 0.50 and 0.10. In fact, ASHRAE lists "Aluminum coated paper, polished" as having an emissivity of 0.20. Understandably, lower values of emissivity are always preferred for reflective insulation, and a range in emissivity values that large, and with emissivity values still not qualifying it as a radiant barrier, aluminized paper leaves much to be desired. Combined with the fact that paper naturally contains a certain amount of moisture and that the aluminum may be uncoated or unprotected, the aluminized paper remains susceptible to corrosion in the presence of steam or condensation, which may occur in the normal use of packaging perishable goods. All in all, while aluminized paper may arguably present a better (from the point of view of repulpability and recycling) option than paper with aluminum foil laminated on it, the operational properties of the aluminized paper are substantially sacrificed to achieve such improved repulpability / recycling properties.

[0025] Yet another material that can be considered to achieve low emissivity is a metalized polymeric film. Notably, because such film is not paper itself, it simply cannot be repulped for paper recycling, and instead must be separated from the paper to which it is affixed, beforehand, to allow the remaining paper portion to be recycled. The aluminum or other metal can be applied to a film by vacuum deposition, like sputtering or electron beam evaporation (by analogy with the process of formation of the aluminized paper), but the higher figure of flatness of the surface of the film facilitates the achievement of lower emissivity value even at thicknesses of metallic material of 200 nanometers or less. For example, it was empirically shown in one of our studies that the aluminized polyethylene terephthalate film can achieve an emissivity value of 0.03, while the aluminized low density polyethylene film can achieve an emissivity value of 0.05. The advantage of using a polymeric film for intended purposes is that such film contains little to no moisture, can be coated onto the chosen surface prior to metallization to further smooth the surface, and the metallic material can even be further covered with a coating or film after

metallization to further protect it from corrosion. A light top coating, less than one micron, may increase the emissivity over the level of 0.03 but still keep it below 0.10, while a thick 6 micron to 24 micron polymer film laminated over the aluminum can increase the emissivity to 0.20 to 0.70 (depending on the film thicknesses and types of polymers). (As a comparison, plain brown kraft paper has an emissivity of 0.80, and regular glass has an emissivity of 0.84.) If a metalized film is going to be coated for corrosion protection though, the coating must be thin enough for it to not absorb significant radiant heat and significantly increase the emissivity.

[0026] There are a few metalized film products on the insulated packaging market. One such product is a low density polyethylene bubble packaging material with an aluminized polyethylene terephthalate film facer on one or both sides, making an insert, pouch, or envelope to contain perishable goods. One challenge with this product is that it is a mixed polymer. The Society of the Plastics Industry (SPI) Resin Identification Code and ASTM D7611 (available at astm.org/Standards/D7611.htm) put mixed polymers in the category of "other", numbered with a 7. Blue Apron explains says their bubble liner is "fully recyclable" but as a category 7, would be very difficult to recycle and would often be excluded from recycling streams altogether, ending up in the landfill. It can vary by the community to community whether or not it can be collected and how it can be handled. The State of California has a "CA Cash Refund" program in place to take such items, but other states do not.

[0027] An example of a product that advertises sustainability and uses a reflective insulation is a box liner called "northbox" made by Cascades Inc. Each wall of the liner includes two aluminized layers, each between two layers of polymeric films, with each of those polymeric film/aluminum/polymeric film layer structure separated by a honeycomb paper structure, and the entire assembly is inserted into the shipper box. The Cascades Inc. describes the reason for applying a polymeric film to both sides of the aluminum as "eliminating the risk of crumbling in the pulp during the recycling process", similar to the problems incurred with aluminum foil/paper laminates described above. As was already alluded to above, however, thin aluminum is especially vulnerable when exposed to water and humidity and corrodes easily if not adequately protected. The polymeric film on both sides of the aluminum serves dual purposes of both preventing the aluminum from crumbling off and getting into the pulp in the recycling process, and preventing corrosion that might occur with an unprotected aluminized film in use

during the life of the packaging product. A benefit to the "northbox" product is that it is described as being "pulper-safe" and is illustrated in the Cascade's literature as the film/aluminum/film assembly being fully removed in the pulping process without the aluminum ever making its way into the pulp. There are two problematic issues with a Cascade's product and similar products, however. First, the polymeric films used to protect the aluminum dramatically increase the emissivity, resulting in a product that - while being reflective to visual light - is not nearly as heat-reflective as bare aluminum, and simply does not qualify as a radiant barrier. Second, the films add additional plastic weight, which when processed at the paper recycling mill, is additional waste destined for the landfill instead of being repulped. The ratio of weight of paper to weight of non-paper in a product is one factor in determining if a product can be called repulpable or recyclable as paper.

[0028] When a radiant barrier / reflective insulation is to be repulped and recycled as paper, the preferred / ideal product or material from which such radiant barrier / reflective insulation is made would be one in which:

- The emissivity of at least one surface is 0.10 or less for optimum performance;
- The aluminum present in the preferred material is prevented or protected from corrosion or otherwise unlikely to corrode in normal use, where the normal use is defined as the conditions that the product could reasonably be expected to be subjected to during shipping. For example, if the material is on the inside of a cardboard box and the goods being insulated are within that box, the normal use would be having that box ship across the country. Whereas, if the material is not on the inside surface of the box, but instead located as an insert within the box, then the outside box may provide additional protection from the elements, from temperature variations, from humidity, etc. If the material is instead configured as a mailer or envelope, then it may not be protected as well as if it were in a box.
- The process of protecting the aluminum in the material or product does not result in excess ratio of the weight of the protective layer to paper, so as to more easily meet the 85% / 15% ratio of repulped material to rejected material when tested according to the "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" repulpability test.

Additionally, the protective layer should be sufficiently thin to maintain the desired emissivity of the aluminum surface of the material, and be sufficiently thick to prevent oxidation of the aluminum surface during normal use of the packaging, but does not impede oxidization of the aluminum surface as a result of the treatment. The amount of protection the protective layer or coating needs to provide will depend on the products normal and expected use. Overall, the protective coating needs to ensure that the outer surface of the material used for packaging maintains the required emissivity;

- Any material that does make it through the repulping process is able to be made into paper without excess "spots" or "stickies" per "The Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" recyclability test.

[0029] While flakes, specs or spots of reflective material would certainly contribute to a product's disqualification in the recyclability portion of the test, we discovered surprisingly that the use of a very thin coating over the aluminum as protection against corrosion (as opposed to the use of an aluminum foil or a aluminized layer encapsulated within polymeric film) allows to maintain the low level of emissivity while offering the protection against corrosion and, at the same time, minimizing the weight of a portion of the material that is unable to be made into usable pulp. Because the thickness of the aluminum used in an embodiment of the invention is so thin, any aluminum that does make it into (is processed into) the accepts portion produced by the repulping process ends up being fully oxidized and corroded in the heat and humidity levels used in the process. Aluminum oxide is visually transparent, when observed with the human eye (that is, substantially not visible or not visually-perceivable), and thus, for the purposes of this disclosure and the claims, the aluminum is considered fully oxidized when the aluminum is substantially transparent instead of silver-colored, for example. Using an optical densitometer, the optical density of the aluminum can be measured. Optical density is a measurement of transparency/opacity of the material, and is often defined as the logarithmic ratio of the radiation incident on the material to the radiation transmitted by the medium (at a given wavelength). Since aluminum oxide is transparent and un-oxidized aluminum has varying opacity depending on its thickness, the aluminum is considered to be transparent, for the purposes of this disclosure, when the optical density (OD) is less than 0.09. This threshold value was determined based on

the following observations. Bright white paper or pulp, which would result in aluminum sticking out the most, had a maximum of 253 lumens, a minimum of 219 lumens, and a mode of 248 lumens. According to TAPPI T-563, the software will count as a spot anything darker (lower) than 30 lumens below the chosen mode. This means that while darker areas may be detected, they are not counted if they are close enough in optical properties to the background. In this case, 30 below the mode would be 218 lumens.

[0030] In one case, a sample of bright white paper with a gradient of aluminum (analyzed according to TAPPI T 563) had a brightness of a maximum of 251 lumens, a minimum of 168 lumens, and a mode of 247 lumens. This sample allowed the software to plot a curve of the areas 30 below the mode. By looking at the curve on the identical film sample, we could determine that the average optical density across the curve was 0.092. Since the accuracy of the a typical optical densitometer is limited at about .001, the performed measurements allowed us to conclude with confidence that the optical density of aluminum required to pass the TAPPI T 563 test should be less than OD 0.09.

[0031] Contrary to the prevailing, in related industry, opinion that an aluminum component of the radiant barrier or reflective insulation (as well as other non-paper products) must be prevented from being collected in the pulp for fear of contamination of the paper in the paper repulping and recycling processes, small amounts of aluminum are both undetectable and harmless to the paper being made. We have empirically found that actually allowing and not actively preventing small amounts of aluminum to enter the pulp is not detrimental to the process, and is a way of allowing a paper-containing radiant barrier material to be recyclable as paper. This result is achieved, according to an implementation of the idea of the invention, because the present aluminum is allowed to fully oxidize at the temperatures and humidity levels used in the test. The resulting aluminum oxide is transparent in visual “spot” testing and does not adhere to pulp in the mechanical “stickies” testing. To this end, Fig. 1 illustrates the optical density of Aluminum Polyester during simulated repulpability test conditions. Here, the reference numeral 101 indicates the graphical line for aluminum polyester with an initial optical density of 1.00 and reference numeral 102 indicates the graphical line for aluminum polyester with an initial optical density of 2.00. As the aluminum material corrodes, the optical density falls. Fig. 2 shows a graphical and tabular representation of the emissivity levels of Aluminum

Polyester (PET) film as a function of the initial optical density of the film. As aluminum material corrodes, and the optical density falls, a new (current) value of emissivity can be assessed based on the new (current) value of the optical density. The linear fit allows for extrapolation of an optical density value for a target emissivity value along the fit line.

[0032] Appendix B of the "Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" (available at corrugated.org/wp-content/uploads/PDFs/Recycling/ and incorporated herein by reference) discusses causes for rejection of the pulp. Once the pulp is produced, "spots" are evaluated. There are three methods it specifically calls out to identify "spots": TAPPI T 537 is a dirt count estimator, TAPPI T 277 is a method of identifying a sticky substance that adheres to the pulp, and TAPPI T 563 uses image analysis to measures visual discoloration over an area. (The description of each of these methodologies is available, for example, at standards.globalspec.com/std/1359444/tappi-t-537, standards.globalspec.com/std/1682094/tappi-t-277, and standards.globalspec.com/std/9918295/tappi-t-563, respectively, and is incorporated by reference herein.)

[0033] Specifically, according to the TAPPI T 563 method, a scanner is used to analyze the EBA (equivalent black area) or a dark-colored area on a background of white paper or pulp. Since un-oxidized aluminum is silver-ish or grey-ish in color, and oxidized aluminum is substantially colorless and transparent, the aluminum content of the embodiment of the invention is judiciously chosen such as to be fully oxidized (~ oxidized to the extent beyond the limits of the registration / detection capability of the used scanner to recognize such aluminum content as "spot(s)". To this end, Fig. 3 demonstrate a graphical representation of the empirically-determined detectable lower limit of optical density of aluminum in an EBA test.

[0034] Aluminum is likely not the only material that would provide a low level of emissivity in use while remaining visually transparent and not pulp-adhering after repulpability and recyclability testing, but aluminum would likely be the most practical in use. For example, silver or indium tin oxide could also satisfy the requirements of the present embodiment, but would likely be prohibitively expensive as compared to aluminum.

[0035] Implementation of the present idea includes the use of an aluminized polymeric film - either with a coating less than about one micron in thickness to protect the aluminum from

corrosion in use and not raise the emissivity of the aluminized surface greater than 0.10, or with no coating at all if it is not required for normal operation of a packaging article - to keep the emissivity as low as possible. The various layers and combination of layers are shown in Figs. 4, 5, and 6.

[0036] The embodiment 400 of Fig. 4 contains a paper layer 410 with a first surface 411 and a second surface 412; a polymer layer 420 with a third surface 423 and a fourth surface 424, where the third surface 4233 is affixed to the second surface 412; and an aluminum layer 430 is deposited on the fourth surface 424. The corrugation sub-layer of the paper layer indicated between the surfaces 411, 412 with the line 413, is generally optional.

[0037] Fig. 5 shows a related structure 500, which, in comparison with the structure 400, additionally contains a protective coating 5 over the aluminum layer 430, where the coating layer 510 is generally less than one micron in thickness.

[0038] Similarly, Fig. 6 shows a structure 600 that additionally includes a second coating layer 610 disposed between the polymer layer 420 and the aluminum layer 430.

[0039] Each of these various layered structures 400, 500, and 600 is configured to ensure that the aluminum-containing portion of the structure is removable during the repulping and recycling process, while the aluminum material on the aluminized film is actually allowed to "crumble" into the pulp as the blender and disintegrator scratches, scrapes and otherwise removes and separates the paper products from the non-paper products, thereby facilitating the propagation of the aluminum material towards and into the accepts area for the pulp – against the conventional wisdom of keeping non-paper components and/or materials out of the pulp. Overall, the result will be a material product configured such that achieves a degree of insulation comparable or better than that of a reflective insulation and that does, when applied to a paper product or component, increase the probability of the final, multilayer product being repulpable and recyclable as regular paper.

[0040] It was empirically found that there are two requirements that any coating covering the aluminum material of an embodiment of the invention would need to meet. First, such coating has to be such that the coated aluminum material meets the appropriate emissivity requirement to be considered a radiant barrier, (in other words, to demonstrate emissivity of less than or equal to 0.10 when tested to ASTM C1371). Fig. 7 shows how the emissivity of different types of

coatings change in relation to the thicknesses of the coatings, where the polymer graph line is indicated with reference numeral 701, and the wax graph line is indicated by reference numeral 702.

[0041] Second, the coating must pass the TAPPI T 277 test method, as called out in the "Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" to detect sticky "spots" which would be cause for failure of the standard. For example, during the deposition of fischer tropsch wax (with a 221 F melting point) onto an aluminized film with an initial emissivity of 0.03 (empirically obtained as a result of testing according to the requirements of ASTM C1371), as the thickness of the wax increases from 0.14 microns to 1.05 microns, the emissivity does not increase or otherwise change abruptly, only reaching the value of 0.06 when the wax-coating thickness reaches 1.05 microns. However, the 1.05 micron thick wax is believed to be too thick a layer to pass the "Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", because the presence of the wax material resulted in "stickies" when tested according to TAPPI T 277.

[0042] It was discovered that, in order to comply with the "Voluntary Standard for Repulping and Recycling…", the layer of wax should be less than 0.70 microns thick. A sample with a 0.7 micron thick layer of deposited wax was subjected to testing according to the TAPPI T 277 test method. It will be appreciated that a given product can fail the TAPPI T 227 (the "stickies" test) in one of two ways: if a stickie spot count is greater than 15, and if the spot counts are greater than 30% of the control group. Since the results of the conducted test demonstrated on an average just one spot per sheet, it was concluded that, when the thickness of this type of coating is chosen to be less than 0.7 microns, this coating does not contribute to generation of the defects resulting in rejection of the material from the repulpability / recyclability point of view. If a control figure of merit is set at zero spots per sheet, even one per sheet would result in failing the test, so keeping the thickness of the wax coating under 0.7 micron would result in satisfying (meeting) the "Voluntary Standard for Repulping and Recycling…". To this end, Fig. 8 contains a table illustrating the number of "stickies" defects empirically determined when various embodiments of the invention containing coatings made of materials listed in this table were tested according to TAPPI T 277.

[0043] Another example of a protective coating would be a radiation-cured acidic acrylic copolymer. This copolymer, when deposited onto an aluminized film with an initial emissivity of 0.03, behaves very different from the wax. As the thickness of the copolymer is increased from 0.20 microns to 1.55 microns (see curve 701 of Fig. 7), the emissivity of the so-coated aluminized film rises at a significantly greater rate than in the case of the wax-coated aluminized film (compare with the curve 702). At a polymer thickness of 0.98 microns, the coated surface has emissivity of 0.12 and, therefore, no longer meets the emissivity requirement that must be met by a radiant barrier. Because the copolymer is a thermoset and not a thermoplastic, it does not soften, melt, or contribute to "stickies" when subjected to testing at 221 F at 100% RH for 4 hours, per the "Voluntary Standard For Repulping and Recycling …" and, therefore, passes the required test.

[0044] Examples of a reflective insulation packaging product comprising an embodiment of the present invention are various and diverse, and some of such examples are listed below:

- A box liner with the thin coated aluminized film facing outward, designed in such a way that when fold and closed has tabs or flanges between 1/2 and 3/4 inches, protruding out from all six sides so that when inserted into a corrugated shipper box, the coated and protected metalized film is facing into air spaces between 1/2 and 3/4 inches;
- A standard box with thin coated aluminized film on the outside of the entire box, designed to fit inside a slightly larger box with separate spacers between the inner and outer box;
- A single panel of corrugated paper or cardboard with thin coated aluminized film on one side, designed to fit snugly inside a box containing goods where the height of the goods does not reach all the way to the top of the box, and the panel can be inserted with the coated metalized film facing into the above air space;
- A standard box where the inside of the box is lined with a thin coated aluminized film, where the goods do not completely fill the box and an air space is created by the size and shape of the goods themselves in relation to the walls of the box.

[0045] Examples of normal use of the embodiments of the packaging product of the present invention are substantially dependent on the type of good that is shipped in such packaging product. In one example, if the good is perishable food that needs to remain fresh, the good may

require to be at 40 degrees F on the interior of the packaging while the exterior may be at the ambient in the summer, and while the good would need to maintain its temperature anywhere from 24 to 72 hours (depending on the mode of shipping). On the other hand, if the good is a frozen perishable good, then the internal temperature (in the container or packaging) could be required to be anywhere from 0° to 32° F. If the good is candy or chocolate, then the temperature inside the packaging would be above 32° F but below 65° F. If the good is a pharmaceutical, then it may be subject to its own unique temperature requirements.

[0046] Specific examples of normal use include, but are not limited to, the following examples:

[0047] (1) A recyclable cardboard radiant barrier box liner is made with the aluminum surface facing into an airspace between the cardboard liner and the cardboard box. The liner is packaged with 12 lbs. of dry ice and 10 lbs. of frozen beef. The frozen beef starts off at -5° F and the dry ice at -109° F. The box is shipped through a standard ground service from Los Angeles to Phoenix (48 hours), in the middle of July, when the outside temperature is approximately 75° F in Los Angeles and 110° F in Phoenix. The added condensation created by the dry ice may cause an aluminum portion of the packaging to corrode if not coated, so a protective polymer or wax coating may be necessary. Either the recyclable liner itself must be able to insulate against the temperature difference between the goods and the outside air, or else additional insulation would preferably be used (such as foam, cellulose insulation, or perhaps a second recyclable radiant barrier box liner).

[0048] (2) A recyclable radiant barrier box is made with the aluminum surface facing inward, toward the goods. The box contains 9 lbs. of chocolate and 5 lbs. of frozen gel packs. The chocolate starting off at 65° F and the frozen gel packs at 5° F. The box of chocolate is shipped via overnight air transport (24 hours) from Los Angeles to New York, in December. The temperature of outside air starts off at 55° F in Los Angeles, decreases to about 45° F in the cargo area of the plane, and is at 35° F when the shipment arrives in New York. The temperature differences being smaller than in the previous example, and the aluminum facing the inside instead of the outside, means that vapor condensation on the aluminum surface would be unlikely, and a protective coating over the aluminum material in the embodiment of this packaging may not be necessary. The goods, only needing to arrive at or below 65° F, and the

external air temperature not being as extreme, means that the insulation required to maintain the required temperature of the goods may be achieved with the recyclable radiant barrier box alone.

[0049] (3) A recyclable cardboard radiant barrier insert component is placed at the bottom of a box, which is otherwise insulated with a cotton insulation on the walls and under the lid which would compress under the weight if it was on the bottom. The cardboard radiant barrier insert component is folded or constructed in such a way as to both hold the weight of the payload without compressing and maintain an airspace facing the radiant barrier surface. This insulated box is packed with 8 bottles of juice at 12 oz. each against the insulation on the walls and a 24 oz. frozen gel pack in the center. The juice starts off at 40° F with the frozen gel pack at 10° F. The insulated box is shipped from San Diego, CA to San Francisco, CA in early January. The radiant barrier cardboard insert component holds up the weight of the juice, preventing crushing or collapsing of insulation, while at the same time providing reflective insulation to prevent heat gain from the bottom of the box. The air temperature that day in San Diego is 80° F, the overnight the temperature drops to 60° F, and the packaged good arrives in San Francisco where the temperature is 60° F. The juice arrives safely at its destination at a refrigerated temperature of less than 40° F.

[0050] (4) A recyclable radiant barrier heavy paper bag, with a radiant barrier facing toward the inside, is enclosed around 9 lbs. of food and 6 lbs. of frozen gel packs, and inserted into a large box as a meal delivery kit. Of the 9 lbs. of food, 3 lbs. are frozen meats that start off at 20° F, and 6 lbs. are fresh fruits and vegetables that start off at 35° F, with 6 lbs. of frozen gel packs placed surrounding the meats. This meal kit ships in the winter from Dallas, TX where the temperature is 60° F and travels by ground to Tulsa, OK where the temperature drops down to 40° F at night and is back up to 60° during the day. The meats arrive at a refrigerated temperate of under 40° F, and the fresh fruits and vegetables are still cool to the touch.

[0051] (5) A recyclable radiant barrier box is constructed with outward facing tabs to create air space between it and a larger shipper box, with one radiant barrier surface facing into that air space. The radiant barrier box is filled with 8 frozen tamales at 25° F. No other refrigerant is added. The box ships from Tucson, AZ in early February to New York, NY via two day air transportation. The temperature in Tucson is 70° F the afternoon the package leaves for the

terminal and 70° F the next day before boarding the plane. The temperature decreases to 45° F in the cargo area of the plane, and the package arrives in New York where the temperature is 40° F. The tamales arrive at a temperature under 40° F.

[0052] (6) A recyclable radiant barrier cardboard insert comprises a radiant barrier surface on both sides. The box is constructed with tabs to separate it from an exterior shipping box so that the outward radiant barrier is facing into the air space between it and the shipper box, and the inward radiant barrier is facing into the air space of the interior of the box and any intermittent air spaces created by the positioning of the goods. The good in this case are 32 oz. of refrigerated yogurt and 3 lbs. of frozen gel packs. The frozen gel packs start off at 25° F and the yogurt starts off at 35° F. The package is shipped from Los Angeles, CA to Sacramento, CA in the summer via one-day ground shipment. The outside air temperature across the trip is at about 80° F with little variation. The yogurt is partially frozen for the first 12 hours, but thaws and arrives in Sacramento under 40° F.

[0053] In stark contradistinction with technologies of related art, an embodiment of the present invention complies with the repulpability requirement, yet still provides insulation with very low emissivity figure(s). An embodiment may have a metalized film on one side and paper on the other, with the metal facing outwardly. Optionally, a protective top coating can be added, if required. Thus, an embodiment of the invention includes a paper layer with first and second surfaces; a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface and an aluminum layer is deposited on the fourth surface. Optionally, an embodiment of the invention may include an intermediate layer, where the purpose of the intermediate layer may be to smooth the fourth surface prior to applying the aluminum in order to achieve better emissivity, or it may serve the purpose of being easily removable in order to separate the aluminum from the fourth surface after use. The intermediate layer may, for example, be a polymer or an oligomer.

- The packaging product would possess the emissivity of well under 0.10, and typically closer to 0.05. This would give it superior insulating performance.
- The packaging product would pass the "Voluntary Standard …", as empirical discovery of how vacuum deposited aluminum behaves during the "Voluntary Standard…" test. If

the aluminum is allowed to oxidize under the conditions of the test, then the transparent aluminum oxide can be mixed in the pulp and not be cause for failure.

- As is well known in related art, the industry has been so concerned with aluminum showing up in the pulp (which does happen in the case of the use of aluminum foil) that either the aluminized plastic is not used at all, or else the aluminum portion is fully encapsulated, which solution both adds weight (which could still cause a failure of the Voluntary Standard) and increases emissivity (which significantly diminishes the insulation performance).

  However, in contradistinction with the products of related art, when applied to 60 lb. kraft paper, as might be configured to make an insulated pouch for example, the single layer of 48 gauge PET complemented with the aluminum and top coating layers as proposed in this disclosure results in meeting the 85% / 15% weight criteria for the repulpability test according to the Voluntary Standard.

[0054] A summary of the comparison between the existing technologies and an embodiment of the present invention is shown with reference to two possible products:

[0055] *Product 1*: An insulating pouch using a strong and heavy paper, with a reflective surface on one side, where the reflective surface is:

- The film/aluminum/film product - neither low emissivity nor recyclable;
- Aluminum foil - very low emissivity but is not recyclable;
- Metalized paper - recyclable and somewhat low emissivity;
- An embodiment of the present invention - both recyclable and very low emissivity.

[0056] *Product 2*: An insulating box or insert for a box, using cardboard, with a reflective surface on one side where the reflective surface is:

- The film/aluminum/film product - not low emissivity, but may be recyclable depending on the weight and type of cardboard used;
- Aluminum foil - very low emissivity but is not recyclable;
- Metalized paper - recyclable and somewhat low emissivity;
- An embodiment of the present invention - both recyclable and very low emissivity.

[0057] Thus, as illustrated in the above examples, an embodiment of the present invention may be successfully used to effectively insulate an object during shipment, mail delivery, etc. with the

added benefit that the packaging may then be recycled once it has served its purpose. The method of packaging an object that is perishable, or may otherwise be temperature sensitive, comprises placing the object in suitable proximity to an embodiment of the invention such that adequate thermal insulation is provided. Adequate thermal insulation (of an object or good) is defined as protection (of such good) from heat, cold, or changes between heat and cold, such that the desired temperature range of such object is maintained during and throughout the shipment, mail delivery, etc. time frame.

[0058] As broadly used and described herein, the reference to a material layer being "carried" on a surface of a chosen element refers to a material layer that is disposed directly on the surface of such chosen element or disposed on another coating, layer or layers that are disposed directly on the surface of the chosen element. For the purposes of this disclosure and the appended claims, the use of the terms "substantially", "approximately", "about" and similar terms in reference to a descriptor of a value, element, property or characteristic at hand is intended to emphasize that the value, element, property, or characteristic referred to, while not necessarily being exactly as stated, would nevertheless be considered, for practical purposes, as stated by a person of skill in the art. These terms, as applied to a specified characteristic or quality descriptor means "mostly", "mainly", "considerably", "by and large", "essentially", "to great or significant extent", "largely but not necessarily wholly the same" such as to reasonably denote language of approximation and describe the specified characteristic or descriptor so that its scope would be understood by a person of ordinary skill in the art. In one specific case, the terms "approximately", "substantially", and "about", when used in reference to a numerical value, represent a range of plus or minus 20% with respect to the specified value, more preferably plus or minus 10%, even more preferably plus or minus 5%, most preferably plus or minus 2% with respect to the specified value. As a non-limiting example, two values being "substantially equal" to one another implies that the difference between the two values may be within the range of +/- 20% of the value itself, preferably within the +/- 10% range of the value itself, more preferably within the range of +/- 5% of the value itself, and even more preferably within the range of +/- 2% or less of the value itself. The use of these term in describing a chosen characteristic or concept neither implies nor provides any basis for indefiniteness and for adding a numerical limitation to the specified characteristic or descriptor. As understood by a skilled artisan, the practical deviation of the exact value or characteristic of such

value, element, or property from that stated falls and may vary within a numerical range defined by an experimental measurement error that is typical when using a measurement method accepted in the art for such purposes.

[0059] While the invention is described through the above-described exemplary embodiments, it will be understood by those of ordinary skill in the art that modifications to, and variations of, the illustrated embodiments may be made without departing from the inventive concepts disclosed herein.

[0060] For example, related embodiments provide a receptacle (that is, a container or device configured to receive and hold contents in a cavity defined by the walls of the container) that includes (i) a first shell made from a first material and defining a first cavity therein, the cavity having a first volume, the shell having a first surface facing outwardly and a second surface facing inwardly towards the cavity, said first and second surfaces being separated by a thickness of the shell, and (ii) at least one piece of second material having a third surface and disposed inside the first volume with the third surface facing the second surface and separated from the second surface by a target separation distance. Here, the target separation distance is greater than 3 millimeters; any of the second and third surfaces is metallized. A metallized surface of the receptacle is characterized by an energy-radiating parameter of no greater than 0.1, while an energy-radiating parameter of the first surface is no less than 0.50. The receptacle is recyclable. In one implementation, the at least one piece of the second material is configured as a second shell defining a second cavity therein, the second cavity having a second volume, the second shell having the third surface facing outwardly towards the second surface and a fourth surface facing inwardly towards the second cavity. In a specific case of such implementation, any of the third and fourth surfaces is metallized.

[0061] Embodiments also provide a receptacle that includes (i) a first shell made from a first material and defining a first cavity therein, the cavity having a first volume, the shell having a first surface facing outwardly and a second surface facing inwardly towards the cavity, the first and second surfaces being separated by a thickness of the shell, and(ii) at least one piece of second material having a third surface and disposed inside the first volume with the third surface facing the second surface and separated from the second surface by a target separation distance of greater than 3 millimeters. Here, any of the second and third surfaces is metallized, and an

emissivity of a metallized surface of the receptacle is no greater than 0.1 while an emissivity of the first surface is no less than 0.50. The receptacle is recyclable. In one implementation, any of the second and third surfaces is metallized while the first surface is not metallized. Alternatively or in addition, at least one piece of the second material is configured as a second shell defining a second cavity therein, the second cavity having a second volume, the second shell having the third surface facing outwardly towards the second surface and a fourth surface facing inwardly towards the second cavity.

[0062] Accordingly, the invention should not be viewed as being limited to the disclosed embodiment(s).

CLAIMS

What is claimed is:

1. **A recyclable packaging** comprising:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes

a) blending in a Waring Blender;

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm;

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes; and

d) drying in an oven for 4 hours at 221 degrees F.

2. The recyclable packaging of claim 1, wherein the aluminum layer is disposed directly on the intermediate coating.

3. The recyclable packaging of claim 1, wherein the intermediate coating has a thickness between 10 nm and 2000 nm and includes a material selected from polymer and oligomer.

4. The recyclable packaging of claim 1, further comprising:

a protective coating over the aluminum layer, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during

normal use of the packaging, while the protective coating does not impede oxidization of the aluminum layer as a result of the treatment.

5. The recyclable packaging of claim 4, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

6. The recyclable packaging of claim 1, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

7. The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

8. **A method for manufacturing a recyclable packaging**, the method comprising:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a first thickness of 200 nanometers or less, and wherein the aluminum layer causes an outer surface of the polymer layer to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum when the packaging is exposed to a treatment that includes:

a) blending in a Waring Blender;

b) disintegrating into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm,

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes, and

d) drying in an oven for 4 hours at 221 degrees F.

9. The method of manufacturing a recyclable packaging of claim 8, further comprising:

applying a protective coating over the aluminum layer, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is defined

a) to maintain the emissivity of the outer surface at the first value after the aluminum layer has been coated with the protective coating and

b) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating

does not impede oxidization of the aluminum layer as a result of the treatment.

10. **A recyclable packaging** comprising:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment that includes

a) blending the packaging in a Waring Blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

11. The recyclable packaging of claim 10, further comprising:

a protective coating, over the aluminum layer,

wherein the protective coating has a second thickness of 1 micron or less,

wherein the second thickness is defined to maintain the first value of the emissivity of the outer surface after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,

while the protective coating does not impede oxidization of the aluminum layer caused by the treatment.

12. The recyclable packaging of claim 11, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

13. The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

14. The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: film and fabric.

15. **A method for thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment that includes

a) blending the packaging in a Waring Blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

16. **A method for thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material at a pre-defined proximity distance from the good, said pre-defined proximity distance chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of no more than 200 nanometers to cause an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material as a result of subjecting the recyclable packaging to a treatment that includes

a) blending the packaging in a Waring Blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

ABSTRACT

Material for packaging - and package or receptacle made of such material - that contains a particular aluminized polymeric film with emissivity of equal to, or less than 0.10 and yet sufficiently thin to withstand and satisfy industrial requirements of the recycling process due to substantially complete oxidization of aluminum during the recycling. An optional protective coating (less than one micron in thickness) may be added to protect aluminum in the film from corrosion during the normal use of the packaging. Protective coating is configured to not raise emissivity of the aluminized surface above the 0.10 value and, at the same time, to still allow for the aluminum material it covers to be removed due to becoming fully oxidized and corroded in the heat and at humidity levels used in the recycling/repulping process. Proposed configuration permits the aluminum of the packaging material to be included in the recycled portion of the packaging material.

Optical Density of Aluminum Polyester During Simulated Repulpability Test Conditions

Initial OD	After 20 min in Warm Water	After Drying 8 hours	After Drying 12 hours	After Drying 16 hours
1.00	0.93	0.39	0.03	0.03
2.00	1.90	0.33	0.03	0.03

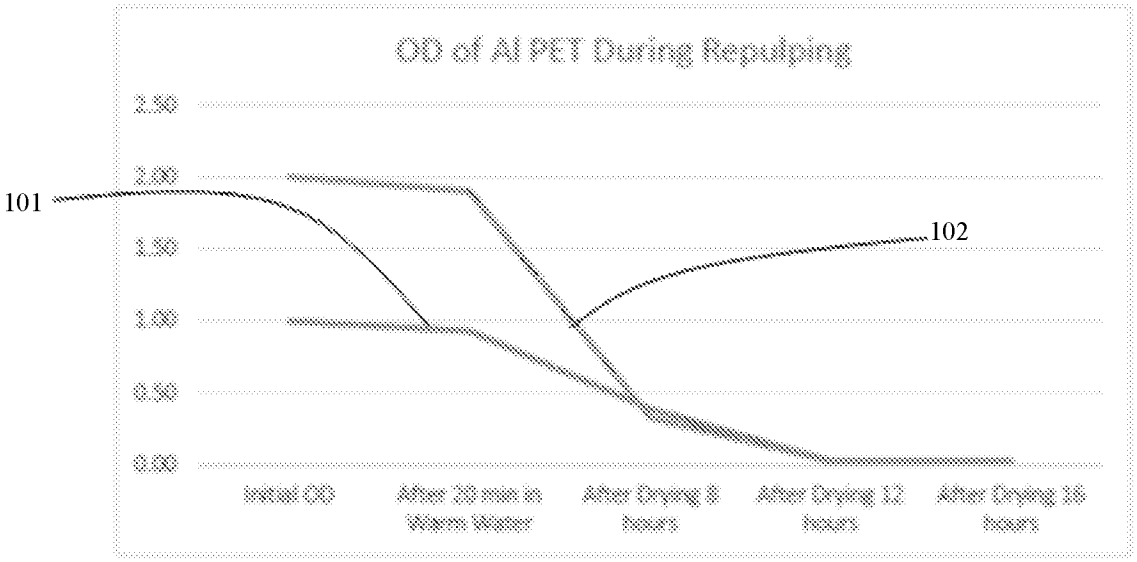


Fig. 1

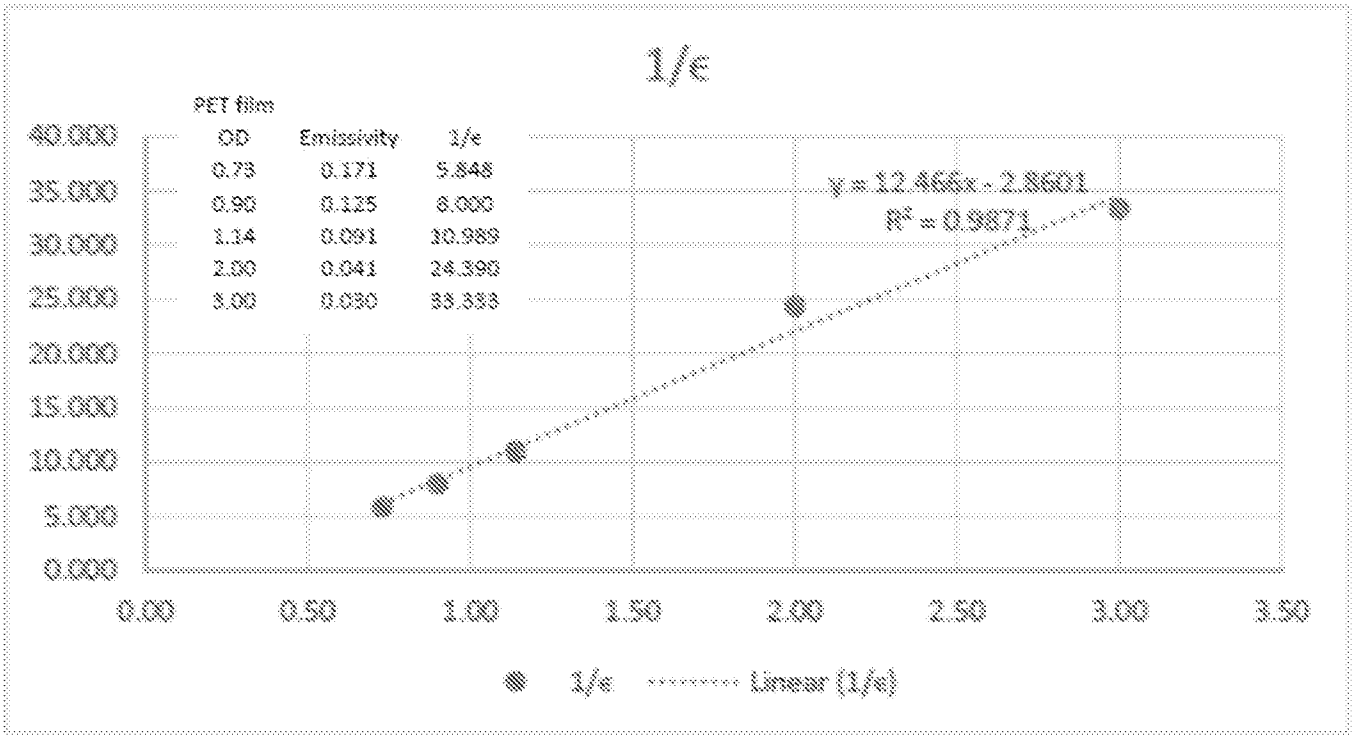


Fig. 2

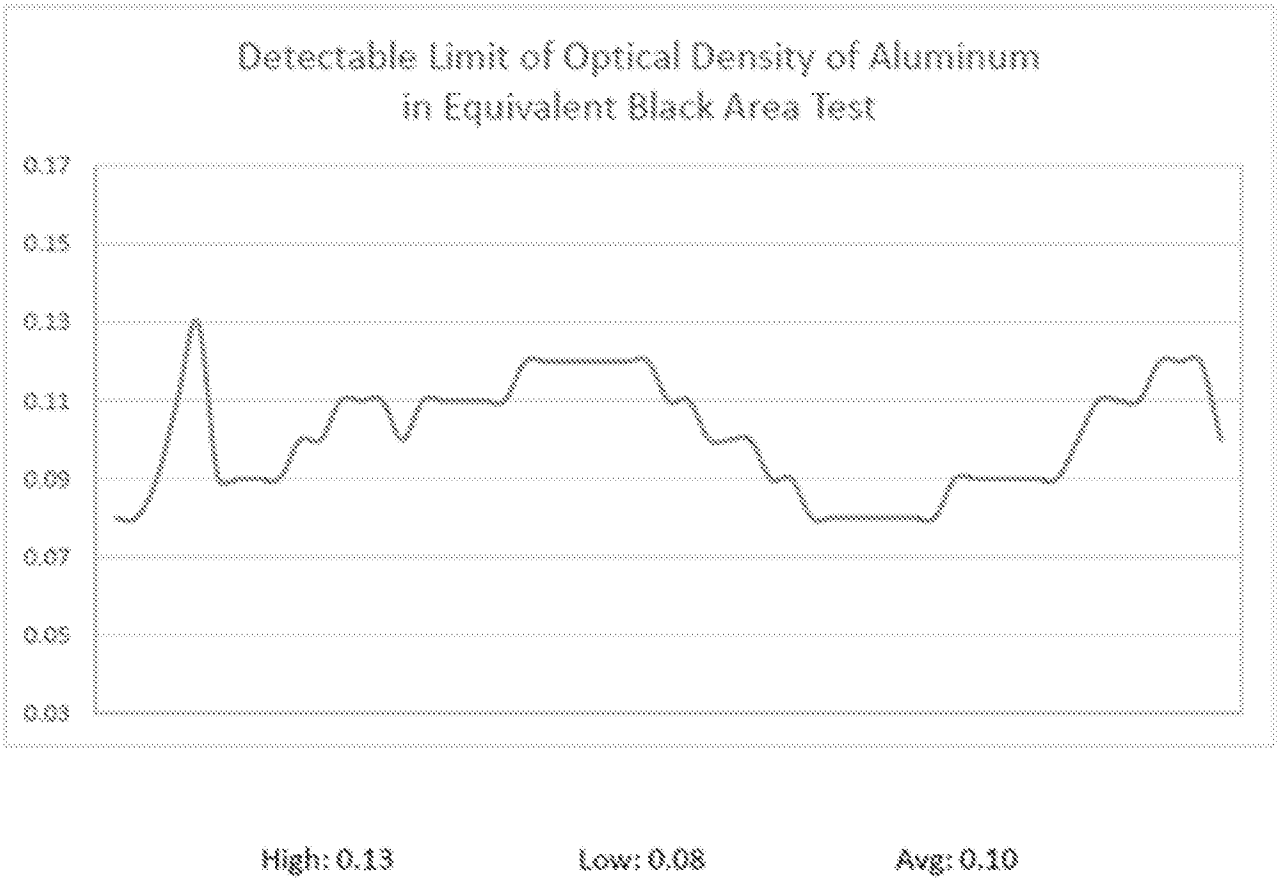

Detectable Limit of Optical Density of Aluminum
in Equivalent Black Area Test
0.17
0.15
0.13
0.11
0.09
0.07
0.05
0.03
High: 0.13
Low: 0.08
Avg: 0.10

Fig. 3

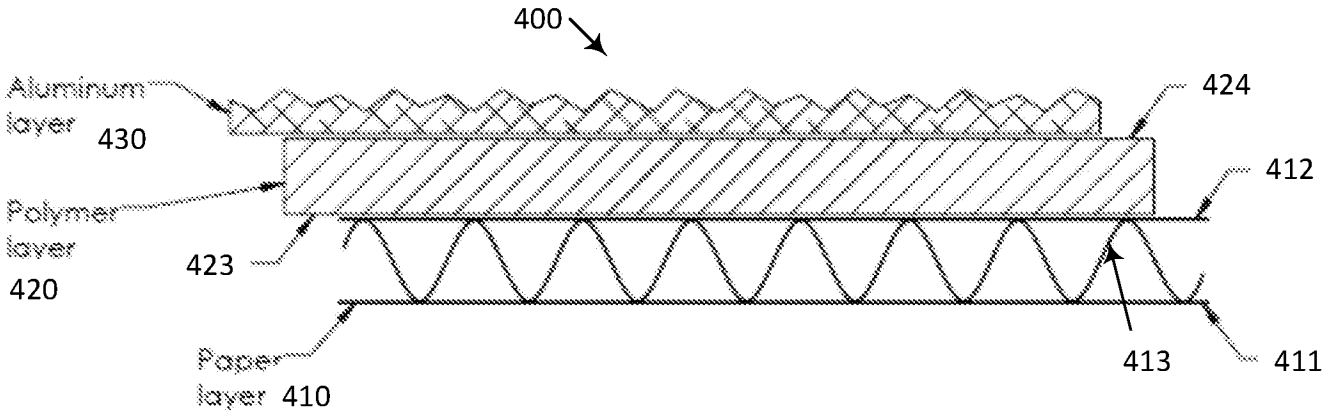


Fig. 4

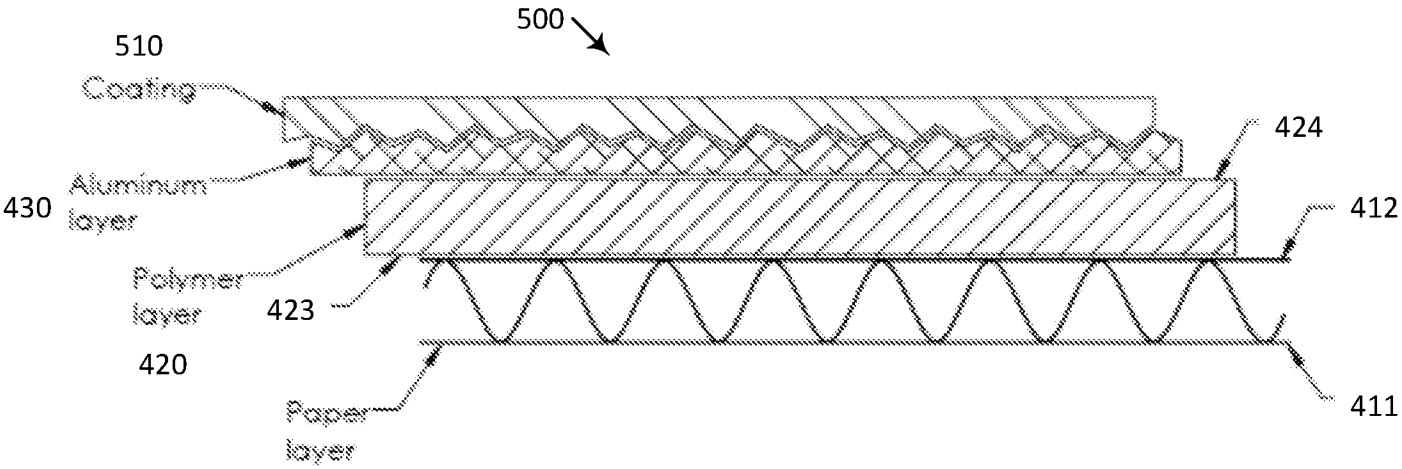


Fig. 5

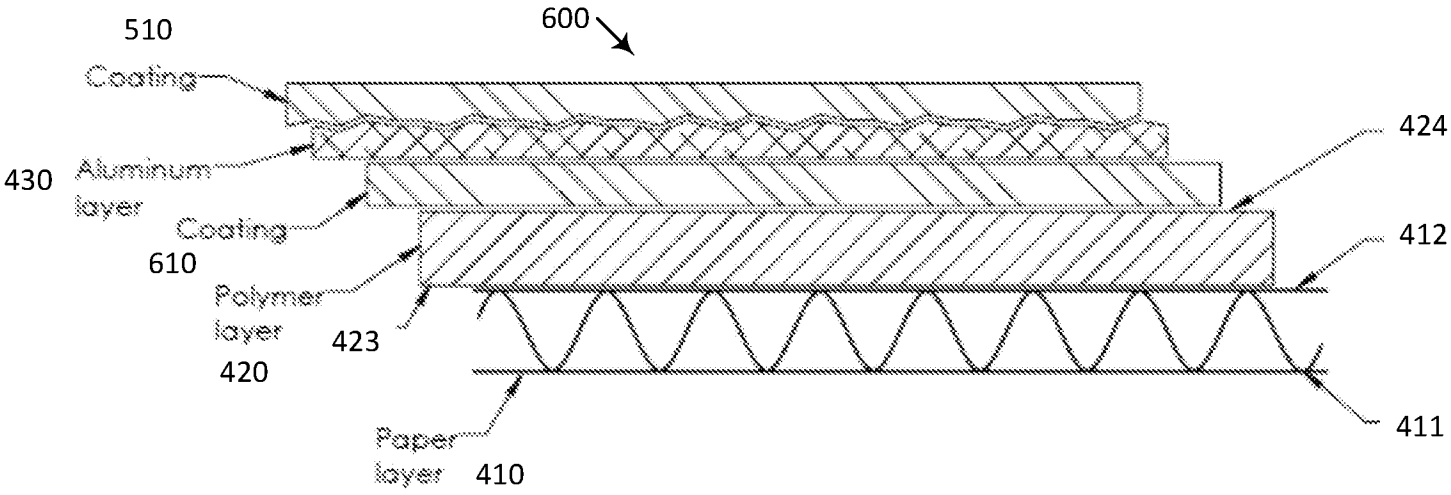


Fig. 6

Fig. 7

Polymer							
um	0.20	0.35	0.30	0.43	0.66	0.96	1.35
*							
Wax	0.04	0.04	0.04	0.03	0.07	0.11	0.22

um	1.85	0.70	0.35	0.23	0.14
*					
Wax	0.06	0.04	0.03	0.03	0.03

Stickies Count on Pressed Pulp Sheets

Type of Coating Over Aluminum	# of Stickies
0.70 micron Fischer Tropsch Wax	3
1.05 micron Fischer Tropsch Wax	294
0.98 micron Thermoset Copolymer	0

Fig. 8

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Filer:	Yakov S. Sidorin/Leslie Lowery
Attorney Docket Number:	861133.00068

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**865**

Electronic Acknowledgement Receipt

EFS ID:	34752117
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	03-JAN-2019
Filing Date:	
Time Stamp:	15:20:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$865
RAM confirmation Number	010419INTEFSW00001696170055
Deposit Account	170055
Authorized User	Leslie Lowery

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	861133_00068_ADS.pdf	1255963 ff09e34652b1edc41ba7544f0efa20b532eeaf20	no	8
Warnings:					
Information:					
2		861133_00068_Application.pdf	246272 b4dc01b8ba8d4d40bd81be1f5501d49b6324bd75	yes	32

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	26
Claims	27	31
Abstract	32	32

Warnings:					
Information:					
3	Drawings-only black and white line drawings	861133_00068_Drawings.pdf	790154 774fd6eda24be2a1eea38d12d80d6eb87940e382	no	5
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	36982 246816cf72fbbff147ae45238c19e2d275093ad7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2329371		

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PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/238,998

filed on January 3, 2019.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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LEGAL NAME OF INVENTOR

Inventor: Steven Yializis Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/238,998 filed on January 3, 2019.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Luke Rogers Date (Optional): 1/9/19

Signature: [signature]

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt

EFS ID:	34836646
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	11-JAN-2019
Filing Date:	
Time Stamp:	17:30:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	861133_00068_Declarations.pdf	914192 71935d6ac0e0a452bd4144d141f516d1a92eb8d4	no	2

Warnings:

Information:	
Total Files Size (in bytes):	914192

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New International Application Filed with the USPTO as a Receiving Office

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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/238,998	01/03/2019	1782	865	861133.00068	16	5

CONFIRMATION NO. 5903

FILING RECEIPT

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

OC000000105445948

Date Mailed: 01/31/2019

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Steven Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Applicant(s)

SIGMA TECHNOLOGIES INT'L., LLC, Tucson, AZ

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/614,568 01/08/2018

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 01/29/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/238,998**

Projected Publication Date: 07/11/2019

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Preliminary Class

428

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/238,998

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	16 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	5 minus 3 =	* 2	x 230 =	460			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1245		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/238,998	01/03/2019	Steven Yializis	861133.00068

CONFIRMATION NO. 5903

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

FORMALITIES LETTER

OC000000105445947

Date Mailed: 01/31/2019

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing.

Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- Additional claim fees of $ **460** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- $ **460** for **2** independent claims over 3.
- $(**0**) previous unapplied payment amount.
- $ **460** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/haberehe/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	SIGMA TECHNOLOGIES INT'L., LLC
Application No.:	16/238,998
Filing Date:	December 27, 2018
Conf.:	5903
Art Unit:	1782
Title:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

RESPONSE TO NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

In response to the Notice to File Missing Parts of Non-provisional Application mailed January 31, 2019, Applicant herewith submits a Fee Transmittal and authorization to charge Deposit Account No. 17-0055 in the amount of $460.00.

If any additional fees are deemed due, please charge them to Deposit Account No. 17-0055.

Date: January 31, 2019

Respectfully submitted,

/Yakov Sidorin, 63507/
Yakov Sidorin, Ph.D.
Registration No. 63,507
Attorney for Applicant

Quarles & Brady LLP
One South Church Avenue
Tucson, Arizona 85701
Tel: (520) 770-8753
Fax: (520) 770-2253

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/238,998	01/03/2019	Steven Yializis	861133.00068

CONFIRMATION NO. 5903

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

FORMALITIES LETTER

OC000000105445947

Date Mailed: 01/31/2019

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing.

Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- Additional claim fees of $ **460** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- $ **460** for **2** independent claims over 3.
- $(**0**) previous unapplied payment amount.
- $ **460** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/haberehe/

PTO/SB/17 (01-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

FEE TRANSMITTAL

Complete if known	
Application Number	16/238,998
Filing Date	January 3, 2019
First Named Inventor	Steven Yializis
Examiner Name	
Art Unit	1782
Practitioner Docket No.	861133.00068

☒ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

TOTAL AMOUNT OF PAYMENT ($) 460.00

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 170055 Deposit Account Name: 170055

For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayment of fee(s)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

	FILING FEES			SEARCH FEES			EXAMINATION FEES			
Application Type	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**Fees Paid ($)**
Utility	300	150*	75	660	330	165	760	380	190	
Design	200	100	50	160	80	40	600	300	150	
Plant	200	100	50	420	210	105	620	310	155	
Reissue	300	150	75	660	330	165	2,200	1,100	550	
Provisional	280	140	70	0	0	0	0	0	0	

* The $150 small entity status filing fee for a utility application is further reduced to $75 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	**Undiscounted Fee ($)**	**Small Entity Fee ($)**	**Micro Entity Fee ($)**
Each claim over 20 (including Reissues)	100	50	25
Each independent claim over 3 (including Reissues)	460	230	115
Multiple dependent claims	820	410	205

Total Claims		**Extra Claims**		**Fee ($)**		**Fee Paid ($)**
16	-20 or HP =	0	x	0	=	

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		**Extra Claims**		**Fee ($)**		**Fee Paid ($)**
5	-3 or HP =	2	x	230	=	460.00

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	**Fee ($)**	**Fee Paid ($)**

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $400 ($200 for small entity) ($100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		**Extra Sheets**		**Number of each additional 50 or fraction thereof**		**Fee ($)**		**Fee Paid ($)**
_____	- 100 =	_____	/ 50 =	_____ (round **up** to a whole number)	x	_____	=	_____

4. OTHER FEE(S) **Fees Paid ($)**

Non-English specification, $130 fee (no small or micro entity discount) _____

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, $400 fee ($200 small or micro entity) _____

Other (e.g., late filing surcharge): _____ _____

SUBMITTED BY

Signature	/Yakov S. Sidorin/	Registration No. (Attorney/Agent) 63507	Telephone 520-770-8753
Name (Print/Type)	Yakov S. Sidorin		Date January 31, 2019

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	35025134
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	31-JAN-2019
Filing Date:	03-JAN-2019
Time Stamp:	17:22:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	861133_00068_Response_to_NTFMP.pdf	138473 30d444138a6771162cc5b6c0c999456eb0f98397	no	3

Warnings:

Information:					
2	Transmittal Letter	861133_00068_Fee_Transmittal.pdf	134087 9e52d3638e08f210426b264f732e7c9bfecefd19	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	272560		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal

Application Number:	16238998
Filing Date:	03-Jan-2019
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Filer:	Yakov S. Sidorin/Leslie Lowery
Attorney Docket Number:	861133.00068

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	2	230	460
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**460**

Electronic Acknowledgement Receipt

EFS ID:	35025167
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	31-JAN-2019
Filing Date:	03-JAN-2019
Time Stamp:	17:24:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$460
RAM confirmation Number	020119INTEFSW00004761170055
Deposit Account	170055
Authorized User	Leslie Lowery

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	30709 a1cd8bbe0dc8d72fb9d60eecf63969b467c98f3f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	30709		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/238,998	01/03/2019	1782	1325	861133.00068	16	5

CONFIRMATION NO. 5903

UPDATED FILING RECEIPT

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

OC000000105569983

Date Mailed: 02/04/2019

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Steven Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Applicant(s)

SIGMA TECHNOLOGIES INT'L., LLC, Tucson, AZ

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/614,568 01/08/2018

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 01/29/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/238,998**

Projected Publication Date: 07/11/2019

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Preliminary Class

428

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 16/238,998

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	16 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	5 minus 3 =	* 2	x 230 =	460			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1245		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/238,998	01/03/2019	Steven Yializis	861133.00068

CONFIRMATION NO. 5903

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

PUBLICATION NOTICE

OC000000109560907

Title:RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Publication No.US-2019-0210324-A1
Publication Date:07/11/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

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In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

34282 7590 06/25/2020

QUARLES & BRADY LLP (TUC)
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ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

EXAMINER	
JALLOW, EYAMINDAE CHOSSAN	

ART UNIT	PAPER NUMBER
3731	

NOTIFICATION DATE	DELIVERY MODE
06/25/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pat-dept@quarles.com

Office Action Summary	Application No. 16/238,998	Applicant(s) Yializis et al.	
	Examiner EYAMINDAE C JALLOW	Art Unit 3731	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 03 January 2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-16 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-16 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 03 January 2019 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claims 1-16** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claims 1, 8, 10, 15 and 16 contain the trademark/trade name Waring. Where a trademark or trade name is used in a claim as a limitation to identify or describe a particular material or product, the claim does not comply with the requirements of 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph. See *Ex parte Simpson*, 218 USPQ 1020 (Bd. App. 1982). The claim scope is uncertain since the trademark or trade name cannot be used properly to identify any particular material or product. A trademark or trade name is used to identify a source of goods, and not the goods themselves. Thus, a trademark or trade name does not identify or describe the goods associated with the trademark or trade

name. In the present case, the trademark/trade name is used to identify/describe a blender and, accordingly, the identification/description is indefinite.

Claim 1 recites "…at about 125 (± 10) degrees F…" This language claims a range within a range, therefore, deeming the limitation indefinite.

Claims 1, 8, 10, 15 and 16 recite "…a 0.01 inch screen…" This phrase is deemed indefinite because it does not clearly point out what aspect of the screen is 0.01 inches.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1-16** are rejected under 35 U.S.C. 103 as being unpatentable over Tilton (US 2014/0272163) in view of Shimizu et al. (US 2017/0129216; "Shimizu") and Wadsworth et al. (US 2011/0020570; "Wadsworth").

Regarding claim 1, Tilton discloses a recyclable packaging (**20**) comprising:

a paper layer with first and second surfaces (**para. [0120]**);

a polymer layer (**32**) with third and fourth surfaces, wherein the third surface is affixed to the second surface (**para. [0110]; Fig. 2**);

an intermediate coating (**28**) applied to the fourth surface (**para. [0110]; Fig. 2**);

an aluminum layer (**22; para. [0094]-[0095]**) carried by the intermediate coating (**para. [0095]; Fig. 2**).

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes

a) blending in a Waring Blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes (**para. [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10.

However, Wadsworth teaches the aluminum layer causes an outer surface of the packaging (**10**) to have emissivity that is equal to or smaller than a first value of 0.10 (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Gregory discloses the claimed invention except for the drying occurring at 221 degrees F. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry at 221 degrees F, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, pg. 6 para. [0018] discloses selecting this temperature to remove water from specimens of the resulting material. Applying the temperature of Gregory to the specimens of the instant application would result in further drying, due to the higher temperature. Furthermore, the reasoning for selecting 221

degrees F is disclosed in pg. 18 para. [0041] of the specification of the instant application. During the repulping process, this temperature is needed to melt wax present on the laminate. If 233.6 degrees F is selected, the wax would still be melted of the paper.

Gregory discloses the claimed invention except for drying for 4 hours. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry for 4 hours, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Additionally, both Gregory and the instant application want to dry the resulting material to be repulped/recycled. The selection of 4 hours would be obvious to one having ordinary skill in the art.

Regarding claim 2, Tilton discloses wherein the aluminum layer (**22; para. [0094]-[0095**) is disposed directly on the intermediate coating (**28; para. [0095]; Fig. 2**).

Regarding claim 3, Tilton in view of Wadsworth disclose wherein the intermediate coating (**28**) includes a material selected from polymer and oligomer (**para. [0110]**).

Tilton in view of Wadsworth fail to disclose the intermediate coating has a thickness between 10 nm and 2000 nm.

However, Shimizu discloses an intermediate coating (**L**) has a thickness between 10 nm and 2000 nm (**para. [0208]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the intermediate coating of Tilton in view of Wadsworth by having provided the thickness, as taught by Shimizu, in

order to further enhance the resulting adhesion between the aluminum and polymer layer (**para. [0208]**).

Regarding claim 4, Tilton discloses the aluminum layer (**22; para. [0094]-[0095]**).

Tilton fails to disclose further comprising: a protective coating over the aluminum layer, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment

However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value (**para. [0012], [0390]**) after the aluminum layer (**Z1**) has been coated with the protective coating (**S**) and ii) to prevent oxidation of the aluminum layer (**Z1**) during normal use of the packaging (**para. [0012]**), while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment (**based on the values and processes combination of references , the resulting impedance would be that of the instant application**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by

having provided the protective coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Shimizu discloses the claimed invention except for a second thickness of 1 micron or less. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to provide a thickness of 1 micron or less, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Regarding claim 5, Tilton discloses the recyclable packaging (**20**).

Tilton fails to wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

However, Shimizu teaches the protective coating (**S**) includes a material selected from: wax, polymer (**para. [0145]**), and lacquer.

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton by having provided the coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Regarding claim 6, Tilton discloses wherein the polymer layer (**32**) includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene (**para. [0110] discloses a polymer-containing resin which include polyurethane and polystyrene**).

Regarding claim 7, Tilton discloses wherein the polymer layer (**32**) is a material selected from: film (**para. [0093]**) and fabric.

Regarding claim 8, Tilton discloses a method for manufacturing a recyclable packaging (**20**), the method comprising:

attaching a polymer layer (**32**) to a paper layer (**para. [0120]**), wherein an inner surface of the polymer layer (**32**) is affixed to a first surface of the paper layer (**para. [0110], [0120]; Fig. 2**);

depositing an aluminum layer (**22; para. [0094]-[0095]**) on the polymer layer (**32; via an intermediate layer (28); para. [0095]; Fig. 2**).

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes:

a) blending in a Waring Blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes (**para. [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10.

However, Wadsworth teaches the aluminum layer causes an outer surface of the packaging (**10**) to have emissivity that is equal to or smaller than a first value of 0.10 (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Gregory discloses the claimed invention except for the drying occurring at 221 degrees F. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry at 221 degrees F, since it has been

held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, pg. 6 para. [0018] discloses selecting this temperature to remove water from specimens of the resulting material. Applying the temperature of Gregory to the specimens of the instant application would result in further drying, due to the higher temperature. Furthermore, the reasoning for selecting 221 degrees F is disclosed in pg. 18 para. [0041] of the specification of the instant application. During the repulping process, this temperature is needed to melt wax present on the laminate. If 233.6 degrees F is selected, the wax would still be melted of the paper.

Gregory discloses the claimed invention except for drying for 4 hours. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry for 4 hours, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Additionally, both Gregory and the instant application want to dry the resulting material to be repulped/recycled. The selection of 4 hours would be obvious to one having ordinary skill in the art.

Regarding claim 9, Tilton discloses the aluminum layer (**22; para. [0094]-[0095]**).

Tilton fails to disclose further comprising: a protective coating over the aluminum layer, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the

aluminum layer during normal use of the packaging, while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment

However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value (**para. [0012], [0390]**) after the aluminum layer (**Z1**) has been coated with the protective coating (**S**) and ii) to prevent oxidation of the aluminum layer (**Z1**) during normal use of the packaging (**para. [0012]**), while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment (**based on the values and processes combination of references , the resulting impedance would be that of the instant application**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the protective coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Shimizu discloses the claimed invention except for a second thickness of 1 micron or less. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to provide a thickness of 1 micron or less, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Regarding claim 10, Tilton discloses a recyclable packaging (**20**) comprising:

a paper layer with first and second surfaces (**para. [0120]**);

a polymer layer (**32**) with third and fourth surfaces, wherein the third surface is affixed to the second surface (**para. [0110]; Fig. 2**);

an aluminum layer (**22; para. [0094]-[0095]**) carried by the intermediate coating (**para. [0095]; Fig. 2**).

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes

a) blending in a Waring Blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes (**para. [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10.

However, Wadsworth teaches the aluminum layer causes an outer surface of the packaging (**10**) to have emissivity that is equal to or smaller than a first value of 0.10 (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Gregory discloses the claimed invention except for the drying occurring at 221 degrees F. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry at 221 degrees F, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, pg. 6 para. [0018] discloses selecting this temperature to remove

water from specimens of the resulting material. Applying the temperature of Gregory to the specimens of the instant application would result in further drying, due to the higher temperature. Furthermore, the reasoning for selecting 221 degrees F is disclosed in pg. 18 para. [0041] of the specification of the instant application. During the repulping process, this temperature is needed to melt wax present on the laminate. If 233.6 degrees F is selected, the wax would still be melted of the paper.

Gregory discloses the claimed invention except for drying for 4 hours. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry for 4 hours, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Additionally, both Gregory and the instant application want to dry the resulting material to be repulped/recycled. The selection of 4 hours would be obvious to one having ordinary skill in the art.

Regarding claim 11, Tilton discloses the aluminum layer (**22; para. [0094]-[0095]**).

Tilton fails to disclose further comprising a protective coating over the aluminum layer, wherein the protective coating has a second thickness of 1 micron or less, wherein the second thickness is defined to maintain the emissivity of the outer surface after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidization of the aluminum layer caused by the treatment.

However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, wherein the second thickness is defined to maintain the emissivity of the outer surface after the aluminum layer has been coated with the protective coating (**para. [0012], [0390]**) and to prevent oxidation of the aluminum layer (**Z1**) during normal use of the packaging (**para. [0012]**), while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment (**based on the values and processes combination of references , the resulting impedance would be that of the instant application**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the protective coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Shimizu discloses the claimed invention except for a second thickness of 1 micron or less. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to provide a thickness of 1 micron or less, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Regarding claim 12, Tilton discloses the recyclable packaging (**20**).

Tilton fails to wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

However, Shimizu teaches the protective coating (**S**) includes a material selected from: wax, polymer (**para. [0145]**), and lacquer.

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton by having provided the coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Regarding claim 13, Tilton discloses wherein the polymer layer (**32**) includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene (**para. [0110] discloses a polymer-containing resin which include polyurethane and polystyrene**).

Regarding claim 14, Tilton discloses wherein the polymer layer (**32**) is a material selected from: film (**para. [0093]**) and fabric.

Regarding claim 15, Tilton discloses a method for thermally insulating a good within a recyclable packaging (**20; para. [0003]**), the method comprising:

placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good (**para. [0075]**), wherein said reflective insulation material comprises the recyclable packaging (**20**) that includes:

a paper layer with first and second surfaces (**para. [0120]**);

a polymer layer (**32**) with third and fourth surfaces, wherein the third surface is affixed to the second surface (**para. [0110]; Fig. 2**);

an aluminum layer (**22; para. [0094]-[0095]**) carried by the intermediate coating (**para. [0095]; Fig. 2**).

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes

a) blending in a Waring Blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes (**para. [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10.

However, Wadsworth teaches the aluminum layer causes an outer surface of the packaging (**10**) to have emissivity that is equal to or smaller than a first value of 0.10 (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Gregory discloses the claimed invention except for the drying occurring at 221 degrees F. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry at 221 degrees F, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, pg. 6 para. [0018] discloses selecting this temperature to remove water from specimens of the resulting material. Applying the temperature of Gregory to the specimens of the instant application would result in further drying, due to the higher temperature. Furthermore, the reasoning for selecting 221

degrees F is disclosed in pg. 18 para. [0041] of the specification of the instant application. During the repulping process, this temperature is needed to melt wax present on the laminate. If 233.6 degrees F is selected, the wax would still be melted of the paper.

Gregory discloses the claimed invention except for drying for 4 hours. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry for 4 hours, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Additionally, both Gregory and the instant application want to dry the resulting material to be repulped/recycled. The selection of 4 hours would be obvious to one having ordinary skill in the art.

Regarding claim 16, Tilton discloses a method for thermally insulating a good within a recyclable packaging (**20; para. [0003]**), the method comprising:

placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good (**para. [0075]**), wherein said reflective insulation material comprises the recyclable packaging (**20**) that includes:

a paper layer with first and second surfaces (**para. [0120]**);

a polymer layer (**32**) with third and fourth surfaces, wherein the third surface is affixed to the second surface (**para. [0110]; Fig. 2**);

an intermediate coating (**28**) applied to the fourth surface (**para. [0110]; Fig. 2**);

an aluminum layer (**22; para. [0094]-[0095]**) carried by the intermediate coating (**para. [0095]; Fig. 2**).

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes

a) blending in a Waring Blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch screen with a 1 inch water head for 20 minutes (**para. [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10.

However, Wadsworth teaches the aluminum layer causes an outer surface of the packaging (**10**) to have emissivity that is equal to or smaller than a first value of 0.10 (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Gregory discloses the claimed invention except for the drying occurring at 221 degrees F. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry at 221 degrees F, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, pg. 6 para. [0018] discloses selecting this temperature to remove water from specimens of the resulting material. Applying the temperature of Gregory to the specimens of the instant application would result in further drying, due to the higher temperature. Furthermore, the reasoning for selecting 221

degrees F is disclosed in pg. 18 para. [0041] of the specification of the instant application. During the repulping process, this temperature is needed to melt wax present on the laminate. If 233.6 degrees F is selected, the wax would still be melted of the paper.

Gregory discloses the claimed invention except for drying for 4 hours. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to dry for 4 hours, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Additionally, both Gregory and the instant application want to dry the resulting material to be repulped/recycled. The selection of 4 hours would be obvious to one having ordinary skill in the art.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to EYAMINDAE JALLOW whose telephone number is (571)270-1927. The examiner can normally be reached on Monday-Thursday from 7:30am-5:00pm and alternating Fridays from 7:30am-4:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ANNA KINSAUL, can be reached on (571)270-1926. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

6. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR

only. For more information about the PAIR system, see

http://portal.uspto.gov/external/portal. Should you have questions on access to the

Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197

(toll-free).

/EYAMINDAE C JALLOW/
Examiner, Art Unit 3731
/ANDREW M TECCO/
Primary Examiner, Art Unit 3731

Notice of References Cited	Application/Control No. 16/238,998	Applicant(s)/Patent Under Reexamination Yializis et al.	
	Examiner EYAMINDAE C JALLOW	Art Unit 3731	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20170129216-A1	05-2017	SHIMIZU; Yuji	B32B15/08	1/1
*	B	US-20140272163-A1	09-2014	Tilton; Christopher R.	B27N3/04	427/427.4
*	C	US-4952278-A	08-1990	Gregory; Paul E.	D21H11/18	162/141
*	D	US-20110020570-A1	01-2011	Wadsworth; Robert L.	B65D5/0236	428/34.2
*	E	US-20170266935-A1	09-2017	Chen; Mai	B32B27/10	1/1
*	F	US-20170188751-A1	07-2017	Resurreccion, JR.; Fermin P.	B32B27/288	1/1
*	G	US-20160343275-A1	11-2016	Huffer; Scott William	B32B3/20	1/1
*	H	US-20180022073-A1	01-2018	SASAKI; Ryoichi	B32B27/36	428/35.7
*	I	US-20170320305-A1	11-2017	McMillan; Lyndsey A.	B32B27/10	1/1
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

CPC - Searched*		
Symbol	Date	Examiner
B65D 1/0215	06/16/2020	Eyamindae Jallow
B32B 2439/00	06/16/2020	Eyamindae Jallow

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
53	473	06/16/2020	Eyamindae Jallow
53	+	06/16/2020	Eyamindae Jallow

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Classification search, inventor search (PALM), forward/backward citation, text search	06/16/2020	Eyamindae Jallow

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	**Art Unit**
	EYAMINDAE C JALLOW	3731

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	2,261	53/473.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 10:21
S2	2	"20190270862"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 10:26
S3	23	"3222657"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 11:26
S4	2	"6846538".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 11:29
S5	6	53/$.ccls. and laminate and (paper near3 polymer near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 11:37
S6	2,891	53/$.ccls. and laminate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 11:40

S7	393	53/$.ccls. and laminate and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:02
S8	10	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2020/06/16 12:23
S9	85	paper and aluminum and plastic and (B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:24
S10	28	("2004/0241454").URPN.	USPAT	OR	OFF	2020/06/16 12:29
S11	11	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2020/06/16 12:43
S12	0	"waring adj blender" and "british adj disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:44
S13	0	"waring adj blender" and "disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:44
S14	0	"waring adj blender"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:44

S15	24	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 12:45
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S17	24	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 15:45
S18	3	("2014/0272163").URPN.	USPAT	OR	OFF	2020/06/16 15:51
S19	19	53/$.ccls. and composite and (paper near3 plastic near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 15:51
S20	21	53/$.ccls. and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 16:08
S21	1	"16238998"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/16 16:55
S22	94	("4481076" | "4483743" | "4627743" | "4761203").PN. OR ("4952278").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/16 22:03
S24	20	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$	US-PGPUB; USPAT; FPRS	OR	OFF	2020/06/17 09:59

		or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$).did. or (EP-3222657-$).did.				
S25	6,143	(B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:00
S26	362	(B65D1/0215).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:07
S27	92	(B65D1/0215).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:22
S28	82	("4064296" | "4701360" | "4894267").PN. OR ("4977004").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/17 10:33
S29	28	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$ or US-20140205786-$ or US-20190112091-$ or US-20160243746-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$ or US-4977004-$ or US-8815360-$ or US-6964797-$ or US-6383582-$).did. or (EP-3222657-$ or WO-2015171193-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2020/06/17 10:52

S30	18,336	(B32B2439/00).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:54
S31	1,920	(B32B2439/00).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:55
S32	792	(B32B2439/00).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 10:58
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S34	0	("2017/0188751").URPN.	USPAT	OR	OFF	2020/06/17 11:40
S35	2	("2015/0284141").URPN.	USPAT	OR	OFF	2020/06/17 12:11
S36	209	(B32B2439/00).CPC. and aluminum and paper and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 12:21
S37	8	(B32B2439/00).CPC. and aluminum and paper and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/17 12:35
S38	0	("2011/0020570").URPN.	USPAT	OR	OFF	2020/06/17 12:40
S39	1	"20050001124"	US-PGPUB; USPAT	OR	OFF	2020/06/17 16:19
S40	2	"20090001124"	US-PGPUB; USPAT	OR	OFF	2020/06/17 16:20

S41	4,547	(B32B2439/00).CPC. and thickness	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/18 10:02
S42	237	(B32B2439/00).CPC. and (thickness near5 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/06/18 10:06

EAST Search History (Interference)

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6/18/2020 8:20:00 PM
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Bibliographic Data

Application No: 16/238,998

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /EYAMINDAE C JALLOW/ Examiner's Signature | Initials

Title: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
01/03/2019	053	3731	861133.00068
RULE			

APPLICANTS

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Luke Rogers Tucson, AZ, UNITED STATES

CONTINUING DATA

This application has PRO of 62614568 01/08/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/29/2019

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621
UNITED STATES

FILING FEE RECEIVED

$865

Electronic Patent Application Fee Transmittal

Application Number:	16238998
Filing Date:	03-Jan-2019
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Filer:	Yakov S. Sidorin/tracey baxter
Attorney Docket Number:	861133.00068

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	2253	1	740	740
Miscellaneous:				
			Total in USD ($)	**740**

Electronic Acknowledgement Receipt

EFS ID:	41463575
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/tracey baxter
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	22-DEC-2020
Filing Date:	03-JAN-2019
Time Stamp:	13:53:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$740
RAM confirmation Number	E2020BLD54338553
Deposit Account	
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	000068rnfoa.pdf	325077 e569bde1977070060376890dc58b018f0ee9ad42	no	19
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31155 9d730839ef0a59f733b4e7f7fe4177a309494f1b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	356232		

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sigma Technologies Int'l., LLC	Docket No.:	861133.00068
Appl. No:	16/238,998	Art Unit:	3731
Filed :	January 03, 2019	Conf. No.	5903
Examiner:	Jallow, Eyamindae Chossan		

Invention: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Date: December 22, 2020

VIA USPTO ELECTRONIC FILING SYSTEM

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Commissioner for Patents
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RESPONSE *A*

To Non-final Office Action dated June 25, 2020

Dear Sir:

In response to the Office Action of June 25, 2020, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 9 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) **A recyclable packaging** comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; and

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating layer, wherein the aluminum layer has a first thickness of 200 nanometers or less;

wherein said stack has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface thereof

~~and wherein the aluminum layer causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10~~; and

wherein, when said packaging is subjected treatment that includes ~~said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material resulting from the packaging being subjected to a treatment that includes~~

a) blending the packaging in a blender ~~Waring Blender~~;

b) disintegrating into water with a British Disintegrator ~~at about 125 (± 10)~~ at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm;

c) separating in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes; and

d) drying in an oven for 4 hours at 221 degrees F

to form a recyclable material, said aluminum layer becomes fully oxidized with no visible aluminum present in said recyclable material.

2. (currently amended) The recyclable packaging of claim 1, wherein the aluminum layer is disposed directly on the intermediate coating.

3. (currently amended) The recyclable packaging of claim 1, wherein the intermediate coating has [[a]] the intermediate coating thickness between 10 nm and 2000 nm and includes a material selected from polymer and oligomer.

4. (currently amended) The recyclable packaging of claim 1, further comprising:

a protective coating layer disposed over the aluminum layer, wherein the protective coating layer has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidization of the aluminum layer as a result of the treatment.

5. (original) The recyclable packaging of claim 4, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

6. (original) The recyclable packaging of claim 1, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

7. (original) The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

8. (currently amended) **A method for manufacturing a recyclable packaging**, the method comprising:

forming a packaging layer stack by:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a first thickness of 200 nanometers or less, and wherein the aluminum layer causes ~~an outer surface of the polymer layer~~ said packaging layer stack to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 ~~becomes fully oxidized with no visible aluminum~~ when the packaging layer stack is exposed to a treatment that includes:

a) blending the packaging stack in a blender ~~Waring Blender~~;

b) disintegrating into water with a British Disintegrator at ~~at about 125 (± 10)~~ at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm,

c) separating an output from step b) in a 0.01 aperture inch screen with a 1 inch water head for 20 minutes, and

d) drying in an oven for 4 hours at 221 degrees F.

9. (currently amended) The method of manufacturing a recyclable packaging of claim 8, further comprising:

applying a protective coating over the aluminum layer to form a coated packaging layer stack, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is defined

a) to maintain the emissivity of the ~~outer surface~~ packaging layer stack at the first value after the aluminum layer has been coated with the protective coating and

b) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidization of the aluminum layer as a result of the treatment.

10. (currently amended) **A recyclable packaging** comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer acquires an optical density (OD) of less than 0.09 ~~becomes fully oxidized~~ with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment that includes

a) blending the packaging in a blender ~~Waring Blender~~ to form a first material;

b) disintegrating the first material into water with a British Disintegrator ~~at about 125 (± 10)~~ at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

11. (currently amended) The recyclable packaging of claim 10, further comprising:

a protective coating, over the aluminum layer,

wherein the protective coating has a second thickness of 1 micron or less,

wherein the second thickness is defined to maintain the first value of the emissivity of the ~~outer surface~~ recyclable packaging after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,

while the protective coating does not impede oxidization of the aluminum layer caused by the treatment.

12. (original) The recyclable packaging of claim 11, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

13. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

14. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: film and fabric.

15. (currently amended) **A method for thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of ~~an outer surface of~~ the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment that includes

a) blending the packaging in a blender ~~Waring Blender~~ to form a first material;

b) disintegrating the first material into water with a British Disintegrator ~~at about 125 (± 10)~~ at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

16. (currently amended) **A method for thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material at a pre-defined proximity distance from the good, said pre-defined proximity distance chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of no more than 200 nanometers to cause ~~an outer surface of~~ the packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material as a result of subjecting the recyclable packaging to a treatment that includes

a) blending the packaging in a blender ~~Waring Blender~~ to form a first material;

b) disintegrating the first material into water with a British Disintegrator ~~at about 125 (± 10)~~ at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

REMARKS

1. Claims 1-16 are pending, of which
- claims 1, 8, 10, 15, 16 stand rejected under 35 USC 112(2) pre-AIA based on assertion of indefiniteness;
- claims 1-16 stand rejected under 35 USC 103 based on assertion of being obvious in light of the combination of Tilton (UUS 2014/0272163) with Shimizu (US 2017/0129216) and Wadsworth (US 2011/0020570) and Gregory (US 2,952,278);

2. With entry of this response, claims 1-16 will be pending. The Applicant respectfully requests reconsideration of the claims in view of the above amendments and the following remarks.

The Applicant respectfully asks the Examiner to please telephone the undersigned, Yakov Sidorin, to discuss any questions that may remain open to advance the application towards allowance - and sincerely appreciates the willingness of the Examiner to do so.

3. Claims 1-4, 8-11, 15, 16 have been amended to correct typographical errors, antecedent bases, and to more precisely claim the invention. No claims have been canceled, and no new claims have been added. No new mater has been introduced. The Applicant believes that with these amendments the rejections based on **section 112** have been obviated.

4. The Applicant respectfully argues that **rejection of claim 1 has been made in error at least because the combination of cited references does not teach, disclose, or suggest the invention as claimed.**

(4A) Firstly, the Office action is incomplete as to all actions and does not even mention the feature of claim 1 as reciting *"said aluminum layer becomes fully oxidized with no*

visible aluminum present in said recyclable material" - let alone analyze and prove the corresponding teaching by the combination of cited art.

Since law requires that the Office Action provide evidence of teaching of each and every element of the claim, the rejection of claim 1 was made in error and must be withdrawn.

Alternatively or in addition:

(4B) Secondly, the Applicant respectfully asserts that **the Office erred in interpreting the teachings of Tilton, and that the teachings of the Tilton reference simply do not amount (do not sum up to) the combination of the features of claim 1.**

Indeed:

(4B.1) While paragraph [0120] of Tilton discusses the "paper layer" in general terms, the only layer of the Tilton structure that can even distantly be interpreted as the "*paper layer*" is the layer 32, which - according to Tilton - is a "*fiber-containing layer*":

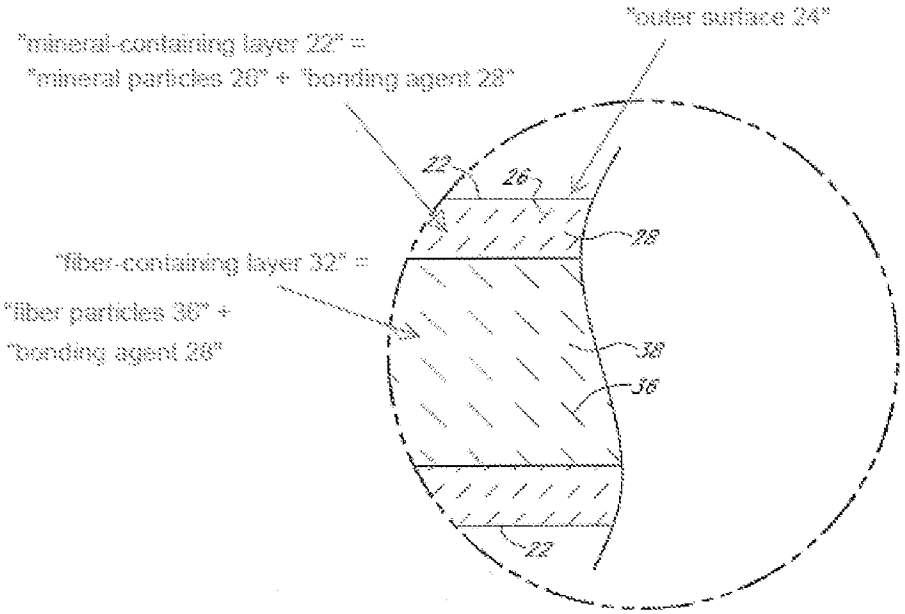


FIG. 1A

Therefore - based on this description of Tilton and in light of the well-recognized concept of claim differentiation - the layer 32 simply cannot be interpreted as a *"polymer layer"* of claim 1 - contrary to the interpretation provided by the USPTY on page 3 of the Office Action.

(4B.2) The only layer of the Tilton structure (see marked-up Fig 1A above) that can possibly be interpreted as a "*polymer layer*" is the layer 22 (which, according to Tilton, contains "*mineral particles 36*" defining this polymer-nature of this layer).

Therefore - based on this description of Tilton and in light of the well-recognized concept of claim differentiation - the layer 22 simply cannot be interpreted as an *"aluminum layer"* of claim 1 - contrary to the interpretation provided by the USPTY on page 3 of the Office Action.

(4B.3) In the next logical step, the Applicant respectfully refers to the recitation of claim 1, according to which the "stack" is formed by - in that order(!) - paper layer,

polymer layer affixed to the paper layer, the intermediate coating layer *on top of* the polymer layer, and only then an aluminum layer carried by the intermediate coating layer.

In other words, the "aluminum layer" as claimed is separated from the "paper layer" by *at least* the "polymer layer (and, in fact, by both the polymer layer and the intermediate coating layer).

And this is where the interpretation of Tilton by the Office take another wrong turn: if the presence of the claimed "aluminum layer" is derived from paragraph [0095] of Tilton (according to the assertion made by the Office on page 3 of the Office Action), then the person of skill in the art simply has to conclude - from the express recitation in paragraph [0095] - that such "aluminum layer" is disposed immediately onto the polymer layer ("mineral containing layer 22"):

> **[0095]** Regarding the mineral-containing composite layer, upon substantially and continuously bonding to the fiber-containing using extrusion coating or extrusion lamination techniques, the layer of which can then be used to form a laminated structure of which the mineral-containing layer can be used as a peel coat onto a desired backing material. The best peel seal, for example, to the mineral-containing layer of the composite, may be selected from poly-4-methyl pentene, nylon, high-density polyethylene (HDPE), aluminum foil, polycarbonate polystyrene, polyurethane, polyvinyl chloride, polyester, polyacrylonitrile, polypropylene (PP), and paper.

In reference to the marked-up version of FIG. 1A of Tilton (as well as Fig. 2 of Tilton, not reproduced here), it means that the "aluminum layer" is disposed directly onto the "outer surface 24" of the "polymer layer 22".

Therefore, Tilton does not teach anything between the aluminum layer and the polymer layer - therefore, Tilton simply *cannot* teach the "intermediate coating layer" as recited in

claim 1. (And, in fact, there is *no express recitation* of any "intermediate coating layer" in the structure of Tilton that would satisfy the requirements of claim 1)

(4B.4) At the same time, the Office has not made an assertion that Tilton *teaching by inherency*. Should the Office decide to make the prima facie of teaching by inherency, the Applicant respectfully asks that the Office provides evidence that the required feature of *'intermediate coating layer"* as recited in claim 1 necessarily follows from the disclosure(s) of he cited references, as is required by well-settled law:

a subject matter is only inherent when the prior art makes it clear that the subject matter "necessarily flows from the teachings of the prior art." *See* MPEP §2112(IV) (emphasis in original), citing *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) ("In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art").

The mere fact that "a certain result or characteristic may occur or be present in the prior art is not sufficient to establish inherency of that result or characteristic. *Id.* (emphasis original), citing *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

Given the absence of evidence of either explicit or inherent teachings of the above-identified feature of claim 1, and the fact that the remaining cited references do not cure this deficiency of Tilton. the Applicant respectfully submits that a *prima facie* case of obviousness has not been established: the rejection of claim 1 was made in error and must be withdrawn at least for this reason.

Alternatively or in addition:

(4C) Claim 1 remains patentable over the art of record at least because the combination of (Tilton + Wadsworth) does not teach the identified feature of claim 1.

Contrary to the assertion made by the Office on page 4 of the Office Action, Wadsworth does not teach "the aluminum layer that causes an outer surface of the packaging to have emissivity that is equal to or smaller than ta first value of 0.10." Instead, all Wadsworth is teaching is that the aluminum layer *itself* has that value of emissivity: a skilled artisan will immediately recognize the difference from carefully reading the referred-to by the Office paragraph [0015] of Wadsworth:

[0015] FIG. **2** shows a surface **22** of the sheet material **20** that, when converted to form the box **10** of FIG. **1**, defines the interior-facing surfaces surrounding the interior volume **12** of the box **10**. As evident from FIG. **2**, the sheet material **20** has been cut, such as with a die, to define the panels of the box **10** in FIG. **1**. In particular, the sheet material **20** comprises the four side panels **14**A-D, four bottom flaps **16**A-D that form the bottom **16** of the box **10**, and the four top flaps **18**A-D that define the closing flaps of the box **10**. An additional flap, referred to as a stitch tab **24**, extends from the side panel **14**D which, as evident from FIG. **1**, enables the panel **14**D to be glued or otherwise attached to the side panel **14**A for closing the sides of the box **10**. The surface **22** of the sheet material **20** seen in FIG. **2** is preferably reflective, such that thermal radiation emitted by the contents of the box **10** is reflected back into the interior volume **12** and its contents. For this purpose, the surface **22** of the sheet material **20** is defined by a reflective film material that exhibits low emissivity (preferably 0.05 or less). The film material is also preferably protected with a coating capable of inhibiting corrosion to maintain the high reflectance of the film material.

[0016] The sheet material **20** is manufactured and config-

The emissivity of a "reflective material" and the emissivity of a "stack" of materials including such "reflective material" are not the same things at all: according to a well-known technical definition of the term "emissivity", the first one is the measure of the ability of the "reflective material" to emit infrared energy, while the second is the measure of the ability of the whole "stack" to emit infrared energy (see, for example www.flukeprocessinstruments.com/en-us/service-and-support/knowledge-center/infrared-technology/what-is-emissivity
or en.wikipedia.org/wiki/Emissivity), and the skilled person cannot possibly confuse one with another.

(

In fact, the Office seems to recognize this as well - based on the statement at the beginning of page 5 amounting to acknowledgement that it is the aluminum layer that possesses the stated emissivity - not the packaging stack:

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Art Unit: 3731

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

)

The remaining references do not cure this deficiency of the vombination of (Tilton + Wadsworth). Claim 1 and all claims dependent therefrom directly or indirectly were rejected in error.

Alternatively or in addition,

5. Claim 2 was rejected in error.

Indeed, since Tilton does not teach the "intermediate coating" (between the "polymer layer" and the "aluminum layer"), the Tilton simply cannot teach *"wherein the aluminum layer is disposed directly on the intermediate coating."*

Alternatively or in addition,

6. The Applicant respectfully asserts that **Claim 4 remains patentable over the art of record** any of the following reasons:

(6A) Contrary to the assertion made by the Office on page 7 of the Office Action, nothing in the referred to paragraphs [012], [0390] of Shimizu allows the skilled artisan to conclude that the "protective coating" of Shimizu is that recited in claim 4, and that

> However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value (**para. [0012], [0390]**) after the aluminum layer (**Z1**) has been coated with the protective coating (**S**) and ii) to

The Applicant is at a loss attempting to find the required *express teaching* in Shimizu - and reproduced these paragraphs of Shimizu for the convenience of the Office below, asking the Office to identify - with particularity, as required by 37 CFR 1.104 - the source of teaching of the above recitation of claim 4 in Shimizu:

[0012] An object of the present invention is to provide: a novel multilayer structure capable of maintaining high performance even after being exposed to physical stresses or after undergoing retorting; a packaging material including the multilayer structure; and a method for producing the multilayer structure. Another object of the present invention is to provide: a packaging material that is capable of maintaining the gas barrier properties at a high level even when exposed to physical stresses and that is resistant to appearance defects even at high temperature and high humidity; and a product including the packaging material. Still another object of the present invention is to provide an electronic device that is capable of maintaining the gas barrier properties at a high level even when exposed to physical stresses and that undergoes less decrease in interlayer adhesion and is thus resistant to appearance defects even at high temperature and high humidity.

[0390] A multilayer structure (**14-1**) of Example 1-14 and a multilayer structure (**15-1**) of Example 1-15 were fabricated in the same manner as in the fabrication of the multilayer structure (**1-1**) of Example 1-1, except for using a deposited layer formed by vacuum deposition instead of the layer (Z1). In Example 1-14, the deposited layer used was the layer (Z2) of aluminum with a thickness of 0.03 μm. In Example 1-15, the deposited layer used was the layer (Z3) of aluminum oxide with a thickness of 0.03 μm. In addition, multilayer structures (**14-2**) and (**15-2**) were obtained in the same manner as in the fabrication of the multilayer structure (**1-2**) of Example 1-1, except for substituting the multilayer structures (**14-1**) and (**15-1**) for the multilayer structure (**1-1**).

As of record, the argument of "*teaching by inherency*" has not been made by the USPTO. At least for this reason, claim 4 remains patentable over the art of record.

(6B) Now, since the absence of the teaching (by Zhimizu) of protective coating as recited in claim 1 with respect to the feature of "maintaining the emissivity … at the first value…" has been established, the logic of the Office asserting that this coating (S) of

Shimizu *"is configured ... [to] not impede oxidization of the aluminum layer cause by the treatment..."* simply does not hold:

> However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value (**para. [0012], [0390]**) after the aluminum layer (**Z1**) has been coated with the protective coating (**S**) and ii) to prevent oxidation of the aluminum layer (**Z1**) during normal use of the packaging (**para. [0012]**), while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment (**based on the values and processes combination of references , the resulting impedance would be that of the instant application**).

How can it possibly be that the "resulting impedance" of the coating (S) of Shimizu "would be that of the instant application" if the coating (S) of Shimizu is not the same as that of the instant application? - This argument is simply no available now.

Accordingly, the feature "… does not impede oxidization of the aluminum layer caused by the treatment…" is not taught by the combination of (Tilton + Wadsworth + Shimizu) either.

7. The Applicant respectfully submits that the same arguments made above in support of patentability of claim 1 equally apply to **claims 15, 16.** At least for the same reasons claims 15, 16 remains patentable over the art of record.

8. The Applicant also respectfully submits that the same arguments made above in support of patentability of claim 1 are now also made in reference to **claims 8, 10**. At least for the same reasons claims 8, 10 remains patentable over the art of record.

Moreover, however: the art of record is silent with respect to the feature of optical density of less than 0.09" recited in claims 8, 10 as amended. At least for this reason claims 8, 10 and claims dependent therefrom directly or indirectly remain patentable over the art of record.

9. All pending claims are believed to be in a form suitable for allowance, which is respectfully solicited.

10. Applicant petitions for a three-month extension of time. In the event that a further extension is needed, this conditional petition of extension is hereby submitted. Applicant requests that deposit account number 17-0055 be charged for any fees that may be required for the timely consideration of this application.

Date: December 22, 2020

Respectfully submitted,

/Yakov Sidorin, 63507/

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/238,998	Filing Date 01/03/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	12/22/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 5	Minus	*** 5	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DENISE HOPKINS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

34282 7590 03/29/2021

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

EXAMINER
JALLOW, EYAMINDAE CHOSSAN

ART UNIT	PAPER NUMBER
3731	

NOTIFICATION DATE	DELIVERY MODE
03/29/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pat-dept@quarles.com

Office Action Summary	Application No. 16/238,998	Applicant(s) Yializis et al.	
	Examiner EYAMINDAE C JALLOW	Art Unit 3731	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on December 22nd 2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-16 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 8-16 is/are allowed.

7) ☑ Claim(s) 1-7 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on January 3rd 2019 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. This action is in response to applicant's amendment received on December 22nd 2020.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1-16** are rejected under 35 U.S.C. 103 as being unpatentable over Tilton (US 2014/0272163) in view of Shimizu et al. (US 2017/0129216; "Shimizu"), Wadsworth et al. (US 2011/0020570; "Wadsworth") and Gregory (US 4,952,278).

Regarding claim 1, Tilton discloses a recyclable packaging (**20**) comprising: a stack (**the paper, polymer, intermediate and aluminum layers form a stack, which is defined as being arranged in a pile**) including

a paper layer (**32**) with first and second surfaces (**para. [0120]**);

a polymer layer (**28**) with third and fourth surfaces, wherein the third surface is affixed to the second surface (**para. [0110]; Fig. 1**); and

an intermediate coating layer (**28**) applied to the fourth surface (**para. [0110]; Fig. 2**);

an aluminum layer (**22; para. [0094]-[0095]**) carried by the intermediate coating layer (**para. [0095]; Fig. 1**).

wherein said packaging (**20**) is subjected to treatment that includes

a) blending the packaging in a blender (**para. [0125]**);

b) disintegrating into water with a British Disintegrator at about a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm (**para. [0125] discloses 52 degrees C, which is 125.6 degrees F ~ 125 F**);

c) separating in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes (**para. [0125]**).

to form a recyclable material, said aluminum layer becomes fully oxidizes with no visible aluminum present in said recyclable material (**para. [0080]-[0081], [0125]**).

Tilton fails to disclose wherein the aluminum layer has a first thickness of 200 nanometers or less.

However, Shimizu teaches an aluminum layer (**Z1**) has a first thickness of 200 nanometers or less (**para. [0390]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the thickness, as taught by Shimizu, in order to protect against oxygen and moisture transmission (**para. [0440]**).

Tilton in view of Shimizu fail to disclose wherein said stack has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface thereof.

However, Wadsworth teaches said packaging (**10**) has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface thereof (**para. [0015]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton in view of Wadsworth by having provided the aluminum layer's emissivity, as taught by Wadsworth, in order to provide low emissivity and protect the contents within the package (**para. [0026]**).

Tilton in view of Shimizu and Wadsworth fail to disclose drying in an oven for 4 hours at 221 degrees F.

However, Gregory teaches drying in an oven (**an oven is defined as: a thermally insulated chamber used for heating, baking or drying**) for 4 hours at 221 degrees F (**col. 12 ll. 8-11 discloses the drying occurring at 112 degrees C = 233.6 degrees F**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the recyclable packaging of Tilton in view of Wadsworth and Shimizu by having provided the drying, as taught by Gregory, in order to produce a dried material ready to be reused.

Regarding claim 2, Tilton discloses wherein the aluminum layer (**22; para. [0094]-[0095**) is disposed directly on the intermediate coating (**28; para. [0095]; Fig. 2**).

Regarding claim 3, Tilton in view of Wadsworth disclose wherein the intermediate coating (**28**) includes a material selected from polymer and oligomer (**para. [0110]**).

Tilton in view of Wadsworth fail to disclose the intermediate coating has the intermediate coating thickness between 10 nm and 2000 nm.

However, Shimizu discloses an intermediate coating (**L**) has the intermediate coating thickness between 10 nm and 2000 nm (**para. [0208]**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the intermediate coating of Tilton in view of Wadsworth by having provided the intermediate coating thickness, as taught by Shimizu, in order to further enhance the resulting adhesion between the aluminum and polymer layer (**para. [0208]**).

Regarding claim 4, Tilton discloses the aluminum layer (**22; para. [0094]-[0095]**).

Tilton fails to disclose further comprising: a protective coating layer disposed over the aluminum layer, wherein the protective coating layer has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment

However, Shimizu teaches a protective coating (**S**) over the aluminum layer (**Z1; [para. [0157]**), wherein the protective coating has a second thickness, and

wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value (**para. [0012], [0390]**) after the aluminum layer (**Z1**) has been coated with the protective coating (**S**) and ii) to prevent oxidation of the aluminum layer (**Z1**) during normal use of the packaging (**para. [0012]**), while the protective coating (**S**) does not impede oxidization of the aluminum layer caused by the treatment (**based on the values and processes combination of references , the resulting impedance would be that of the instant application**).

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the aluminum layer of Tilton by having provided the protective coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Shimizu discloses the claimed invention except for a second thickness of 1 micron or less. However, it would have been obvious to one having ordinary skill in the art at the time the invention was filed to provide a thickness of 1 micron or less, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Regarding claim 5, Tilton discloses the recyclable packaging (**20**).

Tilton fails to wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

However, Shimizu teaches the protective coating (**S**) includes a material selected from: wax, polymer (**para. [0145]**), and lacquer.

It would have been obvious to one having ordinary skill in the art, at the time applicant's invention was filed, to have modified the packaging of Tilton by having

provided the coating layer, as taught by Shimizu, in order to preserve the aluminum layer on the laminate.

Regarding claim 6, Tilton discloses wherein the polymer layer (**32**) includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene (**para. [0110] discloses a polymer-containing resin which include polyurethane and polystyrene**).

Regarding claim 7, Tilton discloses wherein the polymer layer (**32**) is a material selected from: film (**para. [0093]**) and fabric.

Allowable Subject Matter

5. **Claims 8, 10, 15 and 16** are allowed.

Regarding claims 8 and 10, the most relevant prior art is Tilton.

The cited prior art fails to disclose or make obvious said aluminum layer acquiring and optical density of less than 0.09.

Regarding claims 15 and 16, the most relevant prior art is Tilton.

The cited prior art fails to disclose or make obvious the packaging having an emissivity that is equal to or smaller than a first value of 0.10.

6. **Claims 4 and 5** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 4, the most relevant prior art is Tilton and Shimizu.

The combination of Tilton and Shimizu do not disclose maintaining the emissivity at the claimed value.

Response to Arguments

7. Applicant's arguments filed December 22nd 2020 have been fully considered but they are not persuasive.

Applicant's representative (AR) argues the office action does not mention the feature of claim 1 as reciting "said aluminum layer becomes fully oxidized with no visible aluminum present in said recyclable material." Examiner asserts that para. [0085] discloses .mineral layer particles are effectively removed after multiple cleaning processes.

AR argues the Office erred in interpreting the teachings of Tilton, and that the teachings of Tilton reference simply do not amount the combination of the features of claim 1. In response to applicant's argument that there is no teaching, suggestion, or motivation to combine the references, the examiner recognizes that obviousness may be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), and *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007). In this case, Tilton discloses the configuration of layers undergoing processing claimed in claim 1. The remaining references teach characteristics applied to the layers and packaging in order to influence the characteristics of the recycled package. It would be obvious to combine the references because the layers disclosed in Tilton are capable of being influenced in the manner taught by Shimizu, Wadsworth and Gregory.

AR argues regarding the configuration of the layers. The reference has been reinterpreted to use Fig. 1 to read on the layer limitations.

AR asks Office provides evidence that the "intermediate coating layer" as recited n claim 1 necessarily follows from the disclosure of the cited references. Examiner asserts that the configuration of the layers has been reinterpreted through the use of Fig. 1. Intermediate coating layer (**28**) reads on the limitations provided in the instant application.

AR argues that Wadsworth does not teach the aluminum layer that causes an outer surface of the packaging to have emissivity that is equal to or smaller than a first value of 0.10. Instead, all Wadsworth is teaching is that the aluminum layer itself has that value of emissivity. Examiner asserts that the aluminum layer in Tilton, which is the outer surface, it being modified by the emissivity of the aluminum of Wadsworth is located on the outer layer. The combination results in the outer surface having that specific emissivity.

AR argues that Tilton does not teach the aluminum layer is disposed directly on the intermediate coating. Examiner assert that the layer configurations have been reinterpreted to use Fig. 1.

Regarding arguments 6A and 6B, claim 4 has now been deemed allowable subject matter.

Regarding **claims 8 and 10**, the arguments were deemed persuasive. Refer to "allowable subject matter" section above.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to EYAMINDAE JALLOW whose telephone number is (571)270-1927. The examiner can normally be reached on Monday-Thursday from 7:30am-5:00pm and alternating Fridays from 7:30am-4:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ANNA KINSAUL, can be reached on (571)270-1926. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

10. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://portal.uspto.gov/external/portal. Should you have questions on access to the

Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197

(toll-free).

/EYAMINDAE C JALLOW/
Examiner, Art Unit 3731
/ANDREW M TECCO/
Primary Examiner, Art Unit 3731

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

CPC - Searched*		
Symbol	Date	Examiner
B65D 1/0215	06/16/2020	Eyamindae Jallow
B32B 2439/00	06/16/2020	Eyamindae Jallow

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
53	473	06/16/2020	Eyamindae Jallow
53	+ text	06/16/2020	Eyamindae Jallow

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Classification search, inventor search (PALM), forward/backward citation, text search	06/16/2020	Eyamindae Jallow
Updated search	03/23/2021	Eyamindae Jallow

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	165,551	(optical adj density)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/24 09:01
S44	2,262	53/473.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S45	2	"20190270862"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S46	23	"3222657"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S47	2	"6846538".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S48	6	53/$.ccls. and laminate and (paper near3 polymer near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00

S49	2,891	53/$.ccls. and laminate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S50	393	53/$.ccls. and laminate and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S51	10	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S52	94	paper and aluminum and plastic and (B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S53	30	("2004/0241454").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S54	11	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S55	0	"waring adj blender" and "british adj disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S56	0	"waring adj blender" and "disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00

S57	0	"waring adj blender"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S58	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S59	14	(waring adj blender) and (british adj disintegrator) and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S60	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S61	4	("2014/0272163").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S62	19	53/$.ccls. and composite and (paper near3 plastic near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S63	21	53/$.ccls. and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S64	1	"16238998"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2021/03/23 17:00

			DERWENT; IBM_TDB			
S65	97	("4481076" | "4483743" | "4627743" | "4761203").PN. OR ("4952278").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/03/23 17:00
S66	20	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S67	6,561	(B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S68	382	(B65D1/0215).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S69	101	(B65D1/0215).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S70	82	("4064296" | "4701360" | "4894267").PN. OR ("4977004").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/03/23 17:00
S71	28	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$ or US-20140205786-$ or US-	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00

		20190112091-$ or US-20160243746-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$ or US-4977004-$ or US-8815360-$ or US-6964797-$ or US-6383582-$).did. or (EP-3222657-$ or WO-2015171193-$).did.				
S72	19,317	(B32B2439/00).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S73	2,045	(B32B2439/00).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S74	838	(B32B2439/00).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S75	0	("2017/0320305").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S76	0	("2017/0188751").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S77	2	("2015/0284141").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S78	224	(B32B2439/00).CPC. and aluminum and paper and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S79	8	(B32B2439/00).CPC. and aluminum and paper and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00

S80	0	("2011/0020570").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S81	1	"20050001124"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00
S82	2	"20090001124"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00
S83	4,822	(B32B2439/00).CPC. and thickness	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S84	246	(B32B2439/00).CPC. and (thickness near5 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S85	2	"20120175170"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00
S86	2	"20140272163"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:03
S87	1	"20170129216"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:05
S88	1	"20110020570"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:06

EAST Search History (Interference)

<This search history is empty>

3/24/2021 9:23:11 AM
C:\Users\ejallow\Documents\EAST\Workspaces\Recyclable Paper Containing.wsp

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/238,998	Filing Date 01/03/2019	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	04/05/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 15	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 5	Minus	*** 5	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/TAMARA D HARRELL/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sigma Technologies Int'l., LLC	Docket No.:	861133.00068
Appl. No:	16/238,998	Art Unit:	3731
Filed :	January 03, 2019	Conf. No.	5903
Examiner:	Jallow, Eyamindae Chossan		

Invention: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Date: April 05, 2021

VIA USPTO ELECTRONIC FILING SYSTEM

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE *B*

To Office Action dated March 29, 2021 and made Final

Dear Sir:

In response to the Final Office Action of March 29, 2021, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 8 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface; [[and]]

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating layer, wherein the aluminum layer has a first thickness of 200 nanometers or less;

wherein said stack has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface thereof; and

wherein, when said packaging is subjected to treatment that includes

a) blending the packaging in a blender;

b) disintegrating into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm;

c) separating in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes; and

d) drying in an oven for 4 hours at 221 degrees F

to form a recyclable material, said aluminum layer becomes fully oxidized with no visible aluminum present in said recyclable material.

and further comprising

a protective coating layer disposed over the aluminum layer, wherein the protective coating layer has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity of the outer surface of the packaging at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede oxidation of the aluminum layer as a result of the treatment.

2. (previously presented) The recyclable packaging of claim 1, wherein the aluminum layer is disposed directly on the intermediate coating.

3. (previously presented) The recyclable packaging of claim 1, wherein the intermediate coating has the intermediate coating thickness between 10 nm and 2000 nm and includes a material selected from polymer and oligomer.

4. (cancelled)

5. (currently amended) The recyclable packaging of claim [[4]] 1, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

6. (original) The recyclable packaging of claim 1, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

7. (original) The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

8. (previously presented) A method for manufacturing a recyclable packaging, the method comprising:

forming a packaging layer stack by:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a first thickness of 200 nanometers or less, and wherein the aluminum layer causes said packaging layer stack to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 when the packaging layer stack is exposed to a treatment that includes:

a) blending the packaging stack in a blender;

b) disintegrating into water with a British Disintegrator at at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm,

c) separating an output from step b) in a 0.01 aperture inch screen with a 1 inch water head for 20 minutes, and

d) drying in an oven for 4 hours at 221 degrees F.

9. (currently amended) The method of manufacturing a recyclable packaging of claim 8, further comprising:

applying a protective coating over the aluminum layer to form a coated packaging layer stack, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is defined

a) to maintain the emissivity of the packaging layer stack at the first value after the aluminum layer has been coated with the protective coating and

b) to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating does not impede ~~oxidization~~ <u>oxidation</u> of the aluminum layer as a result of the treatment.

10. (currently amended) A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer acquires an optical density (OD) of less than 0.09 with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment, the treatment including ~~that includes~~

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

11. (currently amended) The recyclable packaging of claim 10, further comprising:

a protective coating[[,]] over the aluminum layer,

wherein the protective coating has a second thickness of 1 micron or less,

wherein the second thickness is defined to maintain the first value of the emissivity of the recyclable packaging after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,

while the protective coating does not impede ~~oxidization~~ oxidation of the aluminum layer ~~caused by~~ during the treatment.

12. (original) The recyclable packaging of claim 11, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

13. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

14. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: film and fabric.

15. (currently amended) A method for thermally insulating a good within a recyclable packaging, the method comprising:

placing a reflective insulation material in a pre-defined proximity with [[a]] the good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the packaging being subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

16. (currently amended) **A method for thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material at a pre-defined proximity distance from the good, said pre-defined proximity distance chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of no more than 200 nanometers to cause the packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 and becomes fully oxidized with no visible aluminum present in a recyclable material ~~as a result of subjecting~~ when the recyclable packaging is subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

REMARKS

1. Claims 1-16 are pending, of which

- claims 1-3, 6-7 stand rejected under 35 USC 103 based on assertion of being obvious in light of the combination of Tilton (UUS 2014/0272163) with Shimizu (US 2017/0129216) and Wadsworth (US 2011/0020570) and Gregory (US 2,952,278);

2. With entry of this response, claims 1-3, 5-16 will be pending. The Applicant respectfully requests reconsideration of the claims in view of the above amendments and the following remarks.

The Applicant respectfully asks the Examiner to please telephone the undersigned, Yakov Sidorin, to discuss any questions that may remain open to advance the application towards allowance - and sincerely appreciates the willingness of the Examiner to do so.

3. While the Applicant respectfully does not agree with the maintained rejection of claims 1-3, 6-7, the Applicant elects to not argue this point in the current application and, instead, amends the list of claims to put the application in condition for allowance. To this end,

- Claim 1 has been amended to include limitations of the allowable claim 4 and, as amended, now represents the allowable claim 4. Claim 4 has been cancelled. Claims 5 has been amended to correct the dependency.

- Several of the allowed claims have been amended to correct typographical errors and/or to ensure antecedent bases.

- No new matter has been added.

4. All pending claims are believed to be in a form suitable for allowance, which is respectfully solicited.

5. Applicant believes that no additional fees are required for timely consideration of this response. In the event that some fee has been overlooked, this conditional petition of

extension is hereby submitted. Applicant requests that deposit account number 17-0055 be charged for any fees that may be required for the timely consideration of this application.

Date: April 05, 2021

Respectfully submitted,

/Yakov Sidorin, 63507/

Yakov Sidorin,
Registration No. 63,507
Attorney for Applicant

Quarles & Brady LLP
One South Church Avenue, suite 1800
Tucson, Arizona 85701
Tel: (520) 770-8753
Fax: (520) 770-2253

Electronic Acknowledgement Receipt

EFS ID:	42366345
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Angela Schulz
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	05-APR-2021
Filing Date:	03-JAN-2019
Time Stamp:	14:45:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		861133_00068_response.pdf	153345 86a0e75cceab30f3e14e21027a2a42266b8105d8	yes	9

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Response After Final Action	1	1
Claims	2	7
Applicant Arguments/Remarks Made in an Amendment	8	9

Warnings:	
Information:	
Total Files Size (in bytes):	153345

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

34282 7590 04/28/2021

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

EXAMINER	
JALLOW, EYAMINDAE CHOSSAN	
ART UNIT	PAPER NUMBER
3731	

DATE MAILED: 04/28/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

TITLE OF INVENTION: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	07/28/2021

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

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Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

34282 7590 04/28/2021
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

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Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

TITLE OF INVENTION: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	07/28/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
JALLOW, EYAMINDAE CHOSSAN	3731	053-473000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

34282 7590 04/28/2021

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

EXAMINER	
JALLOW, EYAMINDAE CHOSSAN	
ART UNIT	PAPER NUMBER
3731	

DATE MAILED: 04/28/2021

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/238,998	Applicant(s) Yializis et al.	
	Examiner EYAMINDAE C JALLOW	Art Unit 3731	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the claim amendments/after final submitted on April 5th 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-3 and 5-16 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	/ANDREW M TECCO/ Primary Examiner, Art Unit 3731

ALLOWABILITY NOTICE

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Reasons for Allowance

2. The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the most relevant prior art is Tilton (US 2014/0272163) and Shimizu (US 2017/0129216).

The combination of Tilton and Shimizu do not disclose maintaining the emissivity at the claimed value.

Regarding claims 8 and 10, the most relevant prior art is Tilton (US 2014/0272163).

The cited prior art fails to disclose or make obvious said aluminum layer acquiring and optical density of less than 0.09.

Regarding claims 15 and 16, the most relevant prior art is Tilton (US 2014/0272163).

The cited prior art fails to disclose or make obvious the packaging having an emissivity that is equal to or smaller than a first value of 0.10.

3. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to EYAMINDAE JALLOW whose telephone number is (571)270-1927. The examiner can normally be reached on Monday-Thursday from 7:30am-5:00pm and alternating Fridays from 7:30am-4:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ANNA KINSAUL, can be reached on (571)270-1926. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

6. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://portal.uspto.gov/external/portal. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/EYAMINDAE C JALLOW/
Examiner, Art Unit 3731

/ANDREW M TECCO/
Primary Examiner, Art Unit 3731

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

CPC						
Symbol					Type	Version
B32B	/	15	/	085	F	2013-01-01
B32B	/	29	/	06	I	2013-01-01
B32B	/	29	/	002	I	2013-01-01
B32B	/	27	/	10	I	2013-01-01
B32B	/	27	/	302	I	2013-01-01
B32B	/	5	/	02	I	2013-01-01
B32B	/	15	/	082	I	2013-01-01
B32B	/	15	/	09	I	2013-01-01
B32B	/	15	/	095	I	2013-01-01
B32B	/	15	/	20	I	2013-01-01
B32B	/	27	/	304	I	2013-01-01
B32B	/	27	/	32	I	2013-01-01
B32B	/	27	/	36	I	2013-01-01
B32B	/	27	/	40	I	2013-01-01
B32B	/	29	/	08	I	2013-01-01
B65D	/	65	/	403	I	2013-01-01
B65D	/	65	/	42	I	2013-01-01
B65D	/	81	/	38	I	2013-01-01
B32B	/	2307	/	30	A	2013-01-01
B32B	/	2255	/	10	A	2013-01-01
B32B	/	2255	/	205	A	2013-01-01
B32B	/	2255	/	28	A	2013-01-01
B32B	/	2307	/	732	A	2013-01-01
B32B	/	2255	/	06	A	2013-01-01
B32B	/	2255	/	26	A	2013-01-01
B32B	/	2262	/	0238	A	2013-01-01
B32B	/	2262	/	0253	A	2013-01-01
B32B	/	2262	/	0284	A	2013-01-01
B32B	/	2262	/	0292	A	2013-01-01
B32B	/	2439	/	00	A	2013-01-01

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731 (Assistant Examiner)	15 April 2021 (Date)	Total Claims Allowed: 15	
/ANDREW M TECCO/ Primary Examiner, Art Unit 3731 (Primary Examiner)	22 April 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office — Part of Paper No.: 20210415

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
	/		/					

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731 (Assistant Examiner)	15 April 2021 (Date)	Total Claims Allowed: 15	
/ANDREW M TECCO/ Primary Examiner, Art Unit 3731 (Primary Examiner)	22 April 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office

Part of Paper No.: 20210415

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

INTERNATIONAL CLASSIFICATION					
CLAIMED					
B32B	/	29	/	00	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731 (Assistant Examiner)	15 April 2021 (Date)	Total Claims Allowed: 15	
/ANDREW M TECCO/ Primary Examiner, Art Unit 3731 (Primary Examiner)	22 April 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office — Part of Paper No.: 20210415

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	9	10												
2	2	10	11												
3	3	11	12												
	4	12	13												
4	5	13	14												
5	6	14	15												
6	7	15	16												
7	8														
8	9														

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	15 April 2021	Total Claims Allowed:	
(Assistant Examiner)	(Date)	15	
/ANDREW M TECCO/ Primary Examiner, Art Unit 3731	22 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office Part of Paper No.: 20210415

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

CPC - Searched*		
Symbol	Date	Examiner
B65D 1/0215	06/16/2020	Eyamindae Jallow
B32B 2439/00	06/16/2020	Eyamindae Jallow

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
53	473	06/16/2020	Eyamindae Jallow
53	+ text	06/16/2020	Eyamindae Jallow

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Classification search, inventor search (PALM), forward/backward citation, text search	06/16/2020	Eyamindae Jallow
Updated search	03/23/2021	Eyamindae Jallow
Updated search	04/15/2021	Eyamindae Jallow
Interference search	04/15/2021	Eyamindae Jallow

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/238,998	Yializis et al.
	Examiner	Art Unit
	EYAMINDAE C JALLOW	3731

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
See EAST printout	See EAST printout	04/15/2021	Eyamindae Jallow

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S44	2,262	53/473.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S45	2	"20190270862"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S46	23	"3222657"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S47	2	"6846538".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S48	6	53/$.ccls. and laminate and (paper near3 polymer near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S49	2,891	53/$.ccls. and laminate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00

S50	393	53/$.ccls. and laminate and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S51	10	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S52	94	paper and aluminum and plastic and (B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S53	30	("2004/0241454").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S54	11	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S55	0	"waring adj blender" and "british adj disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S56	0	"waring adj blender" and "disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S57	0	"waring adj blender"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2021/03/23 17:00

			DERWENT; IBM_TDB			
S58	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S59	14	(waring adj blender) and (british adj disintegrator) and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S60	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S61	4	("2014/0272163").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S62	19	53/$.ccls. and composite and (paper near3 plastic near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S63	21	53/$.ccls. and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S64	1	"16238998"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S65	97	("4481076" | "4483743" | "4627743" | "4761203").PN. OR ("4952278").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/03/23 17:00

S66	20	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00
S67	6,561	(B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S68	382	(B65D1/0215).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S69	101	(B65D1/0215).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S70	82	("4064296" | "4701360" | "4894267").PN. OR ("4977004").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/03/23 17:00
S71	28	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$ or US-20140205786-$ or US-20190112091-$ or US-20160243746-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$ or US-4977004-$ or US-	US-PGPUB; USPAT; FPRS	OR	OFF	2021/03/23 17:00

		8815360-$ or US-6964797-$ or US-6383582-$).did. or (EP-3222657-$ or WO-2015171193-$).did.				
S72	19,317	(B32B2439/00).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S73	2,045	(B32B2439/00).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S74	838	(B32B2439/00).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S75	0	("2017/0320305").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S76	0	("2017/0188751").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S77	2	("2015/0284141").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S78	224	(B32B2439/00).CPC. and aluminum and paper and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S79	8	(B32B2439/00).CPC. and aluminum and paper and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S80	0	("2011/0020570").URPN.	USPAT	OR	OFF	2021/03/23 17:00
S81	1	"20050001124"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00

S82	2	"20090001124"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00
S83	4,822	(B32B2439/00).CPC. and thickness	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S84	246	(B32B2439/00).CPC. and (thickness near5 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/23 17:00
S85	2	"20120175170"	US-PGPUB; USPAT	OR	OFF	2021/03/23 17:00
S86	2	"20140272163"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:03
S87	1	"20170129216"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:05
S88	1	"20110020570"	US-PGPUB; USPAT	OR	OFF	2021/03/23 18:06
S89	165,551	(optical adj density)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/03/24 09:01
S90	2,263	53/473.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S91	2	"20190270862"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S92	23	"3222657"	US-PGPUB; USPAT; USOCR;	OR	OFF	2021/04/15 09:30

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S93	3	"6846538".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S94	6	53/$.ccls. and laminate and (paper near3 polymer near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S95	2,891	53/$.ccls. and laminate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S96	393	53/$.ccls. and laminate and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S97	10	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/04/15 09:30
S98	95	paper and aluminum and plastic and (B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S99	30	("2004/0241454").URPN.	USPAT	OR	OFF	2021/04/15 09:30

S100	11	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$).did. or (US-6846538-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/04/15 09:30
S101	0	"waring adj blender" and "british adj disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S102	0	"waring adj blender" and "disintegrator"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S103	0	"waring adj blender"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S104	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S105	14	(waring adj blender) and (british adj disintegrator) and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S106	25	(waring adj blender) and (british adj disintegrator)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30

S107	4	("2014/0272163").URPN.	USPAT	OR	OFF	2021/04/15 09:30
S108	19	53/$.ccls. and composite and (paper near3 plastic near3 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S109	21	53/$.ccls. and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S110	1	"16238998"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S111	98	("4481076" | "4483743" | "4627743" | "4761203").PN. OR ("4952278").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/04/15 09:30
S112	20	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$).did. or (EP-3222657-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/04/15 09:30
S113	6,577	(B65D1/0215).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S114	383	(B65D1/0215).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	2021/04/15 09:30

			JPO; DERWENT; IBM_TDB			
S115	102	(B65D1/0215).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S116	82	("4064296" | "4701360" | "4894267").PN. OR ("4977004").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2021/04/15 09:30
S117	28	(US-20190270862-$ or US-20160107814-$ or US-20160059973-$ or US-20160023830-$ or US-20160023810-$ or US-20150321822-$ or US-20150150716-$ or US-20040241454-$ or US-20200071056-$ or US-20050011623-$ or US-20140272163-$ or US-20160178264-$ or US-20140205786-$ or US-20190112091-$ or US-20160243746-$).did. or (US-6846538-$ or US-4952278-$ or US-6309510-$ or US-6402887-$ or US-5292391-$ or US-5452565-$ or US-4977004-$ or US-8815360-$ or US-6964797-$ or US-6383582-$).did. or (EP-3222657-$ or WO-2015171193-$).did.	US-PGPUB; USPAT; FPRS	OR	OFF	2021/04/15 09:30
S118	19,428	(B32B2439/00).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S119	2,055	(B32B2439/00).CPC. and aluminum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S120	841	(B32B2439/00).CPC. and aluminum and paper	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2021/04/15 09:30

			DERWENT; IBM_TDB			
S121	0	("2017/0320305").URPN.	USPAT	OR	OFF	2021/04/15 09:30
S122	0	("2017/0188751").URPN.	USPAT	OR	OFF	2021/04/15 09:30
S123	3	("2015/0284141").URPN.	USPAT	OR	OFF	2021/04/15 09:30
S124	225	(B32B2439/00).CPC. and aluminum and paper and insulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S125	8	(B32B2439/00).CPC. and aluminum and paper and emissivity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S126	0	("2011/0020570").URPN.	USPAT	OR	OFF	2021/04/15 09:30
S127	1	"20050001124"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30
S128	2	"20090001124"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30
S129	4,845	(B32B2439/00).CPC. and thickness	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S130	246	(B32B2439/00).CPC. and (thickness near5 aluminum)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30
S131	2	"20120175170"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30
S132	2	"20140272163"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30

S133	1	"20170129216"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30
S134	1	"20110020570"	US-PGPUB; USPAT	OR	OFF	2021/04/15 09:30
S135	165,961	(optical adj density)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/04/15 09:30

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	((aluminum adj layer) and (emissivity)).clm.	US-PGPUB; USPAT	OR	OFF	2021/04/15 18:07

4/15/2021 6:10:52 PM
C:\Users\ejallow\Documents\EAST\Workspaces\Recyclable Paper Containing.wsp

Bibliographic Data

Application No: 16/238,998

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /EYAMINDAE C JALLOW/ Examiner's Signature | Initials

Title: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
01/03/2019	053	3731	861133.00068
RULE			

APPLICANTS

SIGMA TECHNOLOGIES INT'L., LLC, Tucson, AZ, UNITED STATES

INVENTORS

Steven Yializis, Tucson, AZ, UNITED STATES

Luke Rogers, Tucson, AZ, UNITED STATES

CONTINUING DATA

This application has PRO of 62614568 01/08/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/29/2019

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

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FILING FEE RECEIVED

$865

OK TO ENTER: /E.C.J/ 04/15/2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sigma Technologies Int'l., LLC	Docket No.:	861133.00068
Appl. No:	16/238,998	Art Unit:	3731
Filed :	January 03, 2019	Conf. No.	5903
Examiner:	Jallow, Eyamindae Chossan		

Invention: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Date: April 05, 2021

VIA USPTO ELECTRONIC FILING SYSTEM

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE *B*

To Office Action dated March 29, 2021 and made Final

Dear Sir:

In response to the Final Office Action of March 29, 2021, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 8 of this paper.

QB\67695737.1

Electronic Acknowledgement Receipt

EFS ID:	42636647
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/tracey baxter
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00068
Receipt Date:	04-MAY-2021
Filing Date:	03-JAN-2019
Time Stamp:	17:41:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment after Notice of Allowance (Rule 312)	00068_amend_312.pdf	112993 490373786191fa84034422e6effcd212ecb17665	no	9

Warnings:

Information:	
Total Files Size (in bytes):	112993

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sigma Technologies Int'l., LLC	Docket No.:	861133.00068
Appl. No:	16/238,998	Art Unit:	3731
Filed :	January 03, 2019	Conf. No.	5903
Examiner:	Jallow, Eyamindae Chossan		

Invention: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Date: May 05, 2021

VIA USPTO ELECTRONIC FILING SYSTEM

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER NOTICE OF ALLOWANCE

UNDER 37 C.F.R. Sec. 1.312

Dear Sir:

In response to the Notice of Allowance dated April 28, 2021, please amend the above-identified application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 9.

AMENDMENTS TO THE CLAIMS

The following list of claims replaces all prior versions, and listings, of claims in the application:

1. (currently amended) A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating layer, wherein the aluminum layer has a first thickness of 200 nanometers or less;

wherein said stack has emissivity that is equal to or smaller than a first value of 0.10 as perceived through an outer surface ~~thereof~~ of the aluminum layer; and

wherein, when said packaging is subjected to treatment that includes

a) blending the packaging in a blender;

b) disintegrating into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm;

c) separating in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes; and

d) drying in an oven for 4 hours at 221 degrees F

to form a recyclable material, said aluminum layer becomes fully oxidized with no visible aluminum present in said recyclable material,

and further comprising

a protective coating layer disposed over the aluminum layer, wherein the protective coating layer has a second thickness of 1 micron or less, and wherein the second thickness is configured i) to maintain the emissivity ~~of the outer surface of the packaging~~ at the first value after the aluminum layer has been coated with the protective coating and ii) to prevent oxidation of the aluminum layer during normal use of the packaging, while ~~the protective coating does not impede~~ not impeding oxidation of the aluminum layer as a result of the treatment.

2. (previously presented) The recyclable packaging of claim 1, wherein the aluminum layer is disposed directly on the intermediate coating.

3. (previously presented) The recyclable packaging of claim 1, wherein the intermediate coating has the intermediate coating thickness between 10 nm and 2000 nm and includes a material selected from polymer and oligomer.

4. (cancelled)

5. (previously presented) The recyclable packaging of claim 1, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

6. (original) The recyclable packaging of claim 1, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

7. (original) The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

8. (currently amended) A method for manufacturing a recyclable packaging, the method comprising:

forming a packaging layer stack by:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a first thickness of 200 nanometers or less, and wherein the aluminum layer causes said packaging layer stack to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 when the packaging layer stack is exposed to a treatment that includes:

a) blending the packaging stack in a blender;

b) disintegrating into water with a British Disintegrator [[at]] at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm,

c) separating an output from step b) in a 0.01 aperture inch screen with a 1 inch water head for 20 minutes, and

d) drying in an oven for 4 hours at 221 degrees F.

9. (currently amended) The method of manufacturing a recyclable packaging of claim 8, further comprising:

applying a protective coating over the aluminum layer to form a coated packaging layer stack, wherein the protective coating has a second thickness of 1 micron or less, and wherein the second thickness is defined

a) to maintain the emissivity of the packaging layer stack at the first value after the aluminum layer has been coated with the protective coating and

b) to prevent oxidation of the aluminum layer during normal use of the recyclable packaging, while the protective coating does not impede oxidation of the aluminum layer ~~as a result of~~ during the treatment.

10. (currently amended) A recyclable packaging comprising:

a stack including

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of an outer surface of the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer acquires an optical density (OD) of less than 0.09 with no visible aluminum present in a recyclable material that results from the recyclable packaging being subjected to a treatment, the treatment including

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

11. (currently amended) The recyclable packaging of claim 10, further comprising:

a protective coating over the aluminum layer,

wherein the protective coating has a second thickness of 1 micron or less,

wherein the second thickness is defined to maintain the first value of the emissivity of the recyclable packaging after the aluminum layer has been coated with the

protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,

~~while~~ wherein the protective coating does not impede oxidation of the aluminum layer during the treatment.

12. (original) The recyclable packaging of claim 11, wherein the protective coating includes a material selected from: wax, polymer, and lacquer.

13. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

14. (original) The recyclable packaging of claim 10, wherein the polymer layer includes a material selected from: film and fabric.

15. (currently amended) A method for thermally insulating a good within a recyclable packaging, the method comprising:

placing a reflective insulation material in a pre-defined proximity with the good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a first thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity of the recyclable packaging to be equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a recyclable material that results from the recyclable packaging being subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British Disintegrator at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

16. (currently amended) A method for thermally insulating a good within a recyclable packaging, the method comprising:

placing a reflective insulation material at a pre-defined proximity distance from the good, said pre-defined proximity distance chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises the recyclable packaging that includes:

a paper layer with first and second surfaces;

a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;

an intermediate coating layer applied to the fourth surface;

an aluminum layer carried by the intermediate coating, wherein the aluminum layer has a first thickness of no more than 200 nanometers to cause the recyclable packaging to have emissivity that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer is configured to acquire optical density (OD) of less than 0.09 and ~~becomes~~ become fully oxidized with no visible aluminum

present in a recyclable material when the recyclable packaging is subjected to a treatment that includes

a) blending the packaging in a blender to form a first material;

b) disintegrating the first material into water with a British at a temperature within a range from about 115 degrees F to about 135 degrees F at 3000 rpm to form a second material;

c) separating the second material in a 0.01 inch aperture screen with a 1 inch water head for 20 minutes to form a fourth material; and

d) drying the fourth material in an oven for 4 hours at 221 degrees F.

REMARKS

(1) With this amendment, the identified allowed claims have been amended to correct typographical and/or grammatical errors, correct indefiniteness issues, and to ensure the antecedent bases are satisfied.

No new matter has been added. The amendments are believed to be in compliance with requirements specified in 37 C.F.R. Sec. 1.121 and with MPEP 714.16 as to require no substantial amount of additional work on the part of the Office.

(w) The Examiner is respectfully invited to contact the undersigned, Yakov Sidorin, with any questions.

No fee is believed due with this amendment. However, if any such fee is deemed due, Applicant hereby authorizes the Director to charge the fee to Deposit Account No. 17-0055.

Date: May 05, 2021

Respectfully submitted,

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Tucson, Arizona 85701
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Fax: (520) 770-2253
Attorney for Applicant

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

34282 7590 05/18/2021

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

EXAMINER	
JALLOW, EYAMINDAE CHOSSAN	

ART UNIT	PAPER NUMBER
3731	

NOTIFICATION DATE	DELIVERY MODE
05/18/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pat-dept@quarles.com

Response to Rule 312 Communication	Application No.	Applicant(s)	
	16/238,998	Yializis et al.	
	Examiner	Art Unit	AIA (FITF) Status
	EYAMINDAE C JALLOW	3731	Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ The amendment filed on 04 May 2021 under 37 CFR 1.312 has been considered, and has been:

a) ☑ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.

Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/EYAMINDAE C JALLOW/ Examiner, Art Unit 3731	/ANDREW M TECCO/ Primary Examiner, Art Unit 3731

OK TO ENTER: /E.C.J/ 05/10/2021

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sigma Technologies Int'l., LLC	Docket No.:	861133.00068
Appl. No:	16/238,998	Art Unit:	3731
Filed :	January 03, 2019	Conf. No.	5903
Examiner:	Jallow, Eyamindae Chossan		

Invention: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Date: May 05, 2021

VIA USPTO ELECTRONIC FILING SYSTEM

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER NOTICE OF ALLOWANCE

UNDER 37 C.F.R. Sec. 1.312

Dear Sir:

In response to the Notice of Allowance dated April 28, 2021, please amend the above-identified application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 9.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

34282 7590 04/28/2021
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	01/03/2019	Steven Yializis	861133.00068	5903

TITLE OF INVENTION: RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	07/28/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
JALLOW, EYAMINDAE CHOSSAN	3731	053-473000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Yakov Sidorin
2 Quarles & Brady LLP
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: SIGMA TECHNOLOGIES INT'L, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): TUCSON, AZ USA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 17-0055

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /YAKOV SIDORIN/ Date 2021-06-21

Typed or printed name YAKOV SIDORIN Registration No. 63,507

Petitioner Exhibit 1003, Page 242 of 244

Electronic Patent Application Fee Transmittal

Application Number:	16238998
Filing Date:	03-Jan-2019
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Filer:	Yakov S. Sidorin/tracey baxter
Attorney Docket Number:	861133.00068

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	600	600

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**600**

Electronic Acknowledgement Receipt

EFS ID:	43036336
Application Number:	16238998
International Application Number:	
Confirmation Number:	5903
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Steven Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin
Filer Authorized By:	
Attorney Docket Number:	861133.00068
Receipt Date:	21-JUN-2021
Filing Date:	03-JAN-2019
Time Stamp:	11:24:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$600
RAM confirmation Number	E20216KB24590247
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	00068_fee_trans.pdf	358731 5b5998ffec67299ce29b9eeae0aa9c2e3610c59a	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30616 92ea82f89ffa0c99176a6b073655a2eac5e77904	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	389347		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/238,998	07/27/2021	11072148	861133.00068	5903

34282 7590 07/07/2021

QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1800
TUCSON, AZ 85701-1621

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 11 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Steven Yializis, Tucson, AZ;
SIGMA TECHNOLOGIES INT'L., LLC, Tucson, AZ
Luke Rogers, Tucson, AZ;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

EXHIBIT C

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Angelo		Yializis	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Tucson	AZ	US

Mailing Address of Inventor:

Address 1	10960 N. Stallard Place
Address 2	

City	State/Province	Postal Code	Country
Tucson	AZ	85737	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Luke		Rogers	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Tucson	AZ	US

Mailing Address of Inventor:

Address 1	10960 N. Stallard Place
Address 2	

City	State/Province	Postal Code	Country
Tucson	AZ	85737	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	34282		
Email Address	pat-dept@quarles.com	Add Email	Remove Email
Email Address	yakov.sidorin@quarles.com	Add Email	Remove Email

Application Information:

Title of the Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION		
Attorney Docket Number	861133.00056	**Small Entity Status Claimed**	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	34282		

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status [ ] Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Applicant:

Address 1			
Address 2			
City		**State/Province**	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

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RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

TECHNICAL FIELD

[0001] Embodiments of the present invention relate to radiant barrier insulation configured for use in paper-containing packaging, where such packaging is intended and structured to be recyclable as paper, and, specifically where a radiant barrier material is used to facilitate thermal insulation in packaging intended to preserve temperature sensitive food or pharmaceutical goods.

BACKGROUND

[0002] A variety of thermal insulation materials are used for perishable and other temperature sensitive goods. Common types of thermal insulation include rigid and flexible foams, bags or batts of fibrous materials, and reflective insulation. Reflective Insulation is any type of insulation intended to insulate against heat gain and heat loss by reducing, reflecting, or not emitting radiant heat; this is accomplished by applying a low emissivity material, such as aluminum, to one or more surfaces. Simply incorporating a low emissivity material as part of the package could reduce the weight or dimensions of the total package, as compared for example to other types of insulation commonly used in packaging (such as foams or bulk fibrous insulation). However, current methods and applications of low-emissivity material impairs the recyclability of the total package, which understandably causes problems in related industries. Thus, there is a need for low-emissivity packaging material that is fully recyclable.

DETAILED DESCRIPTION

[0003] Embodiments of the invention address the problem(s) caused by inability of the related art to fully recycle a low-emissivity packaging material, and solve such problem(s) by using a specific aluminized polymeric film that provides an emissivity of equal to, or less than 0.10, yet is thin enough that when the packaging material is subjected to the recycling process, what little amount of aluminum is present is "crumbled" and fully oxidized and, as a result, does not affect

the recyclability of the packaging material as a whole. Such specific aluminized polymeric film may have an optional protective coating (which would be generally less than one micron in thickness) to protect the aluminum from corrosion during use. However, this protective coating is configured to not raise the emissivity of the aluminized surface above the 0.10 value and, at the same time, to still allow for the aluminum material it covers to be removed in the repulping and recycling process such that the aluminum material in the stack of materials is factually fully oxidized and corroded in the heat and at humidity levels used in the recycling process. It is this specific configuration that permits the aluminum to be included in the recycled portion of the packaging material.

[0004] Repulping is the first stage in paper recycling. Features of the method for testing the repulpability of a paper-based containers are summarized in Part I, : ("The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor"), which is attached to this specification. This test method is recognized in related industry - and, in particular, by the Fibre Box Association and Corrugated Packaging Alliance - and represents the commonly-used test the exposure to which is required to be able to classify a goven corrugated container as repulpable or recyclable. The first part of this test method addresses repulpability. In particular, a sample of the container is blended in a Waring Blender and disintegrated into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm, and separated in a 0.01" screen with a 1 inch water head for 20 minutes. The specimens are then dried in an oven for 4 hours at 221 degrees F to remove water. The dried weights of what passes through the screen after such treatment is compared to what is rejected by the screen. The material that passed through is considered to be repulpable, meaning that it can be used, according to industrial standards, to be remade into paper at a mill, while what is left behind by the screen is considered to be unusable waste and generally is rejected and sent to the landfill. In order to pass the first stage of this test, a portion of at least 85 weight-% of the total, overall amount of material has to be classified as repulpable.

[0005] The second stage of the test involves the use of the accepted pulp for making paper. Here, using a Carver press at 350 degrees F at 500 psi, the accepted pulp (sometime referred to as "accepts") is pressed together to form hand sheets, and the excess moisture is blotted away. Then several (often - three) hand sheets of new paper are inspected for defects or "spots". This

inspection is aided by TAPPI developed test methods. TAPPI is a registered, not-for-profit, international Non-Governmental Organization involved in research and development in the fields of pulp, paper, and packaging (such as corrugated fiberboard, flexible packaging, lamination, adhesives, coatings and extrusion). This organization, among other things, develops and provides industry standards and test methods. Guidance for identifying spots include visually-recognizable discoloration (according to TAPPI T-537 and TAPPI T-563), and a physical adhesion of a spot to pulp caused by melted plastic or "stickies" (according to TAPPI T-277). For example, if a small amount of dirt or aluminum foil comes through the paper and makes its way into the pulp during the repulping phase, it could be made into paper, but could leave the paper with visual blemishes, and would be cause for rejection. Alternatively, if a polymeric coating disposed over a paper layer is adhered to the pulp and makes it through the filter with the pulp (in either a liquid form or in small enough pieces, for example), such piece of polymeric coating would be re-softened or re-melted in the paper making process and could cause "sticky" areas or portions in the newly-formed paper, affecting the physical properties of such paper. It is known in industry that for the newly-formed paper to be accepted and the final product to be considered recyclable according to this test, no more than 15 of either kind of spots can be present in an area that is equal to or greater than 0.4 square mm. An inert material that is both visually transparent (therefore resulting in no visually-recognized defects) and that does not adhere to paper material at 350 degrees F (thereby preventing the formation of sticky areas in the mater material) would not be cause for rejection according to such test.

[0006] Notably, practically all perishable or temperature sensitive goods shipped in small volumes are shipped using corrugated cardboard boxes, which are easily and commonly recycled. According to the "Advancing Sustainable Materials Management: 2014 Fact Sheet" published by the EPA, cardboard boxes were recycled at a rate of 89.5%, whereas PET plastic bottles were recycled at a rate of 31.2%, and HDPE plastic bottles were recycled at a rate of 29.5%, with other plastic materials being recycled at lower rates. In practice, few insulating products are as easy to recycle as a corrugated cardboard box.

[0007] For the category of insulating products referred to as reflective insulation or radiant barrier, the thermal performance is highly dependent on the surface emissivity. Emissivity represents the ability for heat to radiate from a surface into an adjacent air space. Emissivity of

the surface of a material is defined as the material's ability to emit energy as IR radiation (and not visible light), somewhere in the range between about 700 nm and about 1 micron wavelengths. Emissivity is commonly measured using the test method discussed in ASTM C1371 (attached hereto as Part B), using a tabletop portable emissometer. The value of emissivity is stated as a number between 0 and 1, where 0 represents the case of emission of no radiant heat and 1 represents the case of emission of all radiant heat from a given surface. The higher the emissivity value, the more heat is emitted, and the lower the emissivity, the less heat is emitted. For the purposes of the product comparison, the emissivity of typical brown paper used in corrugated cardboard boxes has a value between 0.80 and 0.90, aluminized paper has an emissivity value between 0.10 and 0.50, aluminum foil or aluminized film with a polymeric film applied to both sides of such film has emissivity between 0.20 and 0.70, and aluminized polymeric film without any protection over the aluminum has emissivity between 0.03 and 0.05. When insulating an object with a low emissivity surface facing the air space, the lower the emissivity of the surface, the better quality of the insulation. ASTM C1313 is the industry standard specification for a radiant barrier, and defines a radiant barrier as a material having an emissivity of 0.10 or less, used in the construction of an insulating system. (There currently appears to be no maximum value of emissivity for a material to be called a reflective insulation.)

[0008] The sizes of the air spaces, formed during the insulation of a given workpiece, also makes a difference. During the propagation of heat flow through an given air space, a certain percent of heat travels with moving air (or via convection), and a certain percent of heat wpropagates in the form of infrared radiation. When the heat is transfered downward, convection is minimized and the predominant means of heat transfer is radiation. In this case, the larger the air space, the better the quality of insulation. Circumstances change, however, when the flow of heat is directed upward or sideways, as convection in this case has a greater impact. In these cases, a balance must be found between having a large air space (between the container or wrapper and the workpiece or good, which this container / wrapper protects) the size of which is, nevertheless, judiciously limited to not allow for easy air movement inside the air space. In Chapter 26, Table 3 of the ASHRAE Handbook of Fundamentals, which is incorporated herein by reference, insulation values are given for differently sized air spaces (ranging from 1/2 inch to 3.5 inches) and at different temperature settings, with surfaces of varying emissivities(from 0.03

to 0.82). In Table 1 of that document, emissivities of 0.05 and 0.20 are given as examples of "reflective" and 0.90 is called out as an example of "non-reflective." According to ASHRAE, a 3/4 inch air space has a greater overall insulation value than a 1/2 inch air space for upward and sideways heat flow, but at 1 inch, the insulation value diminishes. When it comes to insulated packaging and shipping, air spaces may conceivably be smaller than 1/2 inch, and multiple insulated liners could be used.

[0009] A person of skill in the art will readily recognize that a variety of different products may be used to reduce the emissivity of a surface. The use of aluminum foil, for example, is a common approach, as aluminum foil is relatively inexpensive. Aluminum foil has very low mechanical strength, but is easy enough to handle when laminated to a paper. In the lamination process, a foil thickness of 6 to 18 microns is commonly preferred in industry (as atthese thicknesses, the aluminum foil has some protection against oxidation and corrosion when exposed to high heat and moisture). Aluminum oxide develops on the outermost layer of the foil, but only down to tens of nanometers at the thickest and typically does not propagate deeper into the body of the foil, so after the initial value of the foil's emissivity (of 0.03 to 0.05) increases to about 0.08 to 0.12, the value of emissivity of the oxidized surface of the aluminum foil remains relatively constant and stable.

Another industrial test, ASTM D3310, is used to test resistance to corrosion, and is specifically called out as the preferred test for a radiant barrier per ASTM C1313. (Emissivity testing after corrosion resistance testing is one method of testing, but the ASHRAE Handbook, Chapter 26, Table 2, specifically calls out a few specific surfaces and materials, including bright aluminum foil as having an emissivity of 0.05 and aluminum sheet as having an emissivity of 0.12.) A disadvantage to using aluminum foil in insulated packaging containers is that the aluminum foil is very difficult to remove from the paper if the container is to be repulped or recycled. In particular, the aluminum foil is so soft it can break apart or crumble and its crumbs or particles make their way into the paper pulp.

[0010] The use of aluminized paper is considered to be another approach. Here, using a vacuum deposition process, like sputtering or electron beam evaporation, a low emissivity aluminum layer is applied to a paper. Since the amount of aluminum applied using this method is miniscule (200 nanometers or less in thickness), the weight of the aluminum layer is insignificant

compared to the weight of the paper products. Therefore, it is generally assumed that when aluminized paper is submitted for repulping, it is easily able to meet the requirement that at least 85% is made into usable pulp, and that the exact weight of the aluminum is practically unmeasurable in the confines of the repulpability test. Since these papers may contain clay coatings, lacquer coatings, printed inks, and other materials that could contribute to a failure from "spots" or "stickies" in the recyclability test, the ratio of non-paper to paper products is minimized, aluminum included. Since the paper is not a smooth, planar surface, the emissivity of the paper surface does not reach as low as that of aluminum foil. Depending on the type of paper, the amount of moisture in the paper, roughness of the paper surface and some other factors, we measured the emissivity of aluminized paper samples to be between 0.50 and 0.10. In fact, ASHRAE lists "Aluminum coated paper, polished" as having an emissivity of 0.20. Lower emissivities are always preferred for reflective insulation, and a range in emissivity values that large, and with emissivity values still not qualifying it as a radiant barrier, aluminized paper leaves much to be desired. Combined with the fact that paper naturally contains a certain amount of moisture and that the aluminum may be uncoated or unprotected, it leaves the aluminized paper susceptible to corrosion in the presence of steam or condensation, which may occur in the normal use of packaging perishable goods. All in all, while aluminized paper may present a better repuplable and recyclable option than aluminum foil laminated on paper, it sacrifices performance to achieve such improved performance.

[0011] Yet another material that can be used to achieve low emissivity is a metalized polymeric film. Notably, because such film is not paper itself, it cannot be repulped for paper recycling, and instead must be separated from the paper to which it is affixed beforehand. The aluminum or other metal can be applied to a film by vacuum deposition, like sputtering or electron beam evaporation (by analogy with the process of formation of the aluminized paper), but the higher figure of flatness of the surface of the film facilitates the achievement of lower emissivity value even at thicknesses of metallic material of 200 nanometers or less. For example, in was empirically showed in one of our studies that the aluminized polyethylene terephthalate film can achieve an emissivity value of 0.03, while the aluminized low density polyethylene film can achieve an emissivity value of 0.05. The advantage of using a polymeric film for intended purposes is that such film contains little to no moisture, can be coated onto the chosen surface

prior to metallization to further smooth the surface, and the metallic material can even be further covered with a coating or film after metallization to further protect it from corrosion. A light top coating, less than one micron, may increase the emissivity over the level of 0.03 but still keep it below 0.10, while a thick 6 micron to 24 micron polymer film laminated over the aluminum can increase the emissivity to 0.20 to 0.70 (depending on the film thicknesses and types of polymers). (As a comparison, plain brown kraft paper has an emissivity of 0.80, and regular glass has an emissivity of 0.84.) If a metalized film is going to be coated for corrosion protection though, the coating must be thin enough for it to not absorb significant radiant heat and significantly increase the emissivity.

[0012] There are a few metalized film products on the insulated packaging market. One such product is a low density polyethylene bubble packaging material with an aluminized polyethylene terephthalate film facer on one or both sides, making an insert, pouch, or envelope to contain perishable goods. One challenge with this product is that it is a mixed polymer. The Society of the Plastics Industry (SPI) Resin Identification Code and ASTM D7611 put mixed polymers in the category of "other", numbered with a 7. Blue Apron explains says their bubble liner is "fully recyclable" but as a 7, would be very difficult to recycle and would often be excluded from recycling streams altogether, ending up in the landfill. It can vary by the community to community whether or not it can be collected and how it can be handled. The State of California does have a "CA Cash Refund" program in place to take such items, but other states do not.

[0013] An example of a product that advertises sustainability which uses a reflective insulation is a box liner called "northbox" made by Cascades Inc. Each wall of the liner consisting of two aluminized layers, each between two layers of polymeric films, with each of those polymeric film/aluminum/polymeric film layers separated by a honeycomb paper structure, and the entire assembly is inserted into the shipper box. They describe the reason for applying a polymeric film to both sides of the aluminum as "eliminating the risk of crumbling in the pulp during the recycling process" similar to the problems incurred with aluminum foil/paper laminates described above. As we've explained, thin aluminum is especially vulnerable to water and humidity and corrodes easily if not adequately protected. The polymeric film on both sides of the aluminum serves dual purposes of both preventing the aluminum from crumbling off and getting

into the pulp in the recycling process, and preventing corrosion that might occur with an unprotected aluminized film in use during the life of the packaging product. A benefit to the "northbox" product is that it is described as being "pulper-safe" and is illustrated in their literature as the film/aluminum/film assembly being fully removed in the pulping process without the aluminum ever making its way into the pulp. There are two issues with a product like this. First the polymeric films used to protect the aluminum dramatically increase the emissivity, leaving a product that, while reflective to visual light, is not nearly as heat reflective as bare aluminum, and does not qualify as a radiant barrier. Second, the films add additional plastic weight, which when processed at the paper recycling mill, is additional waste destined for the landfill instead of being repulped. The ratio of weight of paper to weight of non-paper in a product is one factor in determining if a product can be called repulpable or recyclable as paper.

[0014] When a radiant barrier / reflective insulation is to be repulped and recycled as paper, the ideal product would be one in which:

- The emissivity of at least one surface is 0.10 or less for optimum performance;
- The aluminum is prevented or protected from corrosion or otherwise unlikely to corrode in normal use, where normal use is defined as the conditions that the product could reasonably be expected to be subjected to when shipping. For example, if the material is on the inside of a cardboard box and the goods being insulated are within that box, the normal use would be having that box ship across the country. Whereas, if the material is not on the inside surface of the box, but instead located as an insert within the box, then the outside box may provide additional protection from the elements, from temperature variations, from humidity, etc. If the material is instead a mailer or envelope, then it may not be protected as well as if it were in a box.
- The process of protecting the aluminum does not result in excess plastic weight to paper weight so as to more easily meet the 85% / 15% ratio of repulped material to rejected material when tested to the "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" repulpability test. Additionally, the protective layer is sufficiently thin to maintain the desired emissivity of the aluminum layer, and is sufficiently thick to prevent oxidation of the aluminum layer during normal use of the packaging, but does not impede

oxidization of the aluminum layer as a result of the treatment. The amount of protection the coating needs to provide will depend on the products normal and expected use. The bottom line is that the coating needs to make sure the outer surface maintains the required emissivity;

- Any material that does make it through the repulping process is able to be made into paper without excess "spots" or "stickies" per "The Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor" recyclability test.

[0015] While flakes, specs or spots of reflective material would certainly contribute to a product's disqualification in the recyclability portion of the test, surprisingly, we have found that using a very thin coating over the aluminum as protection against corrosion, as opposed to an aluminum foil or a aluminized layer encapsulated within polymeric film, maintains the low emissivity and offers corrosion protection, while minimizing the weight of material unable to be made into usable pulp, and because the thickness of the aluminum is so thin, any aluminum that does make it into the accepts, will fully oxidize and corrode in the heat and humidity levels used in the process. Aluminum oxide is visually transparent to the human eye (that is, substantially not visible), and thus the aluminum is considered fully oxidized when the aluminum is transparent instead of silver-colored.

[0016] Contrary to the prevailing industry opinion that the aluminum component of the radiant barrier or reflective insulation, as with other non-paper products, must be prevented from collecting in the pulp for fear of contamination the paper in the paper repulping and recycling processes, small amounts of aluminum are both undetectable and harmless to the paper being made. We have found that actually allowing and not actively preventing small amounts of aluminum to enter the pulp is not detrimental, and is a way of allowing a paper-containing radiant barrier material to be recyclable as paper. This is because the aluminum can fully oxidize at the temperatures and humidity levels used in the test. The resulting aluminum oxide is transparent in visual "spot" testing and does not adhere to pulp in the mechanical "stickies" testing.

[0017] Aluminum is not the only material that would be low emissivty in use while visually transparent and not pulp-adhering after repulpability and recyclability testing, but aluminum

would likely be the most practical. For example silver or indium tin oxide could work, but would be prohibitively expensive compared to aluminum.

[0018] Using an aluminized polymeric film, either with a coating less than one micron in thickness to protect the aluminum from corrosion in use and not raise the emissivity of the aluminized surface greater than 0.10, or with no coating at all if it is not required for normal use to keep the emissivity as low as possible. This ensures that the aluminum is removable in the repulping and recycling process, and the aluminum on the aluminized film is actually allowed to "crumble" into the pulp as the blender and disintegrater scratches, scrapes and otherwise removes and separates the paper products from the non-paper products, allowing the aluminum to find its way into the accepts area for pulp – against the conventional wisdom of keeping non paper products out. The result will be a product that insulates well as a reflective insulation and that can, when applied to a paper product, improve the chances of the final product being repulpable and recyclable as paper.

[0019] Examples of a reflective insulation packaging product comprising an embodiment of the present invention are listed below:

- A box liner with the thin coated aluminized film facing outward, designed in such a way that when fold and closed has tabs or flanges between 1/2 and 3/4 inches, protruding out from all six sides so that when inserted into a corrugated shipper box, the coated and protected metalized film is facing into air spaces between 1/2 and 3/4 inches;
- A standard box with thin coated aluminized film on the outside of the entire box, designed to fit inside a slightly larger box with separate spacers between the inner and outer box;
- A single panel of corrugated paper or cardboard with thin coated aluminized film on one side, designed to fit snugly inside a box containing goods where the height of the goods does not reach all the way to the top of the box, and the panel can be inserted with the coated metalized film facing into the above air space;
- A standard box where the inside of the box is lined with a thin coated aluminized film, where the goods do not completely fill the box and an air space is created by the size and shape of the goods themselves in relation to the walls of the box.

[0020] The existing technology compared to an embodiment of the invention is provided below:

[0021] Existing Technology 1: The paper is laminated to aluminum foil.

- The performance is good. The aluminum foil is less than 10% emissive when tested to ASTM C1371.
- The product does not meet the Voluntary Standard for recyclability, because the foil breaks up and contaminates the pulp in the recyclability portion of the test.

[0022] Existing Technology 2: The paper is directly metalized in a vacuum chamber, using either sputtering or electron beam evaporation

- The product cannot meet the emissivity requirement of less than 0.10 emissive. According to the ASHRAE Handbook, metalized paper has an emissivity of 0.20. Lower emissivity can be caused by using a rough or non-planar surface to deposit the aluminum on, or using less overall aluminum (low optical density aluminum is higher emissivity).
- Because no plastics are used, and the aluminum thickness is limited to no more than 30 nm, these products would meet the Voluntary Standard.

[0023] Existing Technology 3: The paper is laminated with a plastic film / metalized aluminum / plastic film composite.

- The product is not less than 0.10 emissive. These products can be anywhere from 0.70 to 0.20 emissive, depending on the films used. We tested a variety of products to ASTM C1371.
- The product may be recyclable as paper if a lot of paper were being used (like an entire cardboard box with this film composite material laminated to one side) because the plastic is easily removed, and manufacturers tout that the plastic "encapsulates" the aluminum to prevent it from getting into the pulp, so they can use any thickness of aluminum. The plastic is separated from the paper.
- Depending on the thickness or weight of the paper, the added plastic film may add too much weight. For example, if instead of a large cardboard box, this were a paper pouch with 60 lbs kraft paper (which is a very thick and heavy weight), and using 2 layers of 48 gauge PET plastic film, the plastic would exceed 15% of the weight and would fail the first stage of the test - the repulpability requirement.

[0024] In stark contradistinction to known technologies, an embodiment of the present invention would comply with the repulpability requirement, yet still provide insulation with very low

emissivity. An embodiment may have a metalized film on one side and paper on the other, with the metal facing out. Possibly with a protective top coating, if required. Thus, an embodiment of the invention comprises a paper layer with first and second surfaces; a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface and an aluminum layer is deposited on the fourth surface. Optionally, an embodiment of the invention may comprise an intermediate layer, where the purpose of the intermediate layer may be to smooth the fourth surface prior to applying the aluminum in order to achieve better emissivity, or it may serve the purpose of being easily removable in order to separate the aluminum from the fourth surface after use. The intermediate layer may, for example, be a polymer or an oligomer.

- The product would be well under 0.10 emissivity, and typically closer to 0.05. This would give it superior insulating performance.
- The product would pass the Voluntary Standard because of what we discovered about how vacuum deposited aluminum would behave in the Voluntary Standard test. If the aluminum is allowed to oxidize under the conditions of the test, then the transparent aluminum oxide can be mixed in the pulp and not be cause for failure.
- Everyone in the industry has been so concerned with aluminum showing up in the pulp (which does happen with aluminum foil) that they either don't use aluminized plastic at all, or else they fully encapsulate the aluminum, which BOTH adds weight (which could still cause a failure of the Voluntary Standard) and increases the emissivity (which significantly hurts the insulation performance).
- When applied to 60 lbs kraft paper, as might be configured to make an insulated pouch for example, the single layer of 48 gauge PET with just our aluminum and top coating would still meet the 85% / 15% weight criteria for the repulpability test in the Voluntary Standard.

[0025] A summary of the comparison between the existing technologies and an embodiment of the present invention is shown with reference to two possible products:

[0026] Product 1: An insulating pouch using a strong and heavy paper, with a reflective surface on one side, where the reflective surface is:

- The film/aluminum/film product - neither low emissivity nor recyclable;
- Aluminum foil - very low emissivity but is not recyclable;

- Metalized paper - recyclable and somewhat low emissivity;
- An embodiment of the present invention - both recyclable and very low emissivity.

[0027] Product 2: An insulating box or insert for a box, using cardboard, with a reflective surface on one side where the reflective surface is:

- The film/aluminum/film product - not low emissivity, but may be recyclable depending on the weight and type of cardboard used;
- Aluminum foil - very low emissivity but is not recyclable;
- Metalized paper - recyclable and somewhat low emissivity;
- An embodiment of the present invention - both recyclable and very low emissivity.

[0028] Thus, as illustrated in the above examples, an embodiment of the present invention may be used to effectively insulate an object during shipment, mail delivery, etc. with the added benefit that the packaging may then be recycled once it has served its purpose. The method of packaging an object that is perishable, or may otherwise be temperature sensitive, comprises placing the object in suitable proximity to an embodiment of the invention such that adequate thermal insulation is provided. Adequate thermal insulation indicates protection from heat, cold, or changes between heat and cold, such that the desired temperature range of the object is maintained during the shipment, mail delivery, etc. time frame.

[0029] While the invention is described through the above-described exemplary embodiments, it will be understood by those of ordinary skill in the art that modifications to, and variations of, the illustrated embodiments may be made without departing from the inventive concepts disclosed herein. Accordingly, the invention should not be viewed as being limited to the disclosed embodiment(s).

TENTATIVE CLAIMS

1. **A recyclable packaging** comprising:

a paper layer with first and second surfaces;
a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;
an aluminum layer deposited on the fourth surface, wherein the aluminum layer has a thickness of 200 nanometers or less and wherein the aluminum layer causes an emissivity value of an outer surface of the packaging to be equal to or smaller than a first value of 0.10; and
wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a material resulting from the packaging being subjected to a following treatment
blending in a Waring Blender;
disintegrating into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm;
separating in a 0.01 inch screen with a 1 inch water head for 20 minutes; and
drying in an oven for 4 hours at 221 degrees F.

2. The recyclable packaging of claim 1, further comprising:
a protective coating over the aluminum layer, wherein the protective coating has a thickness of 1 micron or less, wherein the thickness is defined to maintain the first value after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging,
while the protective coating does not impede oxidization of the aluminum layer caused by the treatment.

3. The recyclable packaging of claim 2, wherein the protective coating is a material selected from: wax, polymer, and lacquer.

4. The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

5. The recyclable packaging of claim 1, wherein the polymer layer is a material selected from: film and fabric.

6. **A recyclable packaging** comprising:
a paper layer with first and second surfaces;
a polymer layer with third and fourth surfaces, wherein the third surface is affixed to the second surface;
an intermediate coating applied to the fourth surface;
an aluminum layer deposited on the intermediate coating, wherein the aluminum layer has a thickness of 200 nanometers or less and wherein the aluminum layer causes an outer

surface of the packaging to have an emissivity value that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum present in a material resulting from the packaging being subjected to a following treatment

blending in a Waring Blender;

disintegrating into water with a British Disintegrator at about 125 (± 10) degrees F at 3000 rpm;

separating in a 0.01 inch screen with a 1 inch water head for 20 minutes; and

drying in an oven for 4 hours at 221 degrees F.

7. The recyclable packaging of claim 6, wherein the intermediate coating has a thickness of between 10 nm and 2000 nm and is a material selected from polymer and oligomer.

8. The recyclable packaging of claim 6, further comprising:

a protective coating over the aluminum layer, wherein the protective coating has a thickness of 1 micron or less, and wherein the thickness is defined to maintain the first value after the aluminum layer has been coated with the protective coating and to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating

does not impede oxidization of the aluminum layer as a result of the treatment.

9. The recyclable packaging of claim 8, wherein the protective coating is a material selected from: wax, polymer, and lacquer.

10. The recyclable packaging of claim 6, wherein the polymer layer is a material selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

11. The recyclable packaging of claim 6, wherein the polymer layer is a material selected from: film and fabric.

12. **A method of manufacturing a recyclable packaging**, the method comprising:

attaching a polymer layer to a paper layer, wherein an inner surface of the polymer layer is affixed to a first surface of the paper layer;

depositing an aluminum layer on the polymer layer, wherein the aluminum layer has a thickness of 200 nanometers or less and wherein the aluminum layer causes an outer surface of the polymer layer to have an emissivity value that is equal to or smaller than a first value of 0.10; and

wherein said aluminum layer becomes fully oxidized with no visible aluminum when the packaging is exposed to a following treatment:

blending in a Waring Blender;

disintegrating into water with a British Disintegrator at 125 (± 10) degrees F at 3000 rpm,

separating in a 0.01 inch screen with a 1 inch water head for 20 minutes, and

drying in an oven for 4 hours at 221 degrees F.

13. The method of manufacturing a recyclable packaging of claim 12, further comprising:
applying a protective coating over the aluminum layer, wherein the protective coating has a thickness of 1 micron or less, and wherein the thickness is defined to maintain the first value after the aluminum layer has been coated with the protective coating and
to prevent oxidation of the aluminum layer during normal use of the packaging, while the protective coating
does not impede oxidization of the aluminum layer as a result of the treatment.

14. **A method of thermally insulating a good within a recyclable packaging**, the method comprising:

placing a reflective insulation material in a pre-defined proximity with a good, the pre-defined proximity being suitably chosen to provide adequate thermal insulation to the good, wherein said reflective insulation material comprises a recyclable packaging as claimed in claim 1.

15. A material used for packaging or transporting a good wherein said material is repulpable and recyclable, satisfying all of the requirements per "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", said material comprising:

a paper-comprising material with an inner and outer surface, affixed to a polymer-comprising material with an inner and outer surface, wherein the inner surface of the paper-comprising material is affixed to the inner surface of the polymer-comprising material

wherein the outer surface of said polymer-comprising material, the surface not affixed to the paper-comprising material, has a low emissivity of 0.10 or less when tested to ASTM C1371

wherein the emissivity of said low emissivity surface is achieved with aluminum no more than 200 nanometers in thickness, being sufficient to fully oxidize with no visible aluminum when subjected to 221 degrees F at 100% relative humidity for 4 hours

wherein said aluminum applied polymer-comprising material has a protective coating over the aluminum of no more than 1 micron in thickness, being sufficiently thin to maintain the low emissivity, sufficiently thick to prevent oxidation or corrosion of the aluminum in normal use, and sufficiently frail enough to allow for scratches and abrasions to expose the aluminum in "The Voluntary Standard For Repulping and

Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor."

16. The material as claimed in claim 16 where a polymer comprising the polymer-comprising material is selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

17. The material as claimed in claim 16 where the polymer-comprising material is selected from: film, foam or fabric.

18. The material as claimed in claim 16 where the protective coating is selected from: wax, polymer, or lacquer.

19. The material as claimed in claim 16 were the aluminum is not applied directly to the polymer-containing material, but instead a thin coating or film is first applied over the polymer-containing material and then aluminum is applied over said thin coating or film.

20. A material used for packaging or transporting a good wherein said material is repulpable and recyclable, satisfying all of the requirements per "The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor", said material comprising:

    a paper-comprising material with an inner and outer surface, affixed to a polymer-comprising material with an inner and outer surface, wherein the inner surface of the paper-comprising material is affixed to the inner surface of the polymer-comprising material

    wherein the outer surface of said polymer-comprising material, the surface not affixed to the paper-comprising material, has a low emissivity of 0.10 or less when tested to ASTM C1371

    wherein the emissivity of said low emissivity surface is achieved with aluminum no more than 200 nanometers in thickness, being sufficient to fully oxidize with no visible aluminum when subjected to 221 degrees F at 100% relative humidity for 4 hours

    wherein said material will not be exposed to conditions that would corrode or oxidize the aluminum in normal use,

    wherein said aluminum is left exposed rather than covered with a protective coating, allowing the aluminum to more easily oxidize when tested to "The Voluntary Standard

For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor."

21. The material as claimed in claim 21 where a polymer comprising the polymer-comprising material is selected from: low density polyethylene, high density polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride, polyurethane, and polystyrene.

22. The material as claimed in claim 21 where the polymer-comprising material is selected from: film, foam or fabric.

23. The material as claimed in claim 21 were the aluminum is not applied directly to the polymer-containing material, but instead a thin coating or film is first applied over the polymer-containing material and then aluminum is applied over said thin coating or film.

24. A method of thermally insulating a good within a package or container, said method comprising:

    placing a reflective insulation material in close enough proximity with a good so as to provide thermal insulation,

    wherein said reflective insulation material comprises a recyclable packaging as claimed in claim 15.

Revised August 16, 2013

Voluntary Standard
For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor

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Note: Pages 13, 14, and 15 are the Application and Materials forms. They are a part of this document but are also posted separately in "Word" format for ease in filling out these pages.

INTRODUCTION

Disposing of treated corrugated that cannot be recycled can be a financial and logistical burden on the supply chain for these packages. While treated corrugated containers are the most practical and cost-effective way to ship produce, meats, seafood and other items, certain treatments to improve performance in the presence of water or water vapor have made recycling difficult. **It is desirable from both increased recyclable fiber availability and environmental standpoints to encourage the development of treated corrugated that may be recycled into other paper products using common mill technology.**

The corrugated products industry recognizes the solution to this problem should be industry-wide, primarily because the recycling mills cannot effectively identify all treatments specific to particular companies. Different treatment systems may have different impacts on recycling processes; mill operators have even considered some to be highly detrimental.

To address and evaluate the technical as well as the educational aspects of this objective, a joint committee was formed consisting of the Fibre Box Association and the American Forest & Paper Association (AF&PA) members who represented manufacturers of containerboard, corrugated containers, and others who utilize recovered corrugated container fiber. Their work was to evaluate the repulpability and recyclability of moisture barrier treatments or coatings applied to liners or combined corrugated board in an effort to establish a minimum threshold for moisture barrier treated or coated corrugated that is intended, and labeled, to be recyclable into new containerboard and other paper products.

After numerous meetings, tests, and legal reviews, the committee developed this Voluntary Standard for repulpability and recyclability. The Standard contains a test method and test report. Box manufacturers can register treatments and coated board combinations with the Fibre Box Association if they do the following:

- Have a lab approved by the FBA (3rd party or internal) certify that treatment has passed the test protocol.
- Forward the completed Test Report, lab certification, and required samples to the FBA.
- Provide a copy of the Company and Material Information Forms (pages 13-15 of this document) to the FBA signed by an officer of their company.
- Once the "Treatment" Registration letter is received by the applicant, follow the marking guidelines as called for in the protocol.

For additional information, call:

Fibre Box Association (FBA):
25 Northwest Point Blvd. Suite 510
Elk Grove Village, IL 60007
847-364-9600
Fax 847-364-9639
www.fibrebox.org

PURPOSE

1. The application of this Voluntary Protocol is only for "linerboard (including Kraft Paper), corrugating medium, combined board, and corrugated products made from these materials, collectively known as "corrugated fiberboard". The purpose is to encourage the development of treatments to corrugated fiberboard that will provide water resistance or some other desirable characteristic that are repulpable and recyclable, and will replace existing treatments that also provided water resistance or some other desirable characteristic, but did not allow the corrugated fiberboard to be repulpable or recyclable. The goal is to return to the OCC stream corrugated fiberboard that formerly was not accepted into that stream.

2. This standard establishes a repeatable method for simulating a commonly used subset of repulping and recycling processes. It is intended to evaluate the impact of repulping and recycling treated corrugated fiberboard on containerboard mill operations and final products.

3. This standard establishes a method for identifying treated corrugated that can be repulped and recycled in this selected subset of processes. It establishes minimum levels of performance for the handsheets made from treated corrugated, repulped and recycled in accordance with a detailed test protocol given in Appendices A & B. This standard is not intended to preclude the development or use of any technological advances in mill or treatment processes. It is intended to encourage the development, use and repulping and recycling of treated corrugated products for use in high-moisture environments.

SCOPE

1. This standard applies repulping and recycling process technology either in effect or readily achievable in mills currently involved in recycling.

2. This standard establishes a **screening method** to determine the repulpability and recyclability of treated corrugated products that have not previously been considered recyclable.

3. The test method in this standard has two parts:
Part 1 determines the **repulpability** of treated corrugated by determining fiber-on-fiber yield when only the treated corrugated is processed in accordance with this standard (Appendix A).
Part 2 determines the **recyclability** of the treated corrugated by evaluating its effect on mill operations and finished products when it is added to untreated corrugated in the amounts specified (Appendix B).

4. This voluntary standard does not relieve the user from compliance with all applicable local, state and federal laws and regulations, and contractual agreements.

5. This standard is not intended to address the functionality or marketability of the treated corrugated or of mill products that use the treated corrugated as a fiber source.

6. This standard does not address all of the factors that should be considered in the development of a repulpable and recyclable treatment. The companies that develop treatments and treated corrugated and test them under this standard are responsible for making sure that, in addition to being repulpable and recyclable, the products will be safe and suitable for their intended applications— e.g., packaging in contact with food—and will not create other non-desirable environmental effects at the point of use or disposal.

7. Treated corrugated containers recovered for recycling should not be contaminated by their contents, such as hazardous or perishable materials.

DEFINITIONS of KEY TERMS

Fiber-on-fiber yield is the amount of fiber that remains after the processing action, expressed as a percentage of the fiber present in the material to be tested.

Handsheets are sheets made from a suspension of fibers in water in an operation, whereby each sheet is formed separately by draining the pulp suspension on a stationary sheet mold.

OCC (Old Corrugated Containers) is a grade of waste paper comprised of untreated corrugated boxes that have been used for the purpose for which they were originally purchased and have subsequently been source separated from other waste.

Recyclable means used paper, including in-plant and post-consumer waste paper and paperboard, which is capable of being processed into new paper or paperboard using the process defined in this standard.

Recyclability test sample consists of a minimum of 20% (by weight) of the treated corrugated to be tested and the remainder of the untreated corrugated.

Repulpable means the test material that can undergo the operation of re-wetting and fiberizing for subsequent sheet formation, using the process defined in this standard.

Treated corrugated is the combined board or boxes that have been subjected to a specific treatment for the purpose of improving its performance in the presence of water or water vapor. The level of treatment used in the test must be equal to or greater than the level of treatment to be used in the field.

Untreated corrugated/control is the same combined board or boxes that have not been subjected to any treatment to improve performance in the presence of water or water vapor.

TEST METHOD

Preliminary Analysis: Before beginning the test protocol, determine the moisture content of the treated corrugated sample.

PART 1: Repulpability
A 100% charge of treated corrugated is repulped in a Modified Waring Blender and a British Disintegrator in water at a pH of 7 (±0.5 pH) that is maintained at 125°F (±10°) following the procedure outlined in Appendix A. The pulped material is separated in a screen with 0.010-inch or smaller slots to determine fiber recovery as a percentage of the amount of fiber charged. Detailed procedures for repulpability are given in Appendix A.

PART 2: Recyclability
Mix a minimum of 20% treated corrugated and the remainder of the same untreated corrugated in a laboratory-scale pulper at pH 7 (±0.5 pH) and 125°F (±10°). This is the recyclability test sample. As a control, a charge of 100% of the same untreated corrugated is also pulped using identical conditions. Each pulped material is passed through (in succession) a pressure screen equipped with a basket with 0.062 inch holes, the same screen or a similar screen equipped with a basket with 0.010 inch slots and a reverse centrifugal separator under conditions specified in the procedure

Handsheets (3.0 gram) are made from the final stage (cleaner) accepts. For each batch tested, the handsheets are pressed and dried with heat and tested for product performance properties. Properties include slide angle, short span compressive strength (STFI), bursting strength and water drop penetration, using the established TAPPI official test methods. Appearance tests shall be done according to the procedure outlined in Appendix B. The final sheets shall have no more than 15 spot counts, or not exceeding 30% greater counts than the control, with an area of $\geq$ 0.4 mm^2 area, averaged over 3 sheets. The properties and appearance of the handsheets from the recyclability test sample and untreated corrugated tests will be compared. Detailed procedures for recyclability are given in Appendix B.

PART 3: Performance Levels

Treated corrugated satisfying all of the requirements of the voluntary standard will be regarded as repulpable and recyclable. There are three general performance requirements: fiber yield, operational impact and product requirements.

Fiber yield from the repulpability test must be at least 80% based on the total weight, or 85% based on the bone dry fiber charge to the pulper.

Operational impact is acceptable if:

1. The entire procedure can be completed without using an acid wash to clean the flat screen in the Repulpability Test or dismantling the pressure screens to clean them before finishing the Recyclability Test, and
2. There is no visible deposition on any part of the disintegrator during the Repulpability Test or in the pulper during the Recyclability Test.

Product requirements are satisfied if:

1. The appearance of the handsheets made from the recyclability test sample shows no substantial difference from that of the handsheets made from the control and the spot count is $\leq$ 15 counts, or not exceeding 30% greater counts than the control, with an area $\geq$ 0.4 mm^2, averaged over 3 sheets.
2. The decrease in the slide angle of the handsheets (the average of five first slides) made using the recyclability test sample from the slide angle of the handsheets made from the control must be no greater than 15%.
3. STFI and burst strength of the handsheets made using the recyclability test sample, normalized to the sheet basis weight, must show no more than a 10% decrease from the respective values for the control. All test results are to be reported in English units.
4. The water drop penetration of handsheets made from the recyclability test sample must not exceed the water drop penetration of the control handsheets by more than 200 seconds.

CERTIFICATION AND MARKING (Self-Certification)

1. Tests for Parts 1 and 2 are repeated twice. For each set of tests, the results for the first treated sample must be compared to the results for the first untreated sample tested. Similarly, the results of the second treated sample must be compared to the results of the second untreated sample. If the recyclability test sample passes all tests on both trials, it satisfies the standard. If it passes all tests on one trial, but fails some on the other, it may be retested in a third trial. The recyclability test sample must pass all tests in the third trial to satisfy the standard.

2. Manufacturers of treated corrugated or corrugated treatments may self-certify their own product by using any capable laboratory, working in accordance with the detailed protocol provided in this standard. The laboratory may be internal to the company or a third party laboratory. All laboratories (internal and third party) shall certify that their facilities and equipment are suitable for testing the tendered product within the instructions and tolerances of this standard.

3. Treated corrugated must be recertified if there is any significant change in treatment product, substrate chemistry or any increase in the ratio of treatment to fiber. Minor modifications to a treatment material, which do not affect the water resistance or the repulpability/recyclability of the treated boxes, will not require recertification. However, if the chemistry of the treatment material is changed such that the water resistance is increased or the repulpability/recyclability of treated containerboard could reasonably be expected to be more difficult, the treatment material has to be recertified. The substrate chemistry will be considered to have been changed, requiring recertification, if wet strength chemicals, a high level of sizing chemicals or other chemicals significantly affecting the repulpability of the substrate (which were not used in the original certification test) are used in conjunction with the previously approved treatment product.

   Note: Conventional wet strength linerboard and corrugating medium, by definition, is considered to be not repulpable/recyclable unless it has passed the tests in this Voluntary Standard. Wet strength containerboard may not be substituted for standard kraft or recycled containerboard without being re-certified at a lab and re-registered with the FBA. Conventional water resistant corrugating adhesives may be substituted for lower grades of moisture resistant or domestic corrugating adhesive; however, the substitution of proprietary or special corrugating adhesives with known extra water resistance would require re-certification by a lab and re-registration with the FBA.

4. Once a treatment material has been approved at one location, it does not have to be recertified to be used at another location, if it is applied at the previously approved, or lower, treatment-to-fiber ratio and is applied on standard kraft or recycled containerboard. All locations of the company registering the treatment material may use the treated material without further registration, as long as the treatment-to-fiber ratio is not exceeded and it is applied on standard kraft or recycled containerboard.

   However, if a different company purchases treated containerboard or treatment chemicals, or performs production functions on purchased sheets, or markets treated materials under the name of a company that has not registered the use of these treated materials, that company must register their use of these treated materials with the FBA. The same restrictions regarding not exceeding the treatment-to-fiber ratio and the application on standard kraft or recycled containerboard continue to apply. Companies selling registered treatments or treated materials to companies that will be re-selling previously registered treatments or treated materials are required to provide sufficient technical information so that the company purchasing the treatments and/or the treated containerboard for resale can comply with the

treatment-to-fiber ratio maximums and that the application is on standard kraft or recycled containerboard. (See the "Option B" registration procedure on pages 13-14 of this document.)

Multiple trade names may be used for the same registered treatment as long as the treatment is applied or the treated materials are combined so that the previously approved, or lower, treatment-to-fiber ratio is not exceeded and the application is on standard kraft or recycled containerboard. All trade names for a given registered treatment or treated material must be reported to the FBA on a continuing basis with additions, deletions, and changes reported within 30 days of implementation. Identical trade names may not be used for different registered treatments or treated materials. However, a common "Family Name" with varying prefixes and/or suffixes is allowed.

The objective of having all sellers of registered treatments or treated materials report all relevant trade names is to allow the FBA to know who is producing treatments and treated materials and how they may be identified in the marketplace. This information is critical to permit the FBA to facilitate tracing any complaints from containerboard mills back to a box plant.

5. Marking

If the repulpable/recyclable certification marking (as shown below) is used, it must clearly appear on the box with the box manufacturer's name and location.

See Appendix D for guidelines on use of this symbol.

MODIFIED CORRUGATED RECYCLES SYMBOL



SAMPLES

1. In addition to common basis weights and except for the treatment(s), to the extent possible, control and treated samples should be made as alike as possible. (eg. common rolls of containerboard for non-treated components, consecutive corrugated runs, etc.)

2. Because of differences in pilot plant equipment, test labs will each have their own sample size, quantity, etc requirements. Consult with your test lab to understand their sample submission parameters.

APPENDIX A: REPULPABILITY TEST PROCEDURE

PURPOSE

To determine the repulpability of corrugated board. (Note that the Repulpability Test must be run at least twice on the treated corrugated board. The sample must pass two out of three tests.)

APPARATUS

- Specimen Cutting Device
- Balance (accurate to 0.01 gram)
- Waring Blender (with special blade, see Figure 1)
- Hot Water 125° F ± 10° F (52° C ± 5° C)
- British Disintegrator (Standard Apparatus for Pulp Evaluation No. 270)
- Open Flat Screen 10 Cut (0.010"), such as the Valley or Somerville screens
- Aluminum Weighing Pans
- Laboratory Oven at 221°F (105°C)

SPECIMEN TESTING

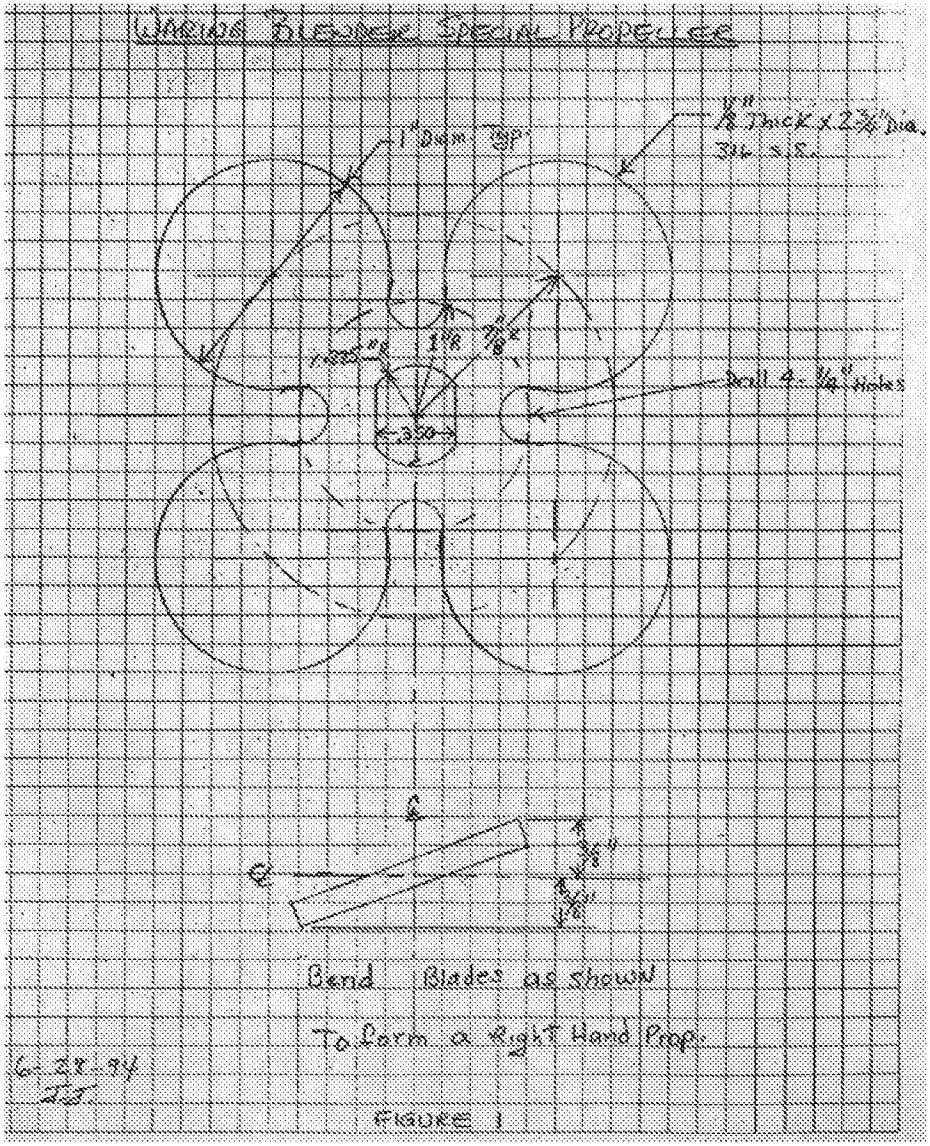
1. Cut corrugated board into 1 1/4 in. (31.8 mm) by 4 in. (102 mm) strips.
2. Weigh out .055 lb. (25 gm.) of corrugated board.
3. Place sample in 1500 ml. of water at 125° F ± 10° F (52° C ± 3° C).[1]
4. Preheat blender and British disintegrator to 125^0 F ± 10^0 F.
5. Blend in a one-gallon Waring blender (equipped with special blades) on low speed (15,000 rpm) for four minutes.
6. Rinse all fibers from the blender with 500 ml. of hot water.
7. Deflake for five minutes in the British disintegrator (2000 ml. total volume) at 3000 rpm.
8. Run on .010" (.254 mm) slotted open flat screen, maintaining 1" water head, – for 20 minutes; save the accepts and rejects in aluminum weighing pans.
9. Dry in a laboratory oven for 12 hours (± 4 hours) at 221°F (105°C).
10. Weigh the pans and record the net weight of accepts, rejects, and the sum of the accepts and rejects.

CALCULATION

$$\text{\% of Rejects} = \frac{\text{Net Rejects} \times 100}{\text{Net Accepts + Net Rejects}}$$

REPORT

Percentage of rejects to the nearest 0.1%.


Bend Blades as shown
To form a Right Hand Prop.
Figure 1

APPENDIX B: RECYCLABILITY TEST PROCEDURE

Note: Both the Control sample and the sample of Treated and Untreated test material must be tested at least twice and must pass two out of three tests.

1. Obtain a sample of the treated corrugated to be evaluated. From this sample, select a sufficient amount of material for the test. The selection should be as representative as possible of the material as a whole. Also obtain a sufficient amount of untreated corrugated to run the protocol. Selection of the charge size will depend upon the capacity of the pilot plant pulper to be used. Pulping is to be carried out at 3% consistency, or, at the consistency recommended by the pulping equipment manufacturer.

2. Determine the moisture content [TAPPI T 412]. Perform steps 3 through 9 twice—once with the untreated "control" sample, once with the "recyclability test sample."

3. Use selected sample materials of any convenient size, but no smaller than 1 x 1 inch square. Bring the equipment to 125°F (±10°). Adjust the pH of the charge so that after pulping the pH will be equal to 7 (± 0.5 pH). Raise the temperature of the pulper to 125^0F ($\pm 10^0$). Charge the pulper and pulp for 15 minutes while maintaining 125°F (±10°).

4. Repeat step 3 until sufficient material has been obtained for the following steps. Maintain the temperature of the pulp at 125°F (±10°) until it is used in step 5.

5. Combine the pulp from several batches, as necessary, and dilute to the manufacturer's recommended consistency with water heated to 125°F (±10°). Adjust the pH to 7 (± 0.5 pH). Preheat a screen with 0.0625 inch holes to 125°F (±10°) and maintain the temperature throughout this screening step. Pass the pulp sample through the preheated screen at a volumetric reject rate of 10% of the feed rate or at appropriate volumetric reject rate based on manufacturer's specifications or recommendations.

6. With the accepts from step 5, repeat the procedure in step 5, using a screen basket with 0.010 inch slots, again maintaining the temperature, consistency and a 10% reject rate or at a rate based on manufacturer's specifications.

7. Pass the accepts from step 6 through a lightweights reverse centrifugal-type cleaner, maintaining the temperature at 125°F (±10°), consistency, and the pressure differential specified for the cleaners being used. Determine the volumetric reject rate and report.

8. From the accepts from step 7, form handsheets according to TAPPI T 205 with the following conditions:
   - The slurry should be vigorously agitated (without causing a change in fiber distribution in the slurry) and maintained at 125°F (±10°) and pH 7 (±0.5 pH).
   - Dry the sheets under restraint to 7% moisture content on a surface dryer maintained at 250 – 275°F.
   - Recondition to TAPPI standard conditions prior to testing.

Test the handsheets for:
- Basis Weight [TAPPI T220]
- Slide Angle [TAPPI T 815]
- Short Span Compression (STFI) [TAPPI T 826]
- Bursting Strength [TAPPI T 403]
- Water Drop Penetration [TAPPI T 831]

Note 1. The Slide Angle test on the handsheets is to be tested blotter side to blotter side.
Note 2. The Water Drop Penetration test is to be conducted with five (5) drops each on the wire side and the blotter side of the handsheets.
Note 3. Basis Weight, STFI, Bursting Strength and the Indexed Value are to be reported in English units.

9. If the test must be halted to clean **any** post pulping apparatus in **any** aspect of the procedure, note your observations on the test report.

10. Report the results using the form provided (Appendix C).

HANDSHEET PREPARATION FOR STICKIES/SPOT COUNT TEST

1. Plug in Carver press and pre-heat top and bottom platens to 350° F.
   - Caution: use gloves and wear safety glasses when using Carver press -- the plates get very hot and can burn you.
2. Dilute test stock to approximately 1% consistency.
3. Form and dry a 500 ml check sheet.
   - Couch off the excess water with two blotters, the round metal plate, and the roller.
   - Dry on top of a new blotter in the speed dryer.
4. Weigh the handsheet and mark its identification and dry weight on the topside of the handsheet (not the wire side).
5. Calculate the amount of slurry to use for test sheets using the following formula:
   - 2.00 grams ÷ dry sheet weight x 500 = mls of slurry to use for test sheets.
6. Form 3 handsheets for testing by using the calculated amount of slurry.
7. Place sheets on blotters and dry on the speed dryer, then mark their identification on the topside of each sheet.
8. Remove test sheets from the speed dryer (drying period is 3-5 minutes).
9. Place each test sheet between filter paper and blotters in the following configuration (bottom to top):

Blotter
Filter
Stickie Sheet
Filter
Blotter

10. Set the stacks of test sheets on top of each other and press them in the pre-heated Carver press for five minutes at 350° F and 500 psi. Watch to see that the pressure gauge maintains 500 psi.
11. Remove the test sheets from the Carver press and weigh each sheet.
    - Record dry weight on each sheet
12. Count the spots in the handsheets that are ≥ 0.4 mm^2 in area using any appropriate analysis tools, such as the dirt count estimator in TAPPI T-537 or the image analysis system mentioned in TAPPI T-277 and TAPPI T-563.

Designation: C1371 – 04a (Reapproved 2010)$^{\varepsilon 1}$

Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers[1]

This standard is issued under the fixed designation C1371; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε^1 NOTE—Section 5.1.4 was editorially revised in January 2011.

1. Scope

1.1 This test method covers a technique for determination of the emittance of typical materials using a portable differential thermopile emissometer. The purpose of the test method is to provide a comparative means of quantifying the emittance of opaque, highly thermally conductive materials near room temperature as a parameter in evaluating temperatures, heat flows, and derived thermal resistances of materials.

1.2 This test method does not supplant Test Method C835, which is an absolute method for determination of total hemispherical emittance, or Test Method E408, which includes two comparative methods for determination of total normal emittance. Because of the unique construction of the portable emissometer, it can be calibrated to measure the total hemispherical emittance. This is supported by comparison of emissometer measurements with those of Test Method C835 (1).[2]

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C168 Terminology Relating to Thermal Insulation

C680 Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C835 Test Method for Total Hemispherical Emittance of Surfaces up to 1400°C

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E408 Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions*—For definitions of some terms used in this test method, refer to Terminology C168.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *diffuse surface*—a surface that emits or reflects equal radiation intensity, or both, in all directions (2).

3.2.2 *emissive power*—the rate of radiative energy emission per unit area from a surface (2).

3.2.3 *emissometer*—an instrument used for measurement of emittance.

3.2.4 *Lambert's cosine law*—the mathematical relation describing the variation of emissive power from a diffuse surface as varying with the cosine of the angle measured away from the normal of the surface (2).

3.2.5 *normal emittance*—the directional emittance perpendicular to the surface.

3.2.6 *radiative intensity*—radiative energy passing through an area per unit solid angle, per unit of the area projected normal to the direction of passage, and per unit time (2).

3.2.7 *spectral*—having a dependence on wavelength; radiation within a narrow region of wavelength (2).

3.2.8 *specular surface*—mirrorlike in reflection behavior (2).

3.3 *Symbols:*

3.3.1 For standard symbols used in this test method, see Terminology C168. Additional symbols are listed here:

[1] This test method is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.30 on Thermal Measurement.

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[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

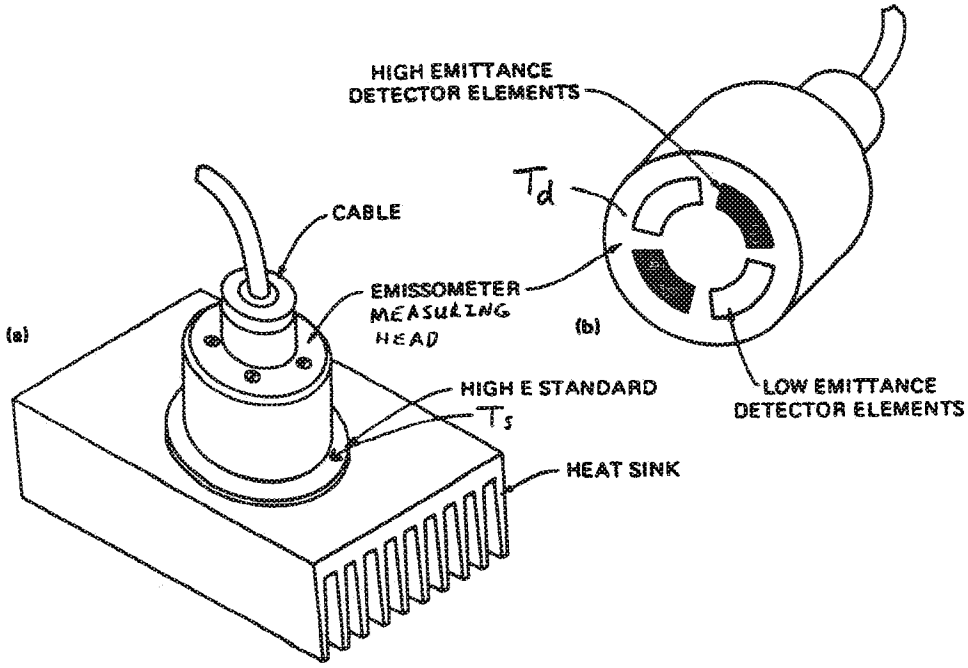
[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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α = total absorptance, dimensionless
α_λ = spectral absorptance, dimensionless
ε_{hi} = total emittance of the high-emittance calibration standard, dimensionless
ε_{low} = total emittance of the low-emittance calibration standard, dimensionless
ε_{spec} = apparent total emittance of the test specimen, dimensionless
ε = apparent total emittance of the surface, dimensionless
V_{low} = voltage output of the detector when stabilized on low-emittance calibration standard
V_{spec} = voltage output of the detector when stabilized on test specimen

4. Summary of Test Method

4.1 This test method employs a differential thermopile emissometer for total hemispherical emittance measurements. The detector thermopiles are heated in order to provide the necessary temperature difference between the detector and the surface.[4] The differential thermopile consists of one thermopile that is covered with a black coating and one that is covered with a reflective coating. The instrument is calibrated using two standards, one with a high emittance and the other with a low emittance, which are placed on the flat surface of a heat sink (the stage) as shown in Fig. 1. A specimen of the test material is placed on the stage and its emittance is quantified by comparison to the emittances of the standards. The calibration shall be checked repeatedly during the test as prescribed in 7.2.



NOTE 1—(a) Emissometer measuring head on high-emittance standard during calibration, showing heat sink and cable to readout device. (b) Bottom view of emissometer measuring head showing high- and low-emittance detector elements. The diameter of the emissometer measuring head is about 50 mm and the detector elements are recessed about 3 mm into the measuring head.

FIG. 1 Schematic of Emissometer

ε_1 = apparent total emittance of the surface 1, dimensionless
ε_2 = apparent total emittance of the surface 2, dimensionless
ε_d = apparent total emittance of the surface of detector, dimensionless
ε_s = apparent total emittance of the surface of specimen, dimensionless
ε_λ = spectral emittance, dimensionless
λ = wavelength, μm
ρ = total reflectance, dimensionless
σ = Stefan-Boltzmann constant, 5.6696×10^{-8} W/m^2· K^4
τ = total transmittance, dimensionless
A = area of surface, m^2
k = proportionality constant, V·m^2/W
Q_{rad} = radiation heat transfer, W
q_{rad} = radiative heat flux, W/m^2
T_1 = temperature of the test surface, K
T_2 = temperature of the radiant background, K
T_d = temperature of the detector, K
T_s = temperature of the surface of specimen, K
V_{hi} = voltage output of the detector when stabilized on high-emittance calibration standard

5. Significance and Use

5.1 *Surface Emittance Testing:*

5.1.1 Thermal radiation heat transfer is reduced if the surface of a material has a low emittance. Since the controlling factor in the use of insulation is sometimes condensation

[4] The sole source of supply of emissometers known to the committee at this time is Devices & Services Co., 10024 Monroe Drive, Dallas, TX 75229. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

control or personnel protection, it is important to note that a low emittance will also change the surface temperature of a material. One possible criterion in the selection of these materials is the question of the effect of aging on the surface emittance. If the initial low surface emittance of a material is not maintained during service, then the long-term value of the material is diminished.

5.1.2 This test method provides a means for comparative periodic testing of low emittance surfaces in the field. In this way the effects of aging on the reflective properties can be monitored.

5.1.3 This test method can be used to measure the total hemispherical emittance with a precision of better than ±0.02 units, if some care is taken to avoid potential misapplications. (1) The emittances of the calibration standards shall have been obtained from accurate independent measurements of total hemispherical emittance. This test method shall not be used for specimens that are highly anisotropic or transparent to infrared radiation. This test method also shall not be used for specimens with significant thermal resistance (see 7.3.4).

5.1.4 Once a reliable emittance measurement has been determined, the value is available to be used to calculate radiative heat flow from the subject surface. For example, if the temperature of the surface, T_1, and the temperature of the surroundings, T_2, are known, then the radiative heat flow, Q_{rad}, is given by:

$$Q_{rad} = A\,\varepsilon\,\sigma\,(T_1^4 - T_2^4) \quad (1)$$

where A is the area of the surface, and either A is assumed to be much smaller than the area of the surroundings or the emittance of the surroundings is assumed to be unity. This radiative heat flow when combined with convective and conductive heat flows provides the total heat flow from the surface (a method which is sometimes appropriate is described in Practice C680).

6. Apparatus

6.1 This test method applies only to emittance tests conducted by means of a heated, differential thermopile emissometer, such as that shown in Fig. 1. The following elements are used:

6.1.1 *Differential Thermopile Radiant Energy Detector*—The differential thermopile consists of elements with high and low emittance that produce an output voltage proportional to the temperature difference caused by different amounts of thermal energy emitted and absorbed by each. The output voltage is proportional to the emittance of the surface that the detector faces.

6.1.2 *Controlled Heater*—Within the emissometer measuring head that maintains the head at a temperature above that of the specimen or calibration standard.

6.1.3 *Readout Device*—Typically a digital millivoltmeter, which sometimes includes a means of conditioning the thermopile output signal so that the emittance can be read directly.

NOTE 1—The emissometer[4] has a direct readout of emittance, with a resolution of ±0.01 units. For the work described in Ref (1), the resolution was increased to ±0.001 units.

6.1.4 *Heat Sink Stage*—A heat sink with a flat surface or stage upon which the reference standards and specimen are placed, and which provides a means of maintaining the standards and specimen at the same, stable temperature.

6.1.5 *Reference Standards*—the manufacturer of the emissometer[4] supplies two sets of reference standards, each set consisting of a polished stainless steel standard (emittance about 0.06) and a blackened standard (emittance about 0.9). The standards shall be traceable to measurements made using an absolute test method (for example, Test Method C835). It is recommended that one set be used as working standards and the other set be put aside and used for periodic checks of the emittance of the working standards. The time period between checks of the working standards will depend upon the amount that the working standards are used.

6.1.6 *Sample of the Surface to be Tested*, collected carefully so as to preserve the in-situ surface condition. A specimen slightly larger than the outer dimensions of the emissometer measuring head is carefully cut from the sample.

7. Procedure

7.1 *Set-up*—A sample of the material to be tested shall be collected as near as possible to the time of the test, to control sample conditioning history. The emissometer shall be allowed to equilibrate until the calibrations remain stable, with no drift. For measurements in the field, the emissometer shall be set up as near as possible to the sample site.

NOTE 2—For the emissometer[4] a warm-up time of one hour has been found to be acceptable.

7.2 *Instrument Calibration*:

7.2.1 Place the high- and low-emittance standards on the heat sink. Thermal contact between the standards and the heat sink is improved by filling the air gaps between the standards and the heat sink with distilled water or other high conductance material.

7.2.2 Place the emissometer measuring head over the high-emittance standard. Allow at least 90 s for the reading to stabilize.

7.2.2.1 If a standard millivoltmeter is used as the readout device, record the output voltage.

7.2.2.2 If the emittance is read out directly, use the variable gain control on the readout device to adjust the readout to be equal to the emittance of the high-emittance standard.

7.2.3 Place the emissometer measuring head over the low-emittance standard, and again allow at least 90 s for the reading to stabilize.

7.2.3.1 If a standard millivoltmeter is used as the readout device, calculate the expected reading from the low-emittance standard by means of (Eq 2) (see Section 8). Then adjust the offset trimmer on the emissometer until the readout value agrees with the calculated reading.

7.2.3.2 If the emittance is read out directly, use the offset trimmer control on the emissometer to adjust the readout to be equal to the emittance of the low-emittance standard.

7.2.4 Place the emissometer measuring head over the high-emittance standard again, and repeat the procedure in 7.2.1-7.2.3, until the measuring head can be moved from one

standard to the other without requiring any adjustment to obtain the expected reading.

7.3 *Specimen Collection:*

7.3.1 Since many different kinds of materials can be tested by means of this technique, different specimen collection procedures might be required, depending on the nature of the material. In general, the procedure shall ensure minimum alteration of the specimen surface. For example, if the emittance of a dust-covered specimen is desired, the dust shall not be removed.

7.3.2 All contact with the specimen surface shall be avoided. Furthermore, the specimen surface shall not be exposed to a flow of gas or liquid that is not ordinarily present as installed. If power tools are used, care shall be taken to prevent disturbance of any surface deposit layer (dust, etc.) due to vibration. Handling and time lag before emittance measurement shall be minimized.

7.3.3 The specimen shall be flat to within 0.25 mm over an area equal to that of the emissometer measuring head.

7.3.4 The specimen thermal conductance (that is, thermal conductivity divided by specimen thickness) shall be greater than 1100 $W/m^2 \cdot K$, corresponding to a thermal resistance of less than 0.00091 $m^2 \cdot K/W$. For example, if the specimen material is glass, with a thermal conductivity of about 1.0 W/m·K, then the specimen thickness shall be less than 0.91 mm.

7.4 *Measurement of Specimen Emittance*—The procedure given in 7.4.1-7.4.4.2 shall be used to measure the emittance of the specimen of material.

7.4.1 Recheck the emissometer calibration as per 7.2.

7.4.2 Leave the high-emittance standard in place, but remove the low-emittance standard from the heat sink and replace it with the specimen. For non-hygroscopic specimens, a few drops of distilled water or other high conductance material shall be used to improve the thermal contact between the specimen and the heat sink. Do not use water with hygroscopic specimens, such as paper. Allow at least 90 s for temperatures to stabilize.

7.4.3 Place the emissometer measuring head over the high-emittance standard, and wait for the output reading to stabilize. If a standard millivoltmeter is used, record the output voltage reading.

7.4.4 Place the emissometer measuring head over the specimen, and wait for the output reading to stabilize.

7.4.4.1 If the emittance is read out directly, record the value for the specimen.

7.4.4.2 If a standard millivoltmeter is used, the emittance of the specimen shall be calculated using (Eq 3).

8. Calculations

8.1 The expected reading of low emittance standard (standard millivoltmeter) is given by:

$$V_{low} = \varepsilon_{low} \times V_{hi}/\varepsilon_{hi} \quad (2)$$

8.2 The emittance of specimen (standard millivoltmeter) is given by:

$$\varepsilon_{spec} = V_{spec} \times \varepsilon_{hi}/V_{hi} \quad (3)$$

9. Report

9.1 The report of the results of each test shall have all data reported in SI units. Report the following information:

9.1.1 Name and any other pertinent identification of the material, including a physical description.

9.1.2 Description of the specimen and its relationship to the sample, including a brief history of the specimen, if known.

9.1.3 Thickness of the specimen as received and as tested.

9.1.4 Temperature of the room in which the measurements were conducted, °C.

9.1.5 Source and assigned emittance values of the calibration standards.

9.1.6 Measured values of emittance. Two measured values shall be reported to demonstrate repeatability of the particular instrument for the particular type of surface.

9.1.7 Date of the test, and time periods involved in the test.

9.1.8 Statement of compliance or, where circumstances or requirements preclude complete compliance with the procedures of the test, agreed exceptions. A suggested wording is: "This test conformed with all requirements of ASTM C1371 with the exception of (a complete list of exceptions follows)."

9.1.9 Estimated or calculated uncertainty in reported values.

10. Precision and Bias

10.1 *Interlaboratory Test Program*—An informal interlaboratory comparison was conducted during 1988 and 1989 (**1**). Specimens of Type 304L stainless steel ($\varepsilon \sim 0.12$) and electrolytic tough pitch copper ($\varepsilon \sim 0.04$) were specially prepared.

10.1.1 Test determinations were made on one specimen of each material at one laboratory on 23 different days spanning a time period of about one year. On each day, two test determinations were made by a single operator on each specimen, for a total of 46 test results per material. Another specimen of each material was prepared. A single operator at the same laboratory made two test determinations on each specimen on one day. A single operator at another laboratory made two test determinations on each specimen on one day and four test determinations on each specimen three days later. Yet another specimen of each material was prepared. A single operator at the first laboratory made two test determinations on each specimen on one day. A single operator at a third laboratory made four test determinations on each specimen on one day. These data were analyzed by the methods given in Practice E691 to determine repeatability and reproducibility limits. The fact that many of the test determinations were made over an extended period of time was ignored in this analysis.

10.1.2 Additional specimens of stainless steel and copper were prepared. Each specimen was measured at the first laboratory using an emissometer. The first laboratory also measured the total hemispherical emittance of a specimen of stainless steel using Test Method C835. Three other laboratories used absolute techniques to determine the total hemispherical emittance of each of the materials. The techniques were a calorimeter, a reflectometer, and an infrared thermometer.

10.2 *Test Result*—Each separate test determination from the three laboratories was treated as a test result, for a total of 60 test results per material.

10.3 *Precision*—The numerical values are in dimensionless emittance units. Repeatability limit and reproducibility limit are used as specified in Practice E177. The respective standard deviations among test results is obtained by dividing the above limit values by 2.8.

	Stainless Steel	Copper
95 % repeatability limit (within laboratory)	0.011 units	0.015 units
95 % reproducibility limit (between laboratories)	0.015 units	0.019 units

10.4 *Bias*—Statistical analyses were performed on the results of paired measurements by the emissometer and the absolute techniques. Separate analyses were performed for the stainless steel and copper specimens. The analyses showed no statistically significant difference (at the 5 % significance level) between the average values obtained with the emissometer and the absolute techniques. It is concluded that there is no statistically significant bias in this test method.

11. Keywords

11.1 emissometer; emittance; portable

APPENDIX

(Nonmandatory Information)

X1. HEMISPHERICAL EMITTANCE MEASUREMENTS

X1.1 Because of the application to aging of reflective insulations, there is considerable interest in employing this test method for measurements of hemispherical emittance. This appendix details the pros and cons of using the test method to quantify hemispherical emittance.

X1.1.1 This test method is different from either of two other techniques (Test Method C835 and Test Method E408) for measurement of hemispherical emittance. Instruments for measuring hemispherical emittance typically comprise an enclosed highly reflective envelope, the only absorbing/emitting surfaces being the specimen and the detector or flux source, or both. Alternatively, the specimen is heated, and the total flux through the specimen is measured. The manufacturer of the one instrument known to conform to this test method intended for their instrument to measure the total hemispherical emittance, but because of the directional properties of many real surfaces (especially metals), the property that is measured is somewhere between the hemispherical and normal emittance values (3).

X1.1.2 Note that the detector plane is parallel to the plane of the specimen in Fig. X1.1. For the instrument of this test method, the source of emitted thermal energy is the exposed surface of the detector itself, and the heat flow is from the detector surface to the specimen surface. Since the absolute temperature of the detector is known and the heat flow is measured—and since the instrument is calibrated against standards of known emittance, at the same temperature as a test specimen—the emittance of the test specimen can be solved from:

$$V = k \times \sigma \left(\frac{(T_s^4 - T_d^4)}{(1/\varepsilon_s + 1/\varepsilon_d - 1)} \right) \qquad \text{(X1.1)}$$

where k is a proportionality constant.

X1.1.3 The arrangement of the detector is such that its voltage response is a function of its own diffuse radiation of heat energy (4), and that the emitted radiation is attenuated by the energy reflected from the specimen surface over a detector exposure angle of about 168–169° (± about 84° from normal). This is illustrated in Fig. X1.1.

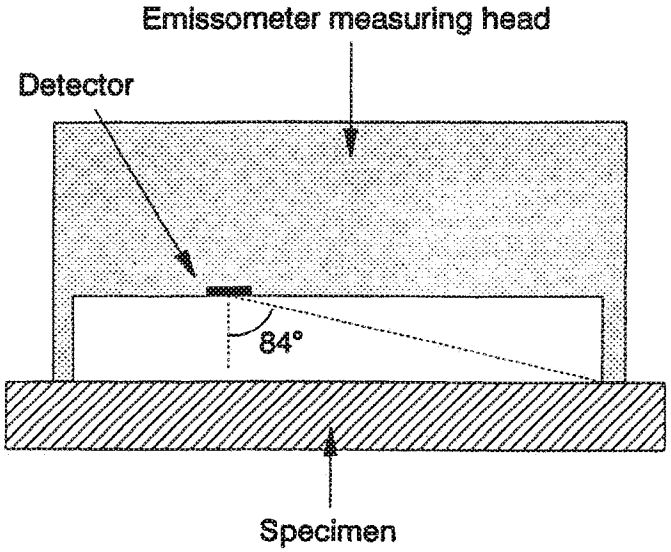
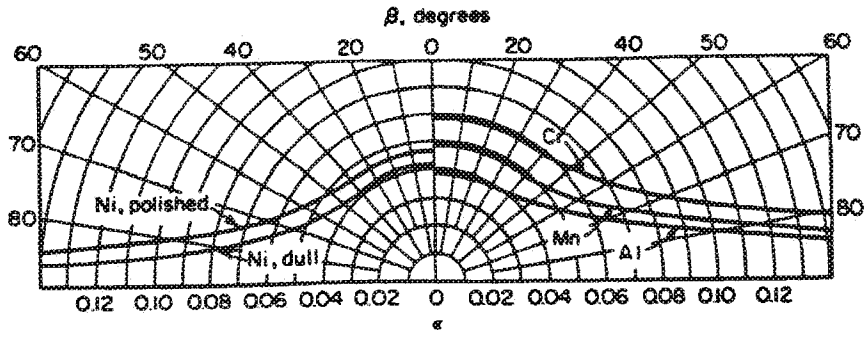


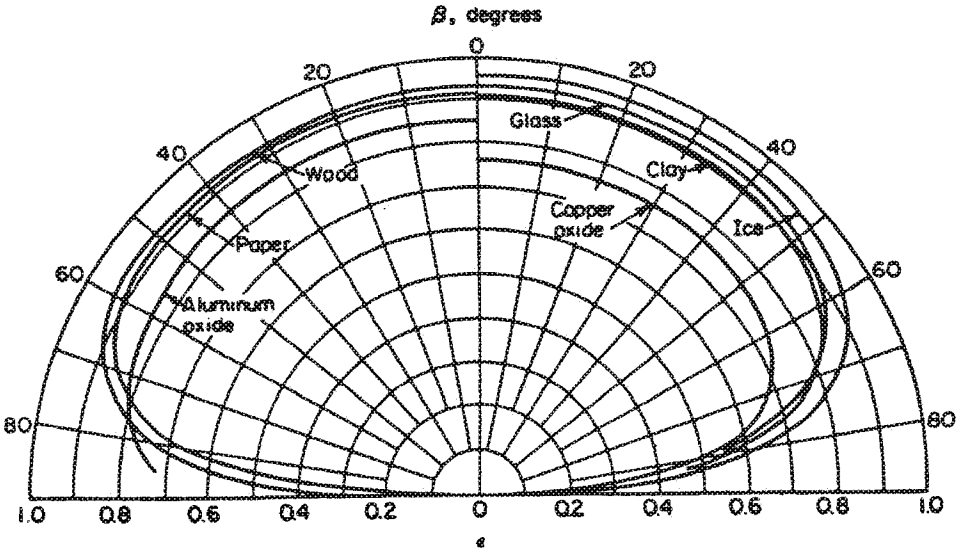
FIG. X1.1 Cross-section of Emissometer Measuring Head, Showing Plane Angle Subtended by Detector Element

X1.1.4 Fig. X1.2(a) shows the directional emittance of some smooth metal surfaces, while Fig. X1.2(b) shows a similar plot for some dielectric materials (5). Note that for aluminum, the emittance is about 0.04 for angles of 0 to about 38° from normal. For angles greater than 38° from normal, the emittance increases, reaching about 0.14 at an angle of about 83° from normal. The average of the integral of this curve (the hemispherical emittance) appears to be about 0.057—a difference of almost 42 % from the normal emittance. This high degree of sensitivity to direction signifies the existence of a large specular component to the reflectance of such a surface (there will be some diffuse emittance/reflectance, as well).

X1.1.5 For aluminum oxide, the directional emittance is about 0.82 at the normal angle, rises to a peak of probably about 0.83 at 45° from normal, and then declines to around 0.74 at an angle of around 85° from normal. The hemispherical



(a)



(b)

NOTE 1—(a) Electrical conductors, (b) electrical nonconductors (6).

FIG. X1.2 Directional Emittance of Selected Materials

emittance would appear to be around 0.813—a difference from the normal emittance of only 2 %. This nearly constant distribution is a good example of a material which is mainly diffuse (that is, it obeys Lambert's cosine law).

X1.1.6 Since the detector/heat source plane is all heated and parallel to the specimen plane (and since the specimen temperature is uniform) the radiation emitted by the detector will primarily be normal to the specimen. Because the detector surface coating is highly diffuse, however, some of the radiation leaving the detector area will reach the unheated wall of the emissometer measuring head. Because the inner surface of this wall is also dull and diffuse, most of this direct irradiation from the detector will be absorbed by the wall, effecting a bias error. The calibration process will tend to eliminate this error, as this bias will be the same for both the calibration standards and the test specimens.

X1.1.7 The next step is to consider what happens to the radiant energy that strikes the specimen surface. The general radiant energy balance equation illustrates that for any test surface of emittance less than 1.0, a fraction of the energy radiated from the detector will be reflected from the specimen surface.

$$\alpha + \rho + \tau = 1 \qquad \text{(X1.2)}$$

where:

α = absorptance,
ρ = reflectance, and
τ = transmittance.

For simplification, by considering only those materials which are opaque to infrared radiation ($\tau = 0$), the energy balance reduces to:

$$\alpha + \rho = 1 \quad \text{(X1.3)}$$

so that only the energy absorbed by the specimen and the energy reflected by the specimen need to be considered for a full accounting of the energy emitted by the detector. Furthermore, Kirchoff's Radiation Law states that, at thermal equilibrium:

$$\alpha_\lambda = \varepsilon_\lambda \quad \text{(X1.4)}$$

so that the fraction of the radiant energy absorbed by the specimen (compared to the energy that could be absorbed by a blackbody at the same temperature) is equal to the emittance of the specimen at these conditions.

X1.1.8 The detector cannot differentiate the amount of energy absorbed by the specimen from the total energy emitted by the detector. In fact, it is the total energy emitted by the detector that is evaluated to determine the emittance (absorptance) of the specimen. Basically, this works because the reflected energy from the specimen returns to the detector and is reabsorbed, so that the total detector radiated energy is reduced to the value necessary to calculate the correct specimen emittance. It can be easily seen that if some mechanism causes part of the reflected energy not to be returned to the detector, an error would result. A study of the radiant heat transfers in the instrument would reveal what conditions (if any) might cause such an error.

X1.1.9 Assuming a detector temperature of 355.4 K (180°F) and a specimen temperature of 295.4 K (72°F), (Eq 1) indicates:

$$q_{rad} = 5.6696 \times 10^{-8} \times (355.4^4 - 295.4^4) = 472.8\ W/m^2 \quad \text{(X1.5)}$$

for blackbody exchange between the two surfaces. If the specimen emittance is actually 0.90, only 90 % of this energy will actually be absorbed; the remainder will be reflected from the specimen. Therefore, $0.90 \times 472.8 = 425.5\ W/m^2$ (6) will be absorbed, and $472.8 - 425.5 = 47.3\ W/m^2$ (7) will be reflected. If the specimen is perfectly specular, all this energy will be reflected back into the detector, effecting a 10 % reduction in the total heat flow through the thermopile (90° incident radiation will be reflected at 90°).

X1.1.10 On the other hand, if the specimen is more a diffuse emitter/reflector, some of the energy which is reflected from that part of the specimen surface directly beneath the detector will be reflected away from the detector. At first, this might seem to present a potential source of error. However, the diameter of the specimen is much larger than the diameter of the detector, and the detector is imbedded flush in the center of a plane which is also heated, and which has the same emittance as the detector itself. This arrangement serves somewhat as a "guard" for the detector, such that reflected energy lost due to the diffuseness of the specimen surface immediately beneath the detector is compensated for by the diffuse component of reflected energy from the outer portion of the specimen surface (the source of this energy being the heated guard area around the detector).

X1.1.11 For the case where the instrument is calibrated using specular standards (those normally supplied) but where the specimen is diffuse, because energy reflected from the standards will mainly be reflected back directly onto the detector plane, there will be little bias error intrinsic to the calibration. If the instrument is calibrated to the normal emittance of the standards, very little measurement error will occur for normal emittance measurements on the test specimen, since any energy loss due to diffuse reflection from the surface immediately under the detector will be compensated for by the energy reflected diffusely from the annular area immediately surrounding. On the other hand, if the instrument is calibrated to the hemispherical emittance value of the specular standards, it still measures only a portion of the energy which relates more to hemispherical emittance from the detector, attenuated by reflectance from the specimen over a 169° exposure. If there is significant reflectance or emittance from the standards in the region 85–90° from normal (from Fig. X1.2(a)), we see that this apparently occurs with some shiny metals), then calibration to the known hemispherical emittance values of the standards will be accomplished by correcting the instrument to account for lost hemispherical energy. If the instrument is then used to measure the emittance of a diffuse specimen, the reflected energy actually returning to the detector will be somewhat higher than expected, and the output of the instrument will contain a low bias error. This error might occur on aged aluminum reflective insulations or jacketing or on diffuse reflective paints and coatings, wherein the existing hemispherical emittance might be measured as a value below the true hemispherical emittance.

X1.1.12 An even greater error might occur with either specular or diffuse standards if the specimen is directionally specular, that is, if the sample emits or reflects non-diffusely, or both, but at some angle far from normal to the surface as is exhibited by some machined surfaces. This has been confirmed by the results of one test conducted on a stainless steel disk that was grooved and polished on one side and smooth but not highly polished on the other side. The smooth, not highly polished side of the disk was resolved at about $\varepsilon = 0.16$ by three laboratories, while the grooved-and-polished side read about $\varepsilon = 0.46$. The detector could only "see" the grooved side as a higher emittance because the detector received a lower reflected energy from the grooved side of the specimen—the specimen reflected the detector's emitted energy away, toward the walls. A true hemispherical device would have recaptured this energy and redirected it to the detector to correctly attenuate the heat flow and the detector output voltage (this effect can be seen mathematically in (Eq 1)). The correct hemispherical emittance would then have been resolved at approximately $1.23 \times 0.16 = 0.20$ (1) (maximum, since the smooth back surface was not polished). (Note that the 0.46 value was probably close to the correct normal emittance for this specimen.)

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Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	RECYCLABLE PAPER CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Angelo Yializis
Filer:	Yakov S. Sidorin/Leslie Lowery
Attorney Docket Number:	861133.00056

Filed as Small Entity

Filing Fees for Provisional

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PROVISIONAL APPLICATION FILING FEE	2005	1	130	130
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**130**

Electronic Acknowledgement Receipt

EFS ID:	31431328
Application Number:	62614568
International Application Number:	
Confirmation Number:	1532
Title of Invention:	RECYCLABLE PAPER CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Angelo Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00056
Receipt Date:	08-JAN-2018
Filing Date:	
Time Stamp:	12:35:15
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$130
RAM confirmation Number	010818INTEFSW00013239170055
Deposit Account	170055
Authorized User	Leslie Lowery

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	861133_00056_ADS.pdf	1822630 d55828fbbc07816c114d533fe6e8a812eb52395f	no	8
Warnings:					
Information:					
2	Specification	861133_00056_Specification.pdf	15959535 8109e27ca5764edb3386d8e7dbc35778b9befe7f	no	38
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30053 1355f9eae67f3b2dd50d645e87aea886f58dcabd	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	17812218		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
62/614,568	01/08/2018		130	861133.00056		

CONFIRMATION NO. 1532

FILING RECEIPT

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

OC000000098786888

Date Mailed: 01/19/2018

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Inventor(s)

Angelo Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Applicant(s)

Angelo Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Power of Attorney:
Yakov Sidorin--63507

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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If Required, Foreign Filing License Granted: 01/18/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 62/614,568**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****

Title

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Doc Code: R48.REQ
Document Description: Request under Rule 48 correcting inventorship

PTO/AIA/40 (04-18)
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REQUEST FOR CORRECTION IN A PATENT APPLICATION RELATING TO INVENTORSHIP OR AN INVENTOR NAME, OR ORDER OF NAMES, OTHER THAN IN A REISSUE APPLICATION (37 CFR 1.48)

Application Number	62/614,568
Filing Date	January 8, 2018
First Named Inventor	Steven Yializis
Art Unit	
Examiner Name	
Practitioner Docket Number	861133.00056

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Applicant hereby **requests that the inventorship be corrected or changed, or that the name of the inventor or a joint inventor, or the order of the names of joint inventors, be changed,** in the above-identified application. **Note**: 37 CFR 1.48 applies to any request to correct inventorship filed on or after September 16, 2012, regardless of the application filing date. **Do not submit this form after payment of the issue fee or if the application has been patented.** See 37 CFR 1.324 for correction of inventorship in a patent.

Please check the applicable box(es) below.

For a nonprovisional application:

☐ 1. This request is to correct or change the inventorship in a **nonprovisional** application (**under 37 CFR 1.48(a)**) and includes:

☐ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) with the corrected or updated information shown with markings (*e.g.*, underlining for insertions, strikethrough for deletions). See the Manual of Patent Examining Procedure (MPEP) section 601.05(a) for information about filing an ADS in an application filed on/after September 16, 2012. For information about filing a Supplemental ADS in an application filed before September 16, 2012, see MPEP 601.05(b).

☐ The processing fee set forth in 37 CFR 1.17(i). $ _____

☐ An inventor is being added. An inventor's oath or declaration by any actual inventor who has not yet executed an oath or declaration is required (see 37 CFR 1.48(b)). See MPEP 602.01(a) for information about an inventor's oath or declaration for an application filed on/after September 16, 2012 (*e.g.*, form **PTO/AIA/01**). For information about an inventor's oath or declaration for an application filed before September 16, 2012 (*e.g.*, form **PTO/SB/01**), see MPEP 602.01(b).

☐ This request is being filed after the first Office action on the merits has been given or mailed (see 37 CFR 1.48(c) and 1.17(d)). Check one of the following:

☐ This request to correct or change the inventorship is due solely to the cancellation of claims in the application.

OR

☐ The fee set forth in 37 CFR 1.17(d) is due (in addition to the fee set forth in 37 CFR 1.17(i)). $ _____

This collection of information is required by 37 CFR 1.48. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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REQUEST FOR CORRECTION IN A PATENT APPLICATION RELATING TO INVENTORSHIP OR AN INVENTOR NAME, OR ORDER OF NAMES, OTHER THAN IN A REISSUE APPLICATION (37 CFR 1.48)

☐ 2. This request is to correct or update the name of the inventor or a joint inventor, or the order of names of joint inventors, in a **nonprovisional** application (**under 37 CFR 1.48(f)**) and includes:

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For a provisional application:

☒ This request is to change or correct the inventorship, or correct or update the name of the inventor or a joint inventor, in a **provisional** application (**under 37 CFR 1.48(d)**) and includes:

☒ **Attached hereto** is a document that is signed by a party set forth in 37 CFR 1.33(b) and identifies each inventor by his or her legal name, in the preferred order. Note: the document may be an application data sheet in accordance with 37 CFR 1.76(c) that identifies the changes with markings (underlining for insertions, strikethrough for deletions).

☒ The processing fee set forth in 37 CFR 1.17(q). $ 70.00

Fee Payment Information:

☒ Applicant asserts small entity status. See 37 CFR 1.27.

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Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously

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I am the

☐ Applicant* ☒ attorney or agent of record Registration number 63507 ☐ attorney or agent acting under 37 CFR 1.34 Registration number _____

Signature /Yakov S. Sidorin/

Typed or printed name Yakov S. Sidorin

Date January 3, 2019

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. *Juristic entities must be represented by a patent practitioner (See 37 CFR 1.31, applicable to any paper filed on or after September 16, 2012 that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below**.

☒ ** Total of one forms are submitted.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	62/614,568

Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

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Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	~~Angelo~~ Steven		Yializis	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

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Mailing Address of Inventor:

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Inventor 2 Remove

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Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

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Postal Code	85737	Country i	US

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Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	34282		
Email Address	pat-dept@quarles.com	Add Email	Remove Email
Email Address	yakov.sidorin@quarles.com	Add Email	Remove Email

Application Information:

Title of the Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION		
Attorney Docket Number	861133.00056	**Small Entity Status Claimed**	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	34282		

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◯ Assignee ◯ Legal Representative under 35 U.S.C. 117 ◯ Joint Inventor

◯ Person to whom the inventor is obligated to assign. ◯ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Applicant:

Address 1			
Address 2			
City		**State/Province**	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2018. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Yakov S. Sidorin/			Date (YYYY-MM-DD)	January 3, 2018 ~~2018-01-08~~
First Name	Yakov	Last Name	Sidorin	Registration Number	63507

Additional Signature may be generated within this form by selecting the Add button.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	861133.00056
	Application Number	
Title of Invention	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	62614568
Filing Date:	08-Jan-2018
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Angelo Yializis
Filer:	Yakov S. Sidorin/Leslie Lowery
Attorney Docket Number:	861133.00056

Filed as Small Entity

Filing Fees for Provisional

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
PROCESSING FEE FOR PROVIS. APPLICATIONS	2807	1	50	50
		Total in USD ($)		**50**

Electronic Acknowledgement Receipt

EFS ID:	34749636
Application Number:	62614568
International Application Number:	
Confirmation Number:	1532
Title of Invention:	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
First Named Inventor/Applicant Name:	Angelo Yializis
Customer Number:	34282
Filer:	Yakov S. Sidorin/Leslie Lowery
Filer Authorized By:	Yakov S. Sidorin
Attorney Docket Number:	861133.00056
Receipt Date:	03-JAN-2019
Filing Date:	08-JAN-2018
Time Stamp:	13:36:58
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$50
RAM confirmation Number	010319INTEFSW00012842170055
Deposit Account	170055
Authorized User	Leslie Lowery

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	861133_00056_Transmittal_Letter.pdf	75065 22ec5fd35895aea2de5e5e4077f8ee9555184770	no	1
Warnings:					
Information:					
2	Request under Rule 48 correcting inventorship	861133_00056_Request_Correct_Inventor_Name.pdf	208848 876a0f17898150c5df59ed7f72e68e5926d66280	no	3
Warnings:					
Information:					
3	Application Data Sheet	861133_00056_Updated_ADS.pdf	227191 bd0af4c76e43ee56973dd400efb3d96120321327	no	8
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
4	Fee Worksheet (SB06)	fee-info.pdf	30382 59920661738acff9349bbb527bb1f10c7420e4be	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	541486		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Yializis et al.
Appln. No.	62/614,568
Filing Date:	January 8, 2018
Title :	RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION
Conf. No.:	1532
Attorney Docket:	861133.00056

TRANSMITTAL LETTER ACCOMPANYING REQUEST TO CORRECTED INVENTOR NAME

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant submits herewith an updated ADS, and Request for Correction of Inventor Name Under 37 CFR 1.48, and respectfully requests issuance of a Corrected Filing Receipt, and correction of the records of PAIR.

The applicant submits herewith the required processing fee in the sum of $70.00. In the event an additional fee is deemed due, please charge the fee to Deposit Account No. 17-0055.

Respectfully submitted,

Date: January 3, 2019

/Yakov S. Sidorin/
Yakov S. Sidorin, Reg. No. 63,507
Attorney for Applicant
QUARLES & BRADY LLP
One South Church Avenue, Suite 1700
Tucson, Arizona 85701
United States of America
Tel.: 520-770-8700
Fax: 520-623-2418

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
62/614,568	01/08/2018	Steven Yializis	861133.00056

CONFIRMATION NO. 1532

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

37 CFR 1.48(d)
ACKNOWLEDGEMENT LETTER

OC000000104899645

Date Mailed: 01/07/2019

NOTICE OF ACCEPTANCE OF REQUEST UNDER 37 CFR 1.48(d)

This is in response to the applicant's request under 37 CFR 1.48(d) submitted on 01/03/2019.

">The request under 37 CFR 1.48(d) to correct the inventorship, to correct or update the name of an inventor, or to correct the order of names of joint inventors is accepted.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/laguirre/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
62/614,568	01/08/2018		130	861133.00056		

CONFIRMATION NO. 1532
UPDATED FILING RECEIPT

34282
QUARLES & BRADY LLP (TUC)
Attn: IP Docket
ONE SOUTH CHURCH AVENUE, SUITE 1700
TUCSON, AZ 85701-1621

OC000000104899642

Date Mailed: 01/07/2019

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)
Steven Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Applicant(s)
Steven Yializis, Tucson, AZ;
Luke Rogers, Tucson, AZ;

Power of Attorney:
Yakov Sidorin--63507

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

RECYCLABLE PAPER-CONTAINING PACKAGING WITH RADIANT BARRIER INSULATION

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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EXHIBIT D

Paper No. 10
Filed: October 2, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PROAMPAC HOLDINGS INC.,

Petitioner

v.

SIGMA TECHNOLOGIES INTERNATIONAL, LLC,

Patent Owner

Case IPR2025-01143
U.S. Patent No. 11,072,148

PATENT OWNER'S PRELIMINARY RESPONSE

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PATENT OWNER'S EXHIBIT LIST

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2001	ProAmpac's *First Amended Answer and Counterclaims* from Parallel Litigation
2002	Declaration of Steven Yializis
2003	Docket Entries from Parallel Litigation (As Of Aug. 27, 2025)
2004	Oral Order Entered 08/14/25 in Parallel Litigation Denying (Without Prejudice) ProAmpac's Motion to Stay Pending IPR
2005	Parallel Litigation *Scheduling Order* entered 03/14/25
2006	Parallel Litigation *Joint Stipulation and [Proposed] Order Substituting Parties and Changing Case Caption* (filed 06/25/25)
2007	*Defendant/Counterclaim Plaintiff ProAmpac Holdings Inc.'s Initial Invalidity Contentions* (served 08/27/25)
2008	Dennis Crouch, *Estoppel Gutted: A Pelican's Guide to Patent Litigation*, PatentlyO.com (May 7, 2025).
2009	Andrew Zappia, Bryan Smith, and Nicolas Gallo, *How IPR Estoppel Ruling May Clash with PTAB Landscape*, Law360.com (Jun. 17, 2025).
2010	Scott R. Boalick, Chief Administrative Patent Judge, *Guidance on USPTO's Recission of 'Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation,"* (Mar. 24, 2025), https://www.uspto.gov/sites/default/files/documents/guidance_memo_on_interim_procedure_recission_20250324.pdf
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2017	*Samsung Elecs. Co. v. GhengisComm Holdings*, LLC, IPR2025-00788, Paper 11 (P.T.A.B. Aug. 25, 2025).
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2019	Coke Morgan Stewart, USPTO Acting Director, *Enforcement and Non-Waiver of 37 C.F.R. § 42.104(b)(4) and Permissible Uses of General Knowledge in Inter Partes Reviews* (Jul. 31, 2025), https://www.uspto.gov/sites/default/files/documents/aapa_memo_final__signed.pdf?utm_campaign=subscriptioncenter&utm_content=&utm_medium=email&utm_name=&utm_source=govdelivery&utm_term= .
2020	Declaration of Ruoxi Ma, Ph.D.
2021	Curriculum vitae of Dr. Ruoxi (Rachel) Ma
2022	"*Biopolymer Films from Glucomannan: The effects of Citric Acid Crosslinking on Barrier Properties*," in Journal of Print and Media Research Technology, Research 7(2018)1, 19-25.
2023	"*Screen Printed Moisture Sensor and Its Application on Smart Packaging*," in The Technical Association of Graphic Arts Proceedings 2021, pgs. 191-203 (focusing on material-layer substrates and substrates/coating surface interactions)

Exhibit No.	DESCRIPTION
2024	*Method for Formulating Silver-Doped Lanthanum Titanate Photochromic Ink* (CN103804986A), issued May 21, 2014.
2025	Friel, John M., and Edwin Nungesser. *"Acrylic Polymers as Coatings Binders."* Paint and Coating Testing Manual - Fifteenth Edition of the Gardner-Sward Handbook: (MNL 17-2nd), edited by JV Koleske, no. MNL17, ASTM International, 2012, pp. 49–64**,** *https://doi.org/10.1520/MNL12186M.*
2026	Gündüz, Güngör. *Chemistry Materials and Properties of Surface Coatings: Traditional and Evolving Technologies.* DEStech Publications, 2015
2027	*Pigment Coating and Surface Sizing of Paper.* Vol. bk. 11., Fapet Oy, 2000**.** Chapter 6: Binders, section Coating binders, @ page 191. This reference covers binders, including latex and acrylic, their functions, properties, and implications for coating formation.
2028	*Recycled Fiber and Deinking.* Vol. bk. 7, Fapet Oy, 2000. Chapter 11, page 441-504.

I. INTRODUCTION

The Petition fails to establish a reasonable likelihood that any challenged claim of U.S. Patent No. 11,072,148 (EX1001, the "'148 Patent") is unpatentable under 35 U.S.C. § 314(a). Rather than pointing to express disclosures in the cited references, Petitioner relies on conclusory expert assertions and hindsight-driven reconstructions to fill gaps the prior art does not supply.

At its core, the '148 Patent, through its independent claims in the aggregate, requires a low emissivity, paper-containing packaging material incorporating an aluminized polymeric film that (i) is recyclable, (ii) in certain claims, achieves an optical density ("OD") of < 0.09 during a specific repulping "treatment" (i.e., the repulping test set forth in the claims), and (iii) in all cases oxidizes fully in the resulting pulp during the claimed repulping treatment. These same three elements—recyclability, the treatment, and OD <0.09/no visible aluminum—are precisely the limitations missing from Petitioner's cited art and constitute holes in every ground. None of ProAmpac's references—alone or in combination—teach these claim-critical requirements. Nor does Petitioner articulate any reasoned motivation with a rational underpinning to combine them.

Reference-by-reference the gaps are the same. Gundlach neither discloses the claimed treatment nor the required recyclability outcomes (including OD < 0.09 / no visible aluminum in the resulting pulp) indeed, Gundlach's use of heavy weight

polymers is inconsistent with recyclability. Yializis focuses on protecting thin aluminum films from oxidation (as opposed to the '148 patent's claimed controlled oxidation during repulping) and is silent on repulpability. Rebouillat concerns breathable Tyvek® cargo covers/bubble mailers—not repulpable, recyclable paper packaging—and contains no Voluntary Standard treatment or OD < 0.09 result. The Fibre Box Association Voluntary Standard is applicant admitted prior art ("AAPA") and is (at most) a testing protocol; it does not disclose structures that meet the claims and, when invoked as applicant-admitted background, cannot serve as the basis of a ground.

As detailed below, each Ground fails for the same fundamental reasons. Ground 1 (Gundlach) fails because Gundlach lacks recyclability, lacks the claimed treatment, and lacks OD < 0.09. Ground 2 (Gundlach + Yializis) fails because Yializis teaches away from the required oxidation and supplies no recyclability, treatment, or OD < 0.09. Ground 3 (Gundlach + Rebouillat) fails because Rebouillat is non-analogous transport/cargo art, discloses no recyclability/treatment/OD < 0.09, and otherwise does not fill Gundlach's gaps.t. Ground 4 (Gundlach + Voluntary Standard) fails because the Voluntary Standard cannot be used as the basis for a ground under § 311(b) since it is AAPA and in any event is only a protocol that cannot cure Gundlach's missing structural limitations. Grounds 5 and 6 (multi-reference stacks) fail because adding Yializis/Rebouillat and the Voluntary Standard

still leaves the same missing elements and rests on hindsight, not an articulated rationale with a rational underpinning. There also is no reasoned motivation to combine the references asserted in Ground 2 – 6.

Petitioner's case thus reduces to an expert-driven attempt to bridge missing disclosures with generalized *ipse dixit* statements. That is not enough. The Examiner already evaluated the closest art—including metallized films, radiant barrier packaging, and repulpability standards—and allowed the claims for precisely the reasons ProAmpac's Petition fails: There is no prior art disclosure of a low emissivity packaging combined with the other elements of the claims.

This preliminary response includes the detailed testimony of Dr. Ruoxi (Rachel) Ma (EX2020, "Declaration of Ruoxi Ma, Ph.D."), whose expertise in metalized films, polymer coatings, and recyclability protocols provides a far more credible, technically grounded analysis than Petitioner's less qualified declarant, Mr. May. Dr. Ma explains why Gundlach's base coat polymers are fundamentally incompatible with the repulping treatment and recyclability, why Yializis teaches away from the claimed oxidation goals, and why neither Rebouillat nor the Voluntary Standard supply the missing limitations. Dr. Ma's testimony, grounded in industry standards and scientific principles, underscores that Petitioner's expert relies on speculation rather than evidence.

Because the Petition rests on cumulative references, hindsight-driven

combinations, and expert speculation, it falls well short of the statutory threshold required by 35 U.S.C. § 314(a).

In addition, as set forth in the separately filed Patent Owner's Request for Discretionary Denial brief (Paper 7), institution should be denied under § 314(a) and related precedent because parallel proceedings[1] and equitable factors further weigh against institution. The discretionary factors are particularly strong here given the advanced parallel infringement action pending in the District of Delaware, where ProAmpac is the defendant and the same '148 Patent is already being litigated. Sigma has granted an exclusive license to Pratt Retail Specialties, LLC, which is enforcing the '148 Patent in that action (EX1009 ¶7). For these reasons, and for those explained in greater detail in the following sections, institution should be denied.

II. SUMMARY OF THE '148 PATENT

A. The '148 Patent

The '148 Patent discloses and claims a low emissivity recyclable packaging material that, based on a number of claimed criteria, "contains a particular aluminized polymeric film with emissivity of equal to, or less than 0.10 yet sufficiently thin to withstand and satisfy industrial requirements of the recycling process."[2] EX1001, Abstract. The low emissivity (i.e., high reflectivity) makes the

[1] *Pratt Retail Specialties, LLC v. ProAmpac Holdings Inc.*, C.A. No. 1:24-cv-1073-RGA (D. Del.).

[2] The term "emissivity" refers to the ability of heat, received by a given surface, to

material highly insulating while post-treatment low optical density leads to transparency of the aluminum, thereby rendering the pulp recyclable. EX2020 ¶39.

The innovative packaging material is illustrated in one embodiment at Figure 6 of the '148 Patent:

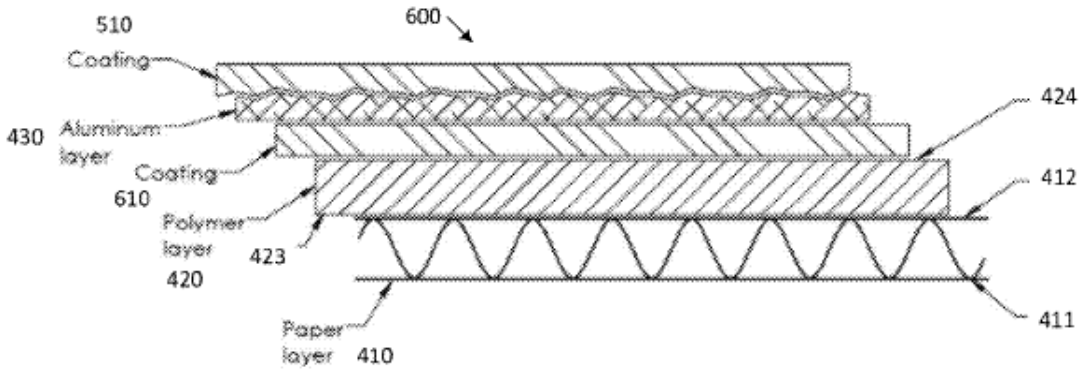


Fig. 6

At the time of the invention, paper-containing packaging with a reflective insulation or radiant barrier insulation was regularly used to facilitate thermal insulation of temperature sensitive food and pharmaceutical goods. EX1001, 1:15-22. Insulation properties were derived from two groups of materials: traditional insulation materials (like foams and fibrous insulation); and reflective insulation (like aluminum foils or other low emissivity material). *Id*. at 3:53-67. Traditional

radiate from the surface, which is measurable according to the test method discussed in ASTM C1371. *See also* EX1001, 6:29-34.

insulation materials tend to be bulky, sometimes rigid, and significantly increase the overall weight of the packaging. *Id*. Reflective insulation materials contribute significantly less weight to the packaging, however, the method and application of the materials historically made the whole paper-containing package unrecyclable. *Id*.

The '148 Patent explains how it seeks to overcome the limitations of other paper-containing packaging by addressing the "problem(s) caused by the inability of the related art to fully recycle a low-emissivity packaging material." EX1001, 4:39-41. That is, Steven Yializis and Luke Rogers invented a way to maintain superior thermal insulation while simultaneously ensuring the packaging and materials remain fully recyclable in commercial processes.

> "[C]urrent methods and applications of low-emissivity material impairs the recyclability of the total package, which understandably causes problems in related industries. Thus, there is a need for low-emissivity packaging material that is fully recyclable."

EX1001, 3:65-4:3.

To achieve this goal, the patent teaches various claimed embodiments including various "stack" configurations—low emissivity packaging combined with the unique characteristics not found in the prior art. The "stacks" include combinations of multiple layers of paper (including corrugated fiberboard), polymer,

aluminum, and an optional protective coating. Importantly, all of the configurations maintain complete recyclability in commercial processes as determined through testing described within the patent.

To ensure complete recyclability, the patent discloses a specific repulping treatment based on the Voluntary Standard (EX1007). This treatment requires that the material used in the packaging meet the established industry standards for repulpability and recycling in a two-step performance test. EX1001, 4:64-5:11. The first step assesses repulpability or the ability of a material to be broken down and dispersed into water for use in papermaking.[3] The test requires the material to be blended and disintegrated into water which is then passed over a 0.01" screen. EX1001, 5:12-16. The portion of the material that passes through the screen (considered suitable for reuse) and the portion of the material that does not pass through the screen (considered unusable, sent to landfill) are dried and weighed separately. *Id*. at 5:16-27. If 85% or more of the total material (measured as percentage of total dry weight) is reusable, the material is classified as repulpable. *Id*. at 5:27-30.

The second step determines recyclability of the material. The reusable pulp from step one, called the accepted pulp (or accepts), is pressed into sheets using a Carver press. *Id*. at 5:31-34. The sheets are then inspected for visual defects or

[3] Smook, Gary A, Handbook for Pulp & Paper Technologists (3d ed. 2002).

"spots" using TAPPI methods. *Id*. at 5:37-53. Dirt, aluminum foil, and polymeric coatings are examples of materials that are commonly found in pulp during the recycling process which result in rejectable visual defects. *Id*. at 5:54-6:4. The '148 Patent, however, discloses a reflective insulation or radiant barrier that is both visually transparent and does not adhere to the paper material during this treatment. *Id*. at 6:4-9. The low emissivity (i.e., high reflectivity) renders the claimed material a good insulator, and the post-treatment low optical density leads to transparency of the pulp rendering the pulp recyclable. EX2020 ¶39.

Therefore, the claims of the '148 Patent render the packaging material fully recyclable in commercial processes while maintaining superior thermal insulation for the transportation of temperature-sensitive goods like food, pharmaceuticals and other perishable products.

B. The Prosecution History

The application for the '148 Patent was filed on January 1, 2019 as application no. 16/238,998 (the "'998 Application") claiming the benefit of U.S. Provisional Patent Application no. 62/614,568 filed on January 8, 2018. The '998 Application was filed with 16 claims, including five (5) independent claims. *See* EX1002, "Prosecution File History for U.S. Patent No. 11,072,148." On July 11, 2019, the '998 Application was published as U.S. Patent Application Publication No. US-2019-0210321-A1. *Id.* at 76.

During prosecution, on June 25, 2020, the Office issued a non-final office action initially rejecting all 16 claims under, *inter alia,* 35 U.S.C. § 103 as being unpatentable over various combinations of Tilton (US 2017/0272163) in view of Shimizu et al. (US 2017/0129216; "Shimizu"), Wadsworth et al. (US 2011/0020570; "Wadsworth"), and Gregory (US 4,952,278; "Gregory"). *Id.* at 77-101. On the same date as the non-final office action, the Office filed its Notice of References Cited listing nine references that were considered by the Examiner, including not only the four cited in the § 103 rejection, but also *inter alia* U.S. Patent Publication No. 2018/0022073 to Sasaki et al. ("Sasaki"). *Id.* at 102; *see also* EX1001, References Cited.

None of these references disclosed the critical elements of the '148 Patent. Tilton discloses multilayer radiant barrier laminates but uses protective polymer films that increases emissivity and adds non-repulpable weight. Tilton does not disclose recyclability under the Voluntary Standard, OD < 0.09, or maintaining emissivity ≤ 0.10 during and until repulping. Shimizu teaches metallized structures for barrier films but is focused on adhesion and barrier properties, not recyclability or controlled oxidation. Shimizu has no disclosure of emissivity ≤ 0.10 or OD < 0.09. Wadsworth deals with barrier boards with polymer coatings. Its emphasis is moisture/oxygen barriers and does not address recyclability or aluminum emissivity/OD. Gregory is directed to high-opacity paper using expanded fibers and

pigments, unrelated to emissivity, OD, or recyclability. Sasaki discloses multilayer gas-barrier laminates for food/electronics packaging, with focus on durability/adhesion. Sasaki includes no teaching of recyclability or the claimed treatment steps. In short, the closest art failed to disclose low emissivity coupled with (i) recyclability, (ii) the claimed treatment protocol, or (iii) the OD <0.09 result.

Patent Owner responded to the non-final office action on December 22, 2020 addressing all issues raised in the non-final office action. EX1002, 116-134.

It was against this backdrop that the Examiner explicitly allowed the '148 Patent, stating that the cited art failed to teach maintaining emissivity ≤0.10 coupled with (i) recyclability, (ii) the claimed treatment protocol, or (iii)the OD <0.09 result. These same three missing elements remain absent from Petitioner's references here. On March 29, 2021, the Office issued a Final Office Action allowing claims 8-16 and rejecting claims 1-7. *Id.* at 136-47. Dependent claims 4 and 5 were deemed to be allowable if rewritten in independent form, including all of the limitations of the base claim. Subsequently, Patent Owner filed its Response after Final Action on April 5, 2021. *Id.* at 157-65. In response, Patent Owner amended independent claim 1 to include limitations of the allowable claim 4, which now placed claims 1-7 in condition for allowance.

On April 28, 2021, the Office mailed its Notice of Allowance and Fee(s) Due, in which claims 1–3 and 5–16 were allowed. *Id.* at 168-74. In its Allowability Notice, the Office stated as reasons for allowance that:

- Regarding claim 1, the most relevant prior art is Tilton and Shimizu. The combination of Tilton and Shimizu do not disclose maintaining the emissivity at the claimed value.
- Regarding claims 8 and 10, the most relevant prior art is Tilton. The cited prior art fails to disclose or make obvious said aluminum layer acquiring and [sic] optical density of less than 0.09.
- Regarding claims 15 and 16, the most relevant prior art is Tilton. The cited prior art fails to disclose or make obvious the packaging having an emissivity that is equal to or smaller than a first value of 0.10. [*Id.*]

These reasons for allowance mirror the same deficiencies in Petitioner's references today: none of them disclose low emissivity packaging coupled with (i) recyclability, (ii) the claimed treatment protocol, or (iii) the OD < 0.09 result. The Examiner's reasoning remains fully applicable here.

The '148 Patent issued on July 27, 2021 with 15 claims, including five independent claims (EX1001).

III. CLAIM CONSTRUCTION

Consistent with the positions of the Patent Owner's exclusive licensee in the

related district court litigation, the Board should apply plain and ordinary meaning, informed by the specification and prosecution history, to all challenged claim terms under the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Indeed Dr. Ma acknowledges that she did not require more than a plain and ordinary meaning of the claim terms and further noted that "Mr. May too said it was not necessary to engage in claim construction" for the '148 Patent analysis. EX2020, ¶32.

For purposes of this Preliminary Response, Patent Owner acknowledges that the Petition states that "no terms need construction to resolve the controversy in this forum" (Paper 1, 10) and therefore does not adopt any meanings other than the plain and ordinary meaning of terms in view of the specification and prosecution history.[4] To the extent Petitioner advances extra-textual constructions that broaden or narrow the claims beyond what a skilled artisan would understand from the intrinsic record, those proposals should be rejected as inconsistent with *Phillips* and its progeny. See *Phillips*, 415 F.3d at 1312–14.

Accordingly, and in alignment with Patent Owner's positions in the parallel district court action, the Board should resolve this IPR under the plain-and ordinary-meaning standard.

[4] In the district court litigation, however, Petitioner has asserted that 10 claim terms require construction as well as 6 terms that Petitioner deems to be indefinite and/or lacking enablement.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Patent owner submits that a person of ordinary skill in the art ("POSITA") would have had at least a bachelor's degree in packaging, chemical engineering, materials science, or paper engineering, or an equivalent field, and at least 5 years of experience in developing or evaluating packaging materials. Relevant experience could include repulpability and recyclability of barrier films, laminates, coatings, recyclability assessments, or thermal management in packaging applications. Additional academic training (e.g., a master's degree) could compensate for less work experience, and conversely, more extensive work experience could compensate for formal education. Such a person would have been familiar with commonly used packaging materials (paper, polymers, thin films, metalized layers), as well as with standard testing methods used in the field (e.g., recyclability, repulpability, and barrier performance). EX2020, ¶31.

Patent Owner submits that this definition of POSITA is more accurate than Petitioner's POSITA, but Patent Owner is not aware of an issue raised by the Petition where the difference in the definition of POSITA impacts the outcome.

V. PRIOR ART CITED

A. Gundlach (EX1005)

Gundlach discloses "a film for use in association with packaging useable with foodstuffs having product contact." EX1005, Abstract. While Gundlach appears to

overlap superficially with the '148 Patent, its purpose and teachings are entirely different. Gundlach only identifies the problem of recyclability of thermal packaging materials in passing—acknowledging that prior art packaging was "not well suited for recycling or composting" (*Id*. at [0006]) and that it "would be advantageous" to develop packaging combining low emissivity with recyclability (*Id*. at [0007])—Gundlach, however, *never provides that solution*.

Instead, Gundlach's base coat structures employ high-molecular-weight polymers that are fundamentally *incompatible* with the repulping treatment or recyclability required by the '148 Patent and would, in fact, create "significant recycling problems, not advantages." EX2020, ¶¶48, 50, 70.

Gundlach tests performance of its packaging material by measuring the leaching of liquids—specifically, pickle juice and peanut oil. EX1005, [0052]. Using various stack configurations and layer thicknesses, performance was rated based on the amount of liquid that "leached through the different layers and began to saturate the base material." *Id*. at [0057].

Gundlach's only discussion of thermal insulation is disclosure of a metallized layer applied "directly to the outer base layer in an optical density of between 1.5 and 4.5 optical density." EX1005, [0009]. Not only does this fall far outside of the range established by the '148 Patent (0.09 or less), but the overall structure Gundlach discloses is unrecyclable. Indeed, Gundlach never mentions recyclability of its

disclosed structure, under any treatment, much less the claimed treatment, and the reference never produces the full, post-treatment oxidation outcome required by the claims.

Gundlach also is cumulative of the art already considered during prosecution; and institution of the Petition should be denied under 35 U.S.C. § 325(d) for this reason in addition to the other reasons addressed herein. The Examiner reviewed prior metallized packaging references—including Tilton, Shimizu, Wadsworth, Gregory, and Sasaki—all of which disclosed low-emissivity laminates but failed to show the claimed combination of (i) emissivity ≤ 0.10, tied together with (ii) recyclability under the claimed repulping treatment, and (iii) OD < 0.09/"no visible aluminum." (see, for example, "Reason's for Allowance", EX1002 at p.173.) Gundlach also discloses metalized packaging and low-emissivity laminates but does not supply these same missing elements. It mentions low-emissivity foil layers but does not disclose emissivity values in the claimed range, does not tie emissivity to recyclability or oxidation outcomes, and does not disclose the required treatment or OD threshold. Furthermore, Petitioner never addresses why the Examiner's detailed analysis during prosecution and subsequent reasons for allowance was erroneous. Where a petition does nothing more than re-argue substantially the same teachings without showing examiner error, the Board should deny institution.[5]

[5] *See Ecto World, LLC v. RAI Strategic Holdings, Inc.*, IPR2024-01280, Paper 13 at

B. Yializis (EX1006)

Yializis presents a study in minimizing the oxidation and corrosion of vacuum deposited aluminum. EX1006, Abstract. The stated purpose of Yializis is "to identify multi-layer, thin film, structures capable of withstanding extreme environments…designed to *protect thin films from the effects of corrosion and oxidation*." (emphasis added) *Id*. at 755.

This objective is the polar opposite of that of the '148 Patent. The '148 Patent seeks to maintain a low emissivity using a deposited aluminum layer that is achieved through such a particular application, while also ensuring the aluminum is fully oxidized in the recycling process for sufficient repulpablity. That is to say, the '148 Patent discloses and claims a structure with an aluminum layer that has low emissivity (i.e., high reflectivity) while in use, but then degrades by becoming fully oxidized during the repulping process. Yializis, by contrast, seeks to maintain emissivity by preventing aluminum oxidation through passivation layers and polymer coatings (*Id*. at 756). Its teaching is not only silent on recyclability but actively discourages the controlled oxidation required by the claims (i.e., the

6 (USPTO Dir. May 13, 2025) (precedential) ("[I]f the Examiner applied the asserted prior art or substantially the same prior art during examination, then a petitioner must demonstrate that, for example, the previously presented art teaches the limitations of the challenged claims, and that no reasonable examiner could have found otherwise."); *see also id.* at 7 ("Petitioner should identify and explain the Office's alleged error in issuing the challenged patent and why that error is material to patentability.").

aluminum layer is durable). EX2020, ¶57.

Further, Yializis contains no disclosure of recyclability or repulpability testing, no reference to the Voluntary Standard, and no OD values under repulping conditions. Its multilayer, anti-oxidation strategies are fundamentally incompatible with the repulping-driven oxidation outcomes required by the '148 Patent.

In summary, there is no indication that Yializis contemplated the use of the aluminum for fully recyclable, thermally insulated packaging at the time of its publication.

C. The Voluntary Standard Reference (EX1007)

The Voluntary Standard Reference is cited in the '148 Patent only as the industry protocol for evaluating repulpability, not as a structural disclosure. The specification states:

> "Repulping is the first stage in paper recycling. Features of the method employed for testing the repulpability of a paper-based containers are summarized in Part I of the document titled 'The Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor', published by the Fibre Box Association (available at fibre-box.org), *the disclosure of which is incorporated herein by reference for all purposes*."

(emphasis added) EX1001, 4:64-5:5.

The ’148 Patent then restates the first repulpability step of the Voluntary Standard protocol to define the claimed “treatment.” *Id*. at 5:11-6:23. But critically, the Voluntary Standard itself is only a test method. It prescribes how to measure fiber yield, stickies count, and recyclability, but does not disclose any packaging structures, aluminized films, or OD outcomes that would satisfy the claims. A protocol is not a teaching of the structures required to pass that protocol.

The Petition itself characterizes the Voluntary Standard as the admitted industry test. For example, Petitioner cites the ’148 Patent’s express incorporation of the Voluntary Standard as “evidence” that the test was known and used in the field (Petition at 6–7, *citing* EX1001, 4:64-5:11). Petitioner goes further and states: “The Voluntary Standard Reference is *admitted prior art* [.]” (emphasis added) *Id*. at 6. Petitioner has thus clearly and unmistakenly characterized the Voluntary Standard reference as applicant-admitted prior art (AAPA). Under Federal Circuit precedent, AAPA cannot serve as the “basis” of an IPR ground. *See Qualcomm Inc. v. Apple Inc.*, 134 F.4th 1355 (Fed. Cir. 2025) (confirming AAPA cannot serve as the basis of an IPR ground under § 311(b)).

Thus, the Voluntary Standard is limited in two critical respects: (1) as a testing protocol, it cannot disclose the claim elements of recyclable structures or OD <0.09/substantially transparent outcomes; and (2) when invoked as AAPA—as Petitioner has done here—it *cannot* serve as the basis for an IPR ground under §

311(b). For these reasons, the Voluntary Standard cannot cure Gundlach's missing limitations.

D. Rebouillat (EX1008)

Rebouillat describes "a breathable product for protecting articles in mass transportation and cold chain applications." EX1008, [0002]. More specifically, Rebouillat addresses the buildup of humidity and condensation resulting in a "greenhouse effect" inside packages containing temperature-sensitive goods that are exposed to surface temperature changes. *Id*. at [0005]. Rebouillat focuses on testing the water vapor transmission rate of packaging that contains distinctly different layers for a purpose entirely different than that of the '148 Patent.

Rebouillat's configurations include such variations as: a "reflective sheet…made of a Tyvek®" (*Id*. at [0032]); "a low emissivity fire retardant cover" (*Id*. at [0033, 0034, 0035]); "honeycomb or similar non-woven structure…and a protective lacquer" for improved structural strength (*Id*. at [0037]); and "an active cooling layer (ACL)…a sealed enclosure containing a wicking sorbent imbibed with a liquid coolant in which the phase changes take place (liquid-vapor, vapor-liquid) (*Id*. at [0038]). All of these layers in the stack would necessarily negatively impact the recyclability of the packaging as a whole though no consideration is given to it in the totality of Rebouillat—because it is not an objective of the material or a problem it seeks to solve.

While Rebouillat does seek to capture a low emissivity in its material configuration, its optimal range of emissivity is far outside and above that of the '148 Patent:

> "A further aim of the present invention is to improve the thermal insulation properties of a cover or sheet through a combination of layers preferably having on its inner surface a layer having a low emissivity of less than 0.35, preferably less than 0.25, and more preferably less than 0.15 so as to reduce radiant heat transfer from the sheet to the protected product or cargo."

EX1008, [0043].

VI. Improper Ipse Dixit/"Common Sense by Another Name"

Petitioner's declarant, Mr. May, never uses the phrase "common sense," but repeatedly couches missing claim elements in statements that are nothing more than attorney argument dressed up as expert opinion. The law is clear: conclusory statements by an expert—without factual support in a patent or printed publication—cannot fill missing limitations. See *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380–81 (Fed. Cir. 2016) (rejecting reliance on conclusory expert assertions); *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016) (warning against invoking "common sense" to supply missing claim limitations); 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data … is entitled

to little or no weight.").

Mr. May does precisely what precedent forbids. For example:

- ¶90: asserts that it was "common at the time of the invention to measure emissivity" using ASTM C1371, but provides no evidence that Gundlach or any other prior art reference actually measured emissivity at all.
- ¶105: claims it was a "common consideration" to make coatings "as thin as possible" (<1 micron) but cites no prior art teaching or data supporting this alleged practice.
- ¶¶156-157: declares that a POSITA "would have been familiar" with Yializis techniques and "standard, predictable stacks" without pointing to any structural disclosure in Gundlach or Yializis that meets *inter alia* the claim's recyclability and OD <0.09 requirements.
- ¶¶185-186: repeats the mantra that the claimed laminates were "standard, predictable" and "well-known" but never ties this to any actual teaching of recyclability, oxidation, or OD thresholds—much less in any of the cited references.
- ¶¶205-206: concludes that a POSITA would have "embraced" recyclable packaging and "readily turned to the Voluntary Standard" because it was "widely considered the gold standard"—again without a printed publication that supplies the missing structural limitations.

EX1003.

These are precisely the kinds of conclusory expert assertions that the PTAB and Federal Circuit have cautioned against: they substitute unsupported opinion for evidence. Petitioner fails to carry its burden of proof under 35 U.S.C. § 316(e), and improperly attempts to base a ground on expert *ipse dixit* rather than patents or printed publications as required by § 311(b).

VII. Ground 1 Fails: Gundlach does not disclose each and every element of Claims 1-2, 4, 6-11, and 13-15.

In Ground 1, Petitioner asserts that claims 1-2, 4, 6-11, and 13-15 are anticipated by Gundlach. To anticipate a claim, a prior art reference must disclose *every limitation* of the claimed invention, either expressly or inherently. *Rapoport v. Dement*, 254 F.3d 1053, 1057 (Fed. Cir. 2001). The question of anticipation is not whether a prior art reference suggests the claimed subject matter, but whether one skilled in the art would reasonably understand or infer from a prior art reference that every claim element is disclosed in that reference. *AstraZeneca LP v. Apotex, Inc.*, 633 F.3d 1042, 1055 (Fed. Cir. 2010). Where even one limitation is missing, anticipation fails. And here Petitioner's anticipation theory fails at the outset because Gundlach (EX1005) does not disclose *several* claim-critical limitations of the '148 Patent.

Petitioner attempts to salvage Gundlach by relying on their expert's *ipse dixit*

that the missing elements are inherently present. Inherency, however, requires *necessity*, not mere possibility. "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is *necessarily present* in the thing described *in the reference*, and that it would be so recognized by persons of ordinary skill." *Cont'l Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991)(emphasis added). Inherency therefore requires that the limitation be necessarily present in the prior art reference itself, not supplied by another reference or introduced by hindsight.

Ground 1 fails this standard. Gundlach does not disclose, either expressly or inherently: a low emissivity packaging coupled with (i) the requirement that the packaging or material be recyclable; (ii) repulping under the required "treatment"; or (iii) the optical density ("OD") requirement of less than 0.09 after repulping. Each gap is fatal to anticipation.

A. Gundlach Does Not Disclose Repulpability or Recyclability

Each independent claim of the '148 Patent (claims 1, 7, 9, 14, and 15) expressly recites "recyclable packaging" and requires packaging that is *recyclable*, including full oxidation of the aluminum layer in the accepts during repulping (see, e.g., EX1001, 5:12-6:9; 9:58-10:67).

By contrast, while Gundlach acknowledges—in passing—that *prior art*

packaging was "not well suited for recycling or composting" (EX1005, [0006]) Gundlach *never* provides a solution. In the Petition, ProAmpac attempts to assert anticipation by making general statements that Gundlach's "packaging material [has] characteristics that are well suited for paper recycling and commercial or industrial composting" (Petition at 18, *citing* EX1005 at [0007], [0009], [0025]-[0027], [0032]-[0036]). But Gundlach *never actually discloses a recyclable packaging*.

As Dr. Rachel Ma explains:

> "While this might suggest Gundlach intended to solve this problem, Gundlach did not. Nowhere in the rest of Gundlach is there any discussion regarding how and why the packaging of Gundlach solves this problem. Indeed, the packaging of Gundlach does not."
>
> EX2020, ¶44.

Dr. Ma further explains that Gundlach's base coat structures employ high-molecular-weight polymers that are *incompatible* with the repulping treatment or recyclability of the claims and would, in fact, create "significant recycling problems, not advantages" (EX2020, ¶¶48, 50, 70).

Gundlach does not disclose a recyclable material and therefore does not anticipate under § 102.

B. Gundlach Does Not Disclose the Claimed "Treatment"

Each independent claim of the '148 Patent (claims 1, 7, 9, 14, and 15) expressly requires packaging that is *recyclable* through a multi-step repulpability/recyclability process ("treatment"), including full oxidation of the aluminum layer in the accepts during repulping (see, e.g., EX1001, 5:12-6:9; 9:58-10:67). In fact, the independent claims all include claim elements that call for a "treatment" of specific repulping protocols that result in recyclable material: a) blending…, b) disintegrating…, c) separating…, and d) drying. Gundlach does not disclose the claimed "treatment" either expressly or inherently.

Dr. Ma confirms that Gundlach "references no standard or test regarding repulpability or recyclability." (EX2020, ¶49). In fact, the only testing that Gundlach is concerned with is the leaching of pickle juice and peanut oil into paper substrates (EX1005, [0052]-[0103]) (EX2020, ¶49). Such liquid barrier tests bear no relation to the repulping and oxidation protocols that define recyclability in the '148 Patent.

The Petition's attempt to import the Voluntary Standard into Gundlach cannot salvage anticipation, because anticipation must be found *within a single reference*. The missing "treatment" cannot be supplied by another reference. Petitioner's argument fails because recyclability and the specific claimed repulping treatment and claimed outcomes is not necessarily present in Gundlach's disclosure, especially "where Gundlach's base coat structure includes high molecular weight polymers that

are not recyclable under industry standards." (EX2020, ¶71). A POSTIA, therefore, would not read Gundlach and determine that the required recyclable packaging achieved through a multi-step repulpability/recyclability process, including full oxidation of the aluminum layer in the accepts during repulping, was necessarily present in Gundlach.

Gundlach does not disclose the required "treatment" and therefore does not anticipate under § 102.

C. Gundlach Does Not Disclose the Optical Density Requirement After Repulping Treatment

Independent claims 7 and 9 add the express requirement that the aluminum acquires OD < 0.09 under the treatment. The '148 Patent sets this threshold explicitly as the line between visible aluminum and transparent, fully oxidized aluminum. EX1001, 10:47-67. This low OD value is critical: it is a measurable proxy for full oxidation of the thin aluminum film that makes it into the pulp, thereby ensuring that no visible aluminum remains and the recycled sheets are free of flakes, specks or spots.

Gundlach never teaches this. The Petition attempts to map Gundlach's disclosure of optical density values (EX1005, [0044]-[0045]) to the claims, but those values are entirely unrelated to recyclability or the repulping protocol recited in the '148 Patent. The '148 Patent makes clear that OD < 0.09 serves as a proxy for full oxidation of the thin aluminum layer during repulping, rendering the material

visually transparent and thus recyclable. EX1001, 10:52-67. By contrast, Gundlach discloses OD values as high as 2.0–4.0, and does so only in the context of radiant barrier performance, not recyclability or repulpability. EX1005, [0044].

Dr. Ma explains that "[t]he optical density measurements disclosed in Gundlach are not taken in the context of a repulpability test and are well above the low claimed range of the '148 Patent – below 0.09 in the claims and the lowest disclosed in Gundlach is 2.0." EX2020, ¶72. Since, as discussed, above, Gundlach's use of thick, high-molecular weight polymers forecloses the possibility of accomplishing the repulping treatment or recyclability of the claims and would, in fact, create "significant recycling problems, not advantages" (EX2020, ¶¶48, 50, 70), a POSITA would recognize that the '148 Patent's requirement that the aluminum layer achieve an optical density ("OD") of less than 0.09 *after* undergoing the defined repulping treatment would be fundamentally incompatible with the structures of Gundlach.

Petitioner's inherency theory—that Gundlach necessarily produces OD < 0.09 after repulping—improperly imports the '148 Patent's disclosure into Gundlach. Inherency requires that the limitation be necessarily present in the prior art reference itself, not introduced by hindsight. Importing disclosure from the '148 Patent itself into a cited reference is classic impermissible hindsight.[6]

[6] "To draw on hindsight knowledge of the patented invention, when the prior art

Thus, even if Gundlach mentions OD values, they are fundamentally disconnected from the repulping/oxidation context required by the claims. A POSITA would not read Gundlach as disclosing, inherently or expressly, the '148 Patent's requirement that the aluminum layer achieve an optical density ("OD") of less than 0.09 *after* undergoing the defined repulping treatment.

Gundlach does not disclose this necessary requirement and therefore does not anticipate under § 102.

D. The Dependent Claims are Patentable for the Same Reasons as Their Respective Base Claims

Each dependent claim incorporates the full set of limitations from its respective base claim, and Petitioner's failure to show that the base limitations are taught or suggested is dispositive. At a minimum, claims depending, either directly or indirectly, from and including the patentable aspects of independent claim 1 (e.g., claims 2-6), claim 7 (e.g., claim 8), and claim 9 (e.g., claims 10-13) are patentable by virtue of that dependency. *Minnesota Mining and Mfg. Co. v. Chemque, Inc.*, 303 F.3d 1294, 1299 (Fed. Cir. 2002); *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). Moreover, several dependent claims add further narrowing features beyond the already-missing base limitations, which the Petition likewise does not substantively

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does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction—an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996).

map to the art.

E. Conclusion on Ground 1

Ground 1 fails. Gundlach identifies a problem in the art but discloses no solution. It does not disclose recyclable packaging, the required repulping treatment, or the OD <0.09 outcome. Anticipation fails where any single limitation is missing. Here, multiple limitations are absent.

Independent claims 1, 14 and 15 require the claimed "treatment" and "fully oxidized with no visible aluminum present. Gundlach lacks both disclosures. Independent claims 7 and 9 require the claimed "treatment" and OD <0.09. Gundlach lacks both disclosures. All of the independent claims 1, 7, 9, 14, and 15 require that the packaging be recyclable. Gundlach's base coat structure creates "significant recyclability problems" and, therefore lacks recyclability.

VIII. Ground 2 Fails: Yializis does not cure the deficiencies of Gundlach.

In Ground 2, Petitioner asserts that all claims 1–15 are obvious over Gundlach in view of Yializis. The ground fails at the threshold. Gundlach, as discussed above, does not disclose recyclable packaging, the required repulping treatment, or an OD <0.09 outcome. Yializis does not supply these missing limitations—indeed, it teaches in the opposite direction by protecting aluminum from oxidation. Petitioner fails to provide the reasoned rationale with a rational underpinning required under *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007), and *In re Kahn*, 441 F.3d

977, 988 (Fed. Cir. 2006). The combination theory is driven by hindsight rather than evidence and, even if there was a motivation to combine, Yializis does not cure the deficiencies in Gundlach.

A. Yializis Teaches Protection Against Oxidation, *Not* Oxidation for Recyclability

The '148 Patent claims depend on aluminum films that are reflective enough to perform as radiant barriers during use, but thin enough such that they *oxidize completely under the repulping treatment*, leaving "no visible aluminum present" (EX1001, 5:12-6:9; 9:58-10:67).

By contrast, Yializis is directed to the opposite goal: preventing oxidation and corrosion of thin vacuum-deposited aluminum. Yializis describes "multi-layer, thin film, structures capable of withstanding extreme environments … designed to protect thin films from oxidation and corrosion" (EX1006, p. 755, right col.). Its goal is to *preserve* low emissivity performance of metallized films by shielding aluminum from corrosion and oxidation in humid or hot conditions. It proposes plasma passivation and polymer over-coatings to prevent aluminum oxidation. EX1006, 757 *passim*.

Thus, far from supplying the claimed feature, Yializis *teaches away* from it. A reference teaches away when it "criticize[s], discredit[s], or otherwise discourage[s]" the path urged by the challenger. *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016). *See In re*

Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994) ("A reference may be said to teach away when a person of ordinary skill…would be led in a direction divergent from the path taken by the applicant.").

A POSITA reading Yializis would understand that its multilayer structures are designed to *prevent* oxidation, not achieve it. Specifically, the '148 Patent claims require that the portion of the thin aluminum layer that make it into the paper pulp oxidize fully during repulping, as measured by OD < 0.09 of the accepts and visual transparency. EX1001, 9:58-10:67. Dr. Ma explains that this is a fundamental incompatibility: the claims of the '148 Patent intentionally tailor film thickness so that the aluminum is oxidized during repulping/recycling, while Yializis designs multilayer coatings to avoid that very outcome. EX2020, ¶¶52-58.

Yializis points a POSITA away from controlled oxidation for recyclability. A POSITA would recognize these teachings as opposite in purpose and would not be motivated to look to Yializis to cure the deficiencies of Gundlach.

B. Yializis Does Not Disclose the Required Recyclability or Treatment

Like Gundlach, Yializis is silent on recyclability. It contains no reference to recyclability or any repulpability protocol, and it reports no results under such a treatment. EX1006, *passim*. As Dr. Ma explains, "The Yializis article does not address the repulpability and recyclability issues relating to low emissivity, thin aluminum layered packaging material addressed in the '148 Patent…There is no

discussion regarding recyclable fiber yield, stickies count, optical density in connection with repulping or any other recyclability matrix." EX2020, ¶¶56-57.

Petitioner cannot cure the missing recyclability or treatment steps into Gundlach by citing Yializis, because Yializis discloses none of them.

C. Yializis Does Not Disclose the Optical Density Requirement

Independent claims 7 and 9 require that, under the treatment, the aluminum acquires an OD <0.09. Yializis nowhere discloses OD values under recycling or repulping conditions. Its focus is on *maintaining barrier performance* of metallized films in extreme environments, not transparency or disappearance of aluminum after treatment. EX1006, 755-757.

Thus, even if combined with Gundlach, Yializis does not remedy Gundlach's failure to disclose the OD <0.09 outcome.

D. No Reasoned Motivation to Combine

Petitioner offers no record-supported rationale for why a POSITA would combine Gundlach's non-recyclable, thick metallized basecoat structures with Yializis' corrosion-resistant multilayers. To the contrary, such a combination is internally inconsistent: Gundlach seeks liquid-resistant radiant barrier layers, and Yializis teaches protecting thin Al films from oxidizing. The claimed invention, by contrast, requires oxidation during repulping. A POSITA would not be motivated to combine Gundlach and Yializis to arrive at the claimed repulpable, oxidize-away

recyclable packaging. Petitioner's assumption to combine lacks the "articulated reasoning with some rational underpinning" that the Federal Circuit requires. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

On the record, there is no "gap" in Gundlach that points a POSITA to Yializis's anti-oxidation strategies and invoking generalities about what was "common knowledge" to a POSITA cannot substitute for a concrete, evidence-based reason a POSITA would have re-engineered the base-coat structured stack of Gundlach to include the thin-film anti-oxidation strategies of Yializis. A skilled artisan would have no expectation of success in adapting Yializis' anti-oxidation strategies to Gundlach's food packaging stacks, much less to achieve the '148 Patent's repulpability outcomes.

As Dr. Ma notes:

> "The Yializis article does not address the repulpability and recyclability issues relating to low emissivity, thin aluminum layered packaging material addressed in the '148 Patent. Indeed, while the '148 Patent seeks full oxidization during the pulping test, the Yializis article describes a protective layer to prevent the oxidization and corrosion of the aluminum layer."

EX2020, ¶56.

As a result, the Petition's combination of Yializis to fill the gaps of Gundlach rests on conjecture rather than "articulated reasoning with some rational

underpinning," and thus runs afoul of the Federal Circuit's requirement in *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006), and *KSR*'s admonition against hindsight, *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–22 (2007).

E. Conclusion on Ground 2

Gundlach lacks the claim-critical elements of recyclability, treatment, and OD <0.09. Yializis does not cure these deficiencies and, in fact, teaches in the opposite direction—protecting aluminum films from oxidation. Petitioner's proposed combination rests on hindsight, not on a record-supported rationale with a rational underpinning. Dr. Ma confirms that, "the Gundlach/Yializis article combination still has the three gaps discussed above – no recyclability, no Voluntary Standard and no optical density measure in the context of the repulpability treatment." EX2020, ¶73. Ground 2 therefore fails.

On this record, the obviousness ground fails as to claims 1-15, and the Board should deny institution for lack of a reasonable likelihood of prevailing under § 103.

IX. Ground 3 Fails: Rebouillat does not cure the deficiencies of Gundlach.

In Ground 3, Petitioner asserts that claims 1–2 and 4–15 are obvious over Gundlach in view of Rebouillat. This ground fails for multiple reasons. First, as explained in Grounds 1 and 2, Gundlach does not disclose recyclable packaging, the required repulping treatment, or the OD <0.09 outcome. Second, Rebouillat is non-analogous art, directed to barrier films for bubble-wrap and cargo covers, not

recyclable food packaging. Third, Rebouillat, like Yializis, does not disclose or suggest the missing claim limitations, but instead teaches away from the oxidation-for-recyclability design of the '148 Patent. Finally, Petitioner fails to supply the record-supported rationale with a rational underpinning required under *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007), and *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The combination rests on hindsight rather than a reasoned rationale grounded in the record.

A. Rebouillat is Non-Analogous Art

Obviousness can only be based on references that are analogous to the field of the invention. The Federal Circuit applies a two-part test: a reference is analogous if (1) it is from the same field of endeavor, regardless of the problem addressed, or (2) if it is reasonably pertinent to the particular problem with which the inventor is involved. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004).

The field of endeavor of the '148 Patent is recyclable, food-grade packaging made of thin metallized paperboard, optimized for radiant barrier performance during use but complete oxidation and recyclability upon repulping. EX1001, 1:17-30; 5:12-6:9.

Rebouillat, by contrast, is directed to "breathable product for protective mass transportation and cold chain applications." EX1008, [0002]. Its background explains that prior art thermal covers were impermeable to gases and water vapor,

causing condensation and a greenhouse effect. EX1008, [0005]. Its solution is a multilayer, breathable reflective sheet with a Tyvek® substrate, a vapor-deposited aluminum layer, and optional protective lacquer or flame-retardant coatings. EX1008, [0032]-[0035]. Rebouillat tests these covers for thermal insulation performance, not for recyclability or repulpability.

A POSITA would not look to Rebouillat for solutions to the recyclability problem acknowledged in Gundlach. Rebouillat is therefore non-analogous art, and cannot be properly combined with Gundlach to show obviousness.

B. Rebouillat Does Not Disclose Recyclability or the Claimed "Treatment"

Even setting aside non-analogousness, Rebouillat never discloses recyclable packaging. It uses thick polymer laminates, heat-sealable films, and foil laminates designed to withstand rough handling and moisture ingress. EX1008, [0042]-[0048]. *Nothing* in Rebouillat suggests that its structures can be repulped, much less that the aluminum layer will oxidize to transparency under the claimed "treatment." Dr. Ma confirms the inability of Rebouillat to be repulped: "Tyvek® is 100% high-density polyethylene that does not repulp into fibers under the TAPPI tests." EX2020, ¶64.

Thus, Rebouillat cannot supply the claim-critical recyclability or "treatment" limitations absent from Gundlach.

C. Rebouillat Does Not Disclose the Optical Density Requirement

Independent claims 7 and 9 require that, under the treatment, the aluminum

oxide has an optical density less than 0.09. Rebouillat nowhere discusses OD values, let alone OD under repulping conditions. Its tests measure cargo temperature profiles, not transparency of aluminum in pulp. As Dr. Ma explains: "Rebouillat fails to disclose the optical density requirement of certain claims of the '148 Patent." EX2020, ¶67.

D. No Reasoned Motivation to Combine

Petitioner offers no record-supported rationale for why a POSITA would combine Gundlach's non-recyclable, thick metallized stacks with Rebouillat's breathable Tyvek-based cargo covers. The problems addressed differ: Gundlach seeks liquid-resistant radiant barrier stacks for food packaging, while Rebouillat seeks breathable thermal covers for bulk cargo. Neither reference addresses recyclability or oxidation during repulping. As Dr. Ma concludes: "The Gundlach/Rebouillat combination still has the same three gaps—no recyclability, no Voluntary Standard, and no optical density measure in the context of repulping treatment." EX2020, ¶74.

Under *KSR* and *Kahn*, an obviousness rationale must include "articulated reasoning with some rational underpinning." Petitioner has not provided any. Instead, the combination is hindsight-driven, inconsistent in purpose, and unsupported by the record.

E. Conclusion on Ground 3

Rebouillat does not cure the fatal deficiencies in Gundlach. It discloses breathable Tyvek-based thermal cargo covers, not recyclable packaging subjected to the claimed repulping treatment. It fails to disclose recyclability, the claimed treatment, or OD <0.09. The proposed combination is hindsight, not evidence-based. On this record, the obviousness ground fails as to claims 1-2 and 4-15, and the Board should deny institution for lack of a reasonable likelihood of prevailing under § 103.

X. Ground 4 Fails: The Voluntary Standard Reference is AAPA and does not cure the deficiencies of Gundlach.

In Ground 4, Petitioner asserts that claims 1-2, 4, 6-11, and 13-15 are obvious over Gundlach in view of the Voluntary Standard Reference. This ground fails for two independent reasons.

First, the Voluntary Standard is not a prior art "patent or printed publication" as required by 35 U.S.C. § 311(b) when relied on as *applicant-admitted prior art (AAPA)*. The Federal Circuit has squarely held that AAPA cannot serve as the "basis" of an IPR ground. *Qualcomm Inc. v. Apple Inc.*, 134 F.4th 1355 (Fed. Cir. 2025). As discussed above, Petitioner states: "The Voluntary Standard Reference is *admitted prior art* [.]" (emphasis added) (Petition at 6). Petitioner has thus clearly and unmistakenly characterized the Voluntary Standard reference as applicant-admitted prior art (AAPA) and, therefore, cannot serve as the basis of an IPR ground under § 311(b)).

Second, even if treated as a printed publication, the Voluntary Standard is merely a test protocol. It does not disclose any packaging structures, any recyclable paper-aluminum stacks, or the OD <0.09 outcome. EX2020, ¶76.

The Federal Circuit has long held that anticipation and obviousness must be based on disclosure of claim limitations in prior art references, not on protocols that merely test for them. A test method does not disclose the structure required to achieve the tested result. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. See *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). The Voluntary Standard does not teach how to design packaging that becomes recyclable; it only describes how to measure whether a sample is recyclable. EX2020, ¶38. Moreover, the Voluntary Standard does not disclose aluminum films that oxidize to transparency; it sets forth the measurement, not the material. EX2020, ¶51. It cannot transform Gundlach's OD 2.0–4.0 films into OD <0.09 recyclables. "[T]he Gundlach/Voluntary Standard combination still omits the recyclability and optical density requirements." EX2020, ¶74.

A. No Reasoned Motivation to Combine

Petitioner also fails to articulate a reasoned rationale for combining Gundlach with the Voluntary Standard. A POSITA would understand that a test protocol is not a blueprint for designing packaging structures. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring "articulated reasoning with some rational underpinning"). *KSR*

allows flexibility but still requires a reasoned explanation, not hindsight.

Here, the Petition's logic is circular: Gundlach discloses non-recyclable laminates; the Voluntary Standard describes how to test for recyclability; therefore Gundlach + Voluntary Standard somehow renders the claims obvious. That is legally insufficient. As *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016) warns, unsupported "common sense" cannot supply a missing limitation. Petitioners' attempt to use the Voluntary Standard to fill the structural gaps in Gundlach is exactly that kind of impermissible hindsight.

B. Conclusion on Ground 4

Petitioner's reliance on the Voluntary Standard fails for two independent reasons. First, when invoked as an "admitted" industry standard in the '148 Patent, it is AAPA. Under § 311(b) and *Qualcomm v. Apple*, AAPA cannot form the basis of an IPR ground. Second, even as a printed publication, the Voluntary Standard is a test protocol, not a disclosure of structural packaging features. It cannot cure Gundlach's absence of recyclability or OD <0.09.

On this record, the obviousness ground fails as to claims 1-2, 4, 6-11, and 13-15, and the Board should deny institution for lack of a reasonable likelihood of prevailing under § 103.

XI. Ground 5 Fails: The combination of Yializis and The Voluntary Standard Reference does not cure the deficiencies of Gundlach.

In Ground 5, Petitioner asserts that claims 1–15 are obvious over Gundlach in

view of Yializis and the Voluntary Standard. This theory fails because neither Yializis nor the Voluntary Standard supplies the missing claim limitations of Gundlach. The combination is incoherent: Gundlach discloses non-recyclable laminates, Yializis teaches away by protecting aluminum from oxidation, and the Voluntary Standard is only a test protocol, not a disclosure of structure. Even if combined, these references do not disclose recyclable packaging or OD <0.09. EX2020, ¶77. Petitioner has not articulated any reasoned rationale with a rational underpinning for this combination, and the ground fails under § 103.

A. The Deficiencies of Gundlach are Not Cured by Stacking References

As shown in Ground 1, Gundlach fails to disclose recyclability, the claimed "treatment", or OD <0.09. These three fatal gaps remain throughout every ground in the Petition. Yializis, discussed above in Ground 2, does not cure the deficiencies of Gundlach and actually points in the opposite direction. A POSITA would not be motivated to look to Yializis to supply the very oxidation outcome required by the claims. As shown in Ground 4, the Voluntary Standard is AAPA and a test protocol. It describes how to measure recyclability, but does not disclose packaging structures that achieve those outcomes. It cannot supply the structural features missing from Gundlach.

B. No Reasoned Motivation to Combine

Petitioner fails to articulate why a POSITA would combine Gundlach's non-

recyclable food packaging laminates with Yializis's anti-oxidation coatings and the Voluntary Standard's testing steps. The proposed combination is logically inconsistent:

- Gundlach discloses laminates that are *not recyclable*.
- Yializis teaches preserving aluminum by *preventing oxidation*.
- The '148 Patent requires and aluminum layer that *does oxidize away under repulping*.
- The Voluntary Standard is only a test and does not teach how to design a structure to pass.

This is not an obvious modification but a hindsight reconstruction. *KSR* requires "some articulated reasoning with some rational underpinning" (*Kahn*, 441 F.3d at 988), and "conclusory statements" or ipse dixit cannot fill that gap. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380–81 (Fed. Cir. 2016). Nor may "common sense" supply a major missing limitation. *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016).

On this record, there is no reason a POSITA would reengineer Gundlach using Yializis and the Voluntary Standard to arrive at the claimed recyclable, OD <0.09 structures.

C. Conclusion on Ground 5

Gundlach lacks recyclability, treatment, and OD <0.09. Yializis does not cure

those deficiencies but teaches away by preventing oxidation. The Voluntary Standard is merely a test protocol—and when treated as AAPA, it cannot serve as the basis of an IPR ground under § 311(b). Even if treated as a printed publication, it does not disclose structural features.

The proposed three-reference combination is hindsight-driven, contradictory, and unsupported by any reasoned rationale. On this record, the obviousness ground fails as to claims 1-15, and the Board should deny institution for lack of a reasonable likelihood of prevailing under § 103.

XII. Ground 6 Fails: The combination of Rebouillat and The Voluntary Standard Reference does not cure the deficiencies of Gundlach.

In Ground 6, Petitioner asserts that claims 1-2, and 4-15 are obvious over Gundlach in view of Rebouillat and the Voluntary Standard Reference. This ground fails because neither Rebouillat nor the Voluntary Standard supplies the missing claim limitations of Gundlach. The combination is incoherent: Gundlach discloses non-recyclable laminates, Rebouillat is directed to Tyvek®-based breathable cargo covers and bubble mailers that are not repulpable, and the Voluntary Standard is AAPA and only a test protocol, not a disclosure of structure. Even if combined, these references do not disclose recyclable packaging or OD <0.09. EX2020 at ¶78. Petitioner has not articulated any reasoned rationale with a rational underpinning for this combination, and the ground fails under § 103.

A. No Reasoned Motivation to Combine

Petitioner also fails to articulate why a POSITA would combine Gundlach's non-recyclable laminates with Rebouillat's Tyvek®-based cargo covers and then apply the Voluntary Standard's testing steps. The proposed combination is logically inconsistent:

- Gundlach discloses laminates that are not recyclable.
- Rebouillat teaches Tyvek®-based thermal covers and bubble mailers, which are plastics, not recyclable paper.
- The '148 Patent requires recyclable paper packaging in which aluminum oxidizes away under repulping, leaving OD <0.09.
- The Voluntary Standard is only a test and does not teach how to design a structure to pass.

This is not an obvious modification but a hindsight reconstruction. *KSR* requires "some articulated reasoning with some rational underpinning" (*Kahn*, 441 F.3d at 988), and "conclusory statements" or ipse dixit cannot fill that gap. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380–81 (Fed. Cir. 2016). Nor may "common sense" supply a major missing limitation. *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016).

On this record, there is no reason a POSITA would reengineer Gundlach using Rebouillat's Tyvek® laminates and the Voluntary Standard's testing protocol to

arrive at the claimed recyclable, OD <0.09 structures.

B. Conclusion on Ground 6

Gundlach lacks recyclability, treatment, and OD <0.09. Rebouillat does not cure those deficiencies, because it discloses Tyvek®-based cargo covers and bubble mailers that do not repulp and are not repulpable under the claimed treatment. The Voluntary Standard is merely a test protocol—and when treated as AAPA, it cannot serve as the basis of an IPR ground under § 311(b). Even if treated as a printed publication, it does not disclose structural features.

The proposed three-reference combination is hindsight-driven, contradictory, and unsupported by any reasoned rationale. On this record, the obviousness ground fails as to claims 1-2, and 4-15, and the Board should deny institution for lack of a reasonable likelihood of prevailing under § 103.

XIII. CONCLUSION

The Petition should be denied on every ground and as to every challenged claim, Under *Phillips* and plain and ordinary meaning, Petitioner never identifies a single reference that teaches each and every claim element, nor a combination of references that, combined, provides a teaching or reasoned rationale that would lead a person of ordinary skill to the inventions claimed in the ’148 Patent.

Petitioner has failed to carry its burden of proof under 35 U.S.C. § 316(e) and, therefore, the Board should deny institution as to all challenged claims and all

grounds.

This 2nd day of October, 2025.

Respectfully submitted,

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Pursuant to 37 C.F.R. §§ 42.24(d), Patent Owner hereby certifies, in reliance on the word count of the word-processing system (Microsoft Word 365) used to prepare this preliminary response, that the number of words in this paper is 9,805. This word count excludes the tables of contents, tables of authorities, certificate of word count, certificate of service, and table of exhibits.

Dated: October 2, 2025

/s/ Michael J. Curley
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6 (e), the undersigned certifies that the foregoing Patent Owner's Preliminary Response and supporting materials are being served on counsel of record by filing the document through the Patent Trial and Appeal Case Tracking System (P-TACTS), with a copy served via electronic mail to the following email address, as authorized in Petitioner's Mandatory Notices:

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EXHIBIT E

Patent Owner's Exhibit 2020
Filed: October 2, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PROAMPAC HOLDINGS INC.,

Petitioner

v.

SIGMA TECHNOLOGIES INTERNATIONAL, LLC,

Patent Owner

Case IPR2025-01143
U.S. Patent No. 11,072,148

DECLARATION OF RUOXI MA, PH.D. IN SUPPORT OF PATENT OWNER'S RESPONSE

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EXHIBITS CITED

Exhibit No.	Description
2021	Curriculum vitae of Dr. Ruoxi (Rachel) Ma
2022	"*Biopolymer Films from Glucomannan: The effects of Citric Acid Crosslinking on Barrier Properties*," in Journal of Print and Media Research Technology, Research 7(2018)1, 19-25.
2023	"*Screen Printed Moisture Sensor and Its Application on Smart Packaging*," in The Technical Association of Graphic Arts Proceedings 2021, pgs. 191-203 (focusing on material-layer substrates and substrates/coating surface interactions)
2024	*Method for Formulating Silver-Doped Lanthanum Titanate Photochromic Ink* (CN103804986A), issued May 21, 2014.
2025	Friel, John M., and Edwin Nungesser. *"Acrylic Polymers as Coatings Binders."* Paint and Coating Testing Manual - Fifteenth Edition of the Gardner-Sward Handbook: (MNL 17-2nd), edited by JV Koleske, no. MNL17, ASTM International, 2012, pp. 49–64**,** *https://doi.org/10.1520/MNL12186M.*
2026	Gündüz, Güngör. *Chemistry Materials and Properties of Surface Coatings: Traditional and Evolving Technologies*. DEStech Publications, 2015
2027	*Pigment Coating and Surface Sizing of Paper.* Vol. bk. 11., Fapet Oy, 2000**.** Chapter 6: Binders, section Coating binders, @ page 191. This reference covers binders, including latex and acrylic, their functions, properties, and implications for coating formation.
2028	*Recycled Fiber and Deinking.* Vol. bk. 7, Fapet Oy, 2000. Chapter 11, page 441-504.

Patent Owner's Exhibit 2020
Filed: October 2, 2025

I, Dr. Ruoxi (Rachel) Ma, make this declaration in connection with the Case IPR2025-01143, ProAmpac Holdings Inc. ("Petitioner") v. Sigma Technologies International LLC ("Patent Holder"):

INTRODUCTION

1. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth in this Declaration.

2. I have been retained on behalf of Pratt Retail Specialties, LLC ("Pratt"), which I understand to be the exclusive licensee of U.S. Patent No. 11,072,148 ("the '148 Patent"). I understand that Patent Holder will submit this declaration as part of its Preliminary Response.

3. Pratt has asked me to respond to the Declaration of Glenn May (EX1003), submitted in connection with the Petition. I understand that Petitioner challenges the patentability of Claims 1-15 of the '148 Patent (the "Challenged Claims"). I have reviewed and analyzed Mr. May's Declaration in this regard, including the list of materials he listed as having been reviewed and considered. I have not been asked and have not analyzed the Petition outside of the May Declaration. My analysis is technical and not legal.

4. In summary, as set forth in greater detail below, I conclude that Mr. May has not shown Claims 1-15 to be unpatentable pursuant to the legal standards that I have been asked to apply.

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5. I am being compensated for my services in connection with the above-identified proceeding at my standard rate of $375 per hour. My compensation is not dependent in any way upon the substance of my testimony or the outcome of Petitioner's Petition.

BACKGROUND INFORMATION

6. All of my opinions stated in this Declaration are based on my own personal knowledge, professional experience and judgement, and analysis of the materials presented by Mr. May. Based on my understanding of a person of ordinary skill in the art as set forth below, I believe I have at least that level of skill regarding the '148 Patent and the materials addressed by Mr. May.

7. I attach a copy of my current curriculum vitae, EX2021, which details my education and professional and academic experience. I summarize below my experiences that are most pertinent to my opinions in this declaration.

8. I am an Associate Professor of Graphic Communication at California Polytechnic State University, where I specialize in packaging materials, barrier coatings, and sustainable design for thermal and food-related applications. My research and teaching span over 14 years.

9. I earned a Ph.D. in Paper and Printing Science from Western Michigan University with a strong research background in barrier materials and sustainable packaging solutions. My dissertation was titled *Screen Printed*

Moisture Sensor on Barrier Coated SBS Board: The Characterizations of the Hemicellulose-Based Biofilms and Their Applications for Smart Packaging. Before that I earned my masters in Paper and Printing Engineering from Xi'an University of Technology, Xi'an China, and my undergraduate Bachelor of Science degree in Printing Science from Qingdao University of Science and Technology, Qingdao, China.

10. I currently teach "Packaging Materials for Medical Applications" and "Digital Printing and Emerging Technologies." I have taught a number of other courses that have touched on the issues relating to the issues raised by Mr. May and the '148 Patent including "Stock Preparation and Papermaking", "Pulping and Paper Coating", and "Emerging Technologies in Graphic Communication".

11. I have published several peer reviewed articles relevant to multilayer recyclable substrates including "*Biopolymer Films from Glucomannan: The effects of Citric Acid Crosslinking on Barrier Properties*," in Journal of Print and Media Research Technology, Research 7(2018)1, 19-25. EX2022. I am also the co-author of "*Screen Printed Moisture Sensor and Its Application on Smart Packaging*," in The Technical Association of Graphic Arts Proceedings 2021, pgs. 191-203 (focusing on material-layer substrates and substrates/coating surface interactions). EX2023.

12. I have presented at numerous conferences and industry meetings. For example, in May 2023, I was invited to speak at the PACKout Conference, presenting on digital print in healthcare packaging, which is a sector analogous to thermal insulated bags. PACKout is a leading annual forum that brings together global packaging professionals to showcase innovations, regulatory trends, and disruptive technologies shaping the future of healthcare and consumer packaging.

13. I was invited to speak at TAGA Conference in 2021, presenting hemicellulose-based barrier coatings and their sustainability impact for smart packaging. TAGA (Technical Association of the Graphic Arts) is a premier international conference that bridges academic research and industry application in printing and packaging sciences, influencing technical standards and advancing best practices across the field.

14. I was the lead researcher on digital printing and functional materials for food and medical packaging (2022-2025). I also served as an external advisor for Duo He's Ph.D. dissertation "The Fractionation of Woody Biomass with Bifunctional Aryl Sulfonic Acids at Mild Conditions" (Western Michigan University, 2022). The work explored bio-based chemistries for coatings and binders that enhance functionality while remaining compatible with recycling streams, aligning with industry efforts to develop fiber-based packaging systems

that maintain repulpability and avoid mill contamination.

15. I was awarded a grant by the German Academic Exchange Service (DAAD) for a project on sustainable medical packaging across the EU and North America. For this project, I served as a visiting researcher at Hochschule München University of Applied Sciences teaching and conducting research on Innovative Packaging Solutions for Medical Applications in Spring 2025.

16. I was Co-PI (co-principle investigator) for a study on carbon footprint estimation and material compatibility of materials used in various mailing solutions in Winter 2025. The study involved lifecycle analysis of multi-layer laminates and was a sponsored project awarded by Quad Graphics Co.

17. I served as co-principal investigator on a study sponsored by Quad Graphics Co. (Quad), one of the world's largest printing and packaging providers, examining the carbon footprint of printing and packaging materials in mailing solutions. The project focused on sustainability and recycling regulations, evaluating the environmental impact and repulpability of common substrates and laminates. Its findings provided actionable guidance on material selection and laminate design, directly informing industry best practices and advancing packaging sustainability.

18. I hold a patent for A *Method for Formulating Silver-Doped*

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Lanthanum Titanate Photochromic Ink (CN103804986A), issued May 21, 2014. EX2024.

RELEVANT LEGAL STANDARDS

19. I am not an attorney. My understanding of the law is based on information provided by counsel for Pratt, which I assume to be true.

20. **Anticipation.** I understand that for a claim to be anticipated: (1) each and every claim element must be identically disclosed, either explicitly or inherently, in a single prior art reference; (2) the claim elements disclosed in the single prior art reference must be arranged in the same way as in the claim; and (3) the identical invention must be disclosed in the single prior art reference. Where even one element is not disclosed in a reference, there is no anticipation.

21. I understand that to serve as an anticipatory reference, the reference itself must provide enough information so that a person of ordinary skill in the art can practice the subject matter of the reference without undue experimentation.

22. I further understand that where a prior art reference fails to explicitly disclose a claim element, the prior art reference inherently discloses the claim element only if the prior art reference must necessarily include the undisclosed claim element. Inherency may not be established by probabilities or possibilities. The fact that an element may result from a given set of circumstances is not sufficient to prove inherency.

23. **Obviousness**. I understand that the test for obviousness is whether the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention, considering the scope and content of the prior art, the differences between the prior art and the invention, the level of skill of the person of ordinary skill in the art and secondary considerations of non-obviousness.

24. I understand that a claim can be obvious in view of a single prior art reference (through modification of that reference) or multiple prior art references (through a combination of two or more prior art references). The single art reference or combination of prior art must teach each and every limitation of the patent claim at issue.

25. I understand that to establish a finding of obviousness, one must show that a person of ordinary skill in the art ("POSITA") would have had a motivation to combine the prior art references to produce the claimed invention and have a reasonable expectation that the combination would be successful.

26. I understand that a prior art reference is proper to use in an obviousness determination if the prior art reference is analogous art to the claimed invention. I understand that a prior art reference is analogous art if at least one of the following two considerations is met. First, a prior art reference is analogous art if it is from the same field of endeavor as the claimed invention, even if the prior art reference addresses a different problem and/or arrives at a different solution.

Second, a prior art reference is analogous art if the prior art reference is reasonably pertinent to the problem faced by the inventor, even if it is not in the same field of endeavor as the claimed invention.

27. I understand that each alleged prior art reference in a proposed obviousness combination must be evaluated in its entirety, i.e., including those portions that would argue against obviousness, and must be considered for everything that it teaches, not simply the described invention or a preferred embodiment.

28. I understand that it is inappropriate to resolve obviousness issues by a retrospective analysis or hindsight reconstruction of the prior art and that the use of "hindsight reconstruction" is improper in analyzing the obviousness of a patent claim.

29. **POSITA.** I understand that a POSITA is a hypothetical person presumed to have known the relevant art at the time of the invention. I understand that date here is January 8, 2018. I also understand that the factors considered in determining the level of ordinary skill in the relevant art include: (1) the problems encountered in the art; (2) the prior art solutions to the problems encountered in the art; (3) the rapidity of innovation; (4) the sophistication of the technology; and (5) the education level of active workers in the field. I understand that not all of these factors need to be considered for analysis and that equivalent work or experience

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may be substituted for education.

30. I have considered Mr. May's description of POSITA for this case. EX1003, ¶ 24. While I agree on certain aspects of Mr. May's description, I believe it is incomplete. This difference, however, does not impact my bottom-line conclusions.

31. In my view, as of January 8, 2018, a person of ordinary skill in the art ("POSITA") would have had at least a bachelor's degree in packaging, chemical engineering, materials science, or paper engineering**,** or an equivalent field**,** and at least 5 years of experience in developing or evaluating packaging materials. Relevant experience could include repulpability and recyclability of barrier films, laminates, coatings, recyclability assessments, or thermal management in packaging applications. Additional academic training (e.g., a master's degree) could compensate for less work experience, and conversely, more extensive work experience could compensate for formal education. Such a person would have been familiar with commonly used packaging materials (paper, polymers, thin films, metalized layers), as well as with standard testing methods used in the field (e.g., recyclability, repulpability, and barrier performance).

32. **Claim construction**. I understand that in certain instances there is the need to engage in a process called claim construction to provide meaning to claim terms that are important to the dispute. Here, I am able to base my analysis on the

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plain and ordinary meaning of the claim terms based on my technical understandings. This includes the '148 patents consistent use of terms such as recyclable packaging and emissivity. Accordingly, I have not engaged in any claim construction analysis. I note that Mr. May too said it was not necessary to engage in claim construction. EX1003, ¶ 61.

SUMMARY OF THE '148 PATENT

33. The '148 Patent is entitled "Recyclable Paper-Coating Packaging With Radiant Barrier Insulation." EX1001. The problem the '148 Patent addresses is how to make a recyclable paper-containing packaging to preserve temperature sensitive foods or pharmaceutical goods. *Id.*, 1:15-22. The '148 Patent observed that "practically all perishable or temperature sensitive goods shipped in small volumes are shipped with the use of corrugated cardboard boxes, which are easily and commonly recycled." *Id.*, 6:10-13. The prior art, however, was not able to provide a fully recyclable, low-emissivity packaging material. *Id.*, 4:39-41.

34. The Abstract summarizes the solution: "Material for packaging – and package or receptacle made of such material – that contains a particular aluminized polymeric film with emissivity of equal to, or less than 0.10 and yet sufficiently thin to withstand and satisfy industrial requirements of the recycling process due to substantially complete oxidation of aluminum during recycling." *Id.*, Abstract.

35. The '148 Patent describes and claims various "stacks" that meet the

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goals of the invention, which include multiple layers of paper (which includes corrugated fiberboard), polymer and aluminum, and sometimes also a coating. Figure 4 illustrates such a stack.

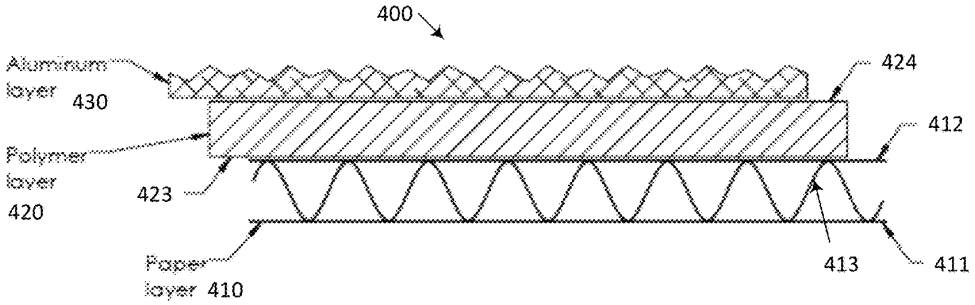


Fig. 4

36. To be recyclable, packaging must first be repulpable. The '148 Patent lays out the industry standard for repulpability and recyclability in great detail underscoring the importance of repulpability and recyclability to the invention. EX1001, 4:64 – 6:9. In this regard, the '148 Patent refers to and incorporates "The Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve its Importance in the presence of Water and Water Vapor" ("Voluntary Standard"). *Id*. I agree that the Voluntary Standard was and is a commonly used test.

37. The first portion of the Voluntary Standard addresses repulpability. The '148 Patent sets forth the Voluntary Standard's test method in this regard. *Id.*, 5:11-24. This test is included in each claim as the "treatment." *Id.*, 19:1 – 22:36.

The material is disintegrated into water which is passed over a screen. The material that passes through the screen is called the "accepts" and the material that does not pass through the screen is called the "rejects." The dried weight of the materials are measured and if the "accepts" weigh at least 85 weight-% of the total material, the material itself is classified as repulpable. That is, if 85% or more of the total material, by oven dry weight, passes through the screen during testing, the material is repulpable.

38. The second step of the Voluntary Standard test involves the potential use of the recyclable material in paper making. EX1001, 5:31-32. The accepts are pressed together to form sheets. *Id.*, 5:32-35. These sheets are then inspected for defects, "spots" or other visual blemishes according to industry test methods. *Id.*, 5:35-53. For example, if a small amount of dirt or aluminum makes its way into the pulp, it could result in visual blemishes and could be a cause for rejection of the paper product. Further, if polymeric material makes its way into the pulp, the polymer material could be re-softened or re-melted and cause undesirable "stickies" because they negatively affect the physical properties of the paper. *Id.*, 5:54-66. To pass this second step of the Voluntary Standard test, and for the paper to be considered recyclable, there can be no more than 15 visually observable spots in a 0.4 square millimeter area of the sheet. *Id.*, 6:1-4.

39. The low emissivity (i.e., reflectivity) and related low optical density

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lead to transparency of the aluminum rendering the pulp recyclable.

ANALYSIS OF MR. MAY'S PRIOR ART

40. Mr. May bases his invalidity analysis on four primary references, which I have reviewed in detail: (1) U.S. Patent Publication No. 2014/0044903 ("Gundlach") (EX1005); (2) S. Yializis, *Multi-Layer, Low Emissivity, Metallized Materials for Replacing Aluminum Foils in Heat Reflection and Energy Management Applications*, Society of Vacuum Coaters, 52nd Annual Technical Conference Proceedings, 755-759 (May 2009) ("Yializis") (EX1006); (3) *The Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve its Performance in the Presence of Water and Water Vapor*, Fibre Box Association (August 16, 2013) ("Voluntary Standard Reference") (EX1007); and (4) U.S. Patent Publication No. 2015/0053086 ("Rebouillat") (EX1008). I also have reviewed the other materials cited in Mr. May's list of materials reviewed and considered, but my focus has been on these four items.

41. Applying the legal standards set forth above, I conclude that Mr. May fails to show the invalidity of the '148 Patent. I address each of the above four references below individually, and then address them in the context of each of the six grounds in the final section of this declaration.

42. I have not been asked to identify every way in which I disagree (or agree) with Mr. May's discussion. Instead, I have been asked to identify the key

areas in which I disagree with Mr. May's analysis of each of the four references - that is, the reference does not satisfy one or more requirements or limitations of the claims of the '148 Patent. I reserve the right to address additional aspects of Mr. May's Declaration if asked to do so.

43. The following is a general discussion of Mr. May's four main references:

Gundlach's Failure to Disclosure Each Element of the Claims of the '148 Patent

44. Gundlach generally addresses a film for use with packaging for foodstuffs having different layers on top of the paperboard "base material." EX1005, Abstract. Gundlach states in the Summary of the Disclosure, "The disclosure is directed to a film for use in association with packaging useable with foodstuffs having product contact." *Id.*, [0008].

45. Gundlach does note in the Background of the Disclosure that the prior art packaging materials were "not well suited for recycling or composting." *Id.*, [0005]. While this might suggest Gundlach intended to solve this problem, Gundlach did not. Nowhere in the rest of Gundlach is there any discussion regarding how and why the packaging of Gundlach solves this problem. Indeed, the packaging of Gundlach does not.

46. I am of the opinion that one of the key aspects of Gundlach is the base coat structure (something different than the base material), which can be made up

of an inner base layer and an outer base layer. *Id.*, [0037-0042]. The importance of the base coat structure to Gundlach is underscored by the fact that the metallic layer is optional. EX1005, [0023; 0051].

47. Of particular interest in Gundlach's discussion of the base coat structure is the disclosure of high molecular weight acrylic polymer resins. *Id.*, [0042]. For instance, Gundlach discloses BMA acrylic copolymer -- a synthetic resin based on butyl methacrylate + ("BMA") other acrylic monomers. *Id.*, [0040]. In packaging, BMA polymer serves as a flexible, adhesive base coat to support metallization and prevent aluminum flaking.

48. Gundlach discloses that these high molecular weight polymer resins "repress[] the propensity for metal flaking upon sheet folding (gusset folds)." *Id.*, [0041]. Put another way, the high-molecular weight polymers help anchor the metallized layer so it doesn't crack or shed upon repeated folding. The literature supports the conclusion that the acrylic copolymer's function is to increase adhesion and flexibility of the metallized layer and reduce flaking: (1) Friel, John M., and Edwin Nungesser. *"Acrylic Polymers as Coatings Binders."* Paint and Coating Testing Manual - Fifteenth Edition of the Gardner-Sward Handbook: (MNL 17-2nd), edited by JV Koleske, no. MNL17, ASTM International, 2012, pp. 49–64**,** *https://doi.org/10.1520/MNL12186M.* EX2025. And (2) Gündüz, Güngör. *Chemistry Materials and Properties of Surface Coatings: Traditional and*

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Evolving Technologies. DEStech Publications, 2015. EX2026.

49. These high molecular weight polymers, however, do not repulp with the fibers. They remain intact and can form stickies – stickies, as mentioned above regarding the disclosures of the ‘148 Patent, are tacky contaminants that can agglomerate in screens and can cause defects in recycled paper such as spots and blemishes. The literature also supports this observation: (1) *Pigment Coating and Surface Sizing of Paper.* Vol. bk. 11., Fapet Oy, 2000. Chapter 6: Binders, section Coating binders, @ page 191. This reference covers binders, including latex and acrylic, their functions, properties, and implications for coating formation. EX2027. And (2) *Recycled Fiber and Deinking.* Vol. bk. 7, Fapet Oy, 2000. Chapter 11, page 441-504. EX2028. This reference deals with the sources and behavior of stickies in pulp, including adhesives, ink, coating binders/latexes as sources.

50. Gundlach does not reference the Voluntary Standard - it references no standard or test regarding repulpability or recyclability. Instead, Gundlach references leaching tests using peanut oil and pickle juice. EX1005, [0052].

51. The Gundlach packaging material thus does not meet all of the requirements of the claims of the ‘148 Patent. As discussed above, the ’148 Patent generally discloses that the thin, low emissivity aluminum layer will oxidize and disappear during the repulping process as per the Voluntary Standard and the

treatment in the claims, resulting in pulpable material that meets the "industrial requirements of the recycling process." EX1001, Abstract. Gundlach, in contrast, not only fails to disclose the Voluntary Standard and specific treatment claimed in the '148 Patent, but, as discussed above, it also discloses material for packaging that has significant recycling problems, not advantages. And the claims of the '148 Patent require a recyclable packaging material.

52. Finally, certain of the claims of the '148 Patent require an optical density (OD) of less than 0.09. EX1001 (e.g., Claim 7). This low OD means that oxidized aluminum layer has disappeared during the repulping test. While Gundlach does mention ODs, they are much higher (e.g., 4.0) and the discussion is not in the context of a measurement taken in connection with repulpability and recyclability tests. EX1005, [0044]. There is no discussion regarding the treatment or recyclability of the Gundlach packaging.

The Yializis Article Fails to Disclose Each Element of the Claims of the '148 Patent

53. The problem addressed in the Yializis article is the degradation of metallized aluminum films in the presence of heat and moisture. EX1006, Abstract. "Unlike oxide layers grown in air, in dry conditions, aluminum hydroxides formed from a water reactions lack the ability to protect the aluminum from further corrosion. . . ." *Id.*, p. 755, right col.. The Yializis article further observes, "Extreme environments consisting of high heat and moisture can result in

propagation of oxidation and corrosion sites to the degree that a vapor deposited, low-e surface is entirely consumed." EX1006, p. 755, right col..

54. The Yializis article then goes on to report on the investigation into the solution to this problem – a "novel, multi-layer, low emissivity materials incorporating one or more vacuum deposited layers designed to protect vacuum deposited aluminum layers from oxidization and corrosion." *Id.*, Abstract. "[V]apor deposited polymer coatings [are] designed to protect thin films from the effects of corrosion and oxidization. *Id.*, p. 755, right col..

55. The Yializis article goes on to discuss an "In-Line Plasma Passivation" that results in the "formation of an aluminum oxide layer that is guaranteed not to contain damaging hydroxides." *Id.*, p. 757, left col.. The article further discusses "Flash Evaporation and Curing," the result of which "is a protective layer capable of preventing ingress of moisture in quantities sufficient to facilitate formation of aluminum hydrozides. *Id.*, p.757, right col..

56. The Yializis article does mention the use of metallized films for use in packaging for foodstuffs and pharmaceutical products (*Id.*, p. 757, left col.), but this is not the focus of the investigation.

57. The Yializis article does not address the repulpability and recyclability issues relating to the low emissivity, thin aluminum layered packaging material addressed in the '148 Patent. Indeed, while the '148 Patent seeks full oxidization

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during the pulping test, the Yializis article describes a protective layer to prevent the oxidization and corrosion of the aluminum layer.

58. Consistent with the above, the Yializis article does not mention the Voluntary Standard or other industry standards (i.e., TAPPI) relating to repulpability and recyclability. There is no discussion regarding recyclable fiber yield, stickies count, optical density in connection with repulping or any other recyclability matrix. The article does mention an "Accelerated Steam Testing" (EX1006, p. 758, right col.), but this test gauges the performance of the protective coating and not to simulate repulping.

59. The Yializis article thus does not meet all of the requirements of the claims of the '148 Patent. The article neither discloses a recyclable paper containing package, nor discloses the Voluntary Standard - the specific treatment claimed in the '148 Patent. Finally, the Yializis article fails to disclose the optical density requirement of certain of the claims of the '148 Patent.

The Voluntary Standard

60. The '148 Patent, as noted above, expressly refers to and incorporates the Voluntary Standard. Each claim of the '148 Patent incorporates the test of the first step of the Voluntary Standard as the treatment.

61. The Voluntary Standard, however, as discussed in the final section of this declaration, does not support Mr. May's arguments for rendering the claims of

the ‘148 Patent obvious.

Rebouillat Fails to Disclose Each Element of the Asserted Claims of the ‘148 Patent

62. Rebouillat is entitled “Breathable Product for Protective Mass Transportation and Cold Chain Applications.” EX1008. The Background of the Invention describes how “thermal covers may be used to protect a wide variety of cargo, such as flowers, fresh fruits and vegetables, fresh fish, pharmaceuticals and electronic products, from temperature fluctuations experienced during transport.” *Id.*, [0004]. The drawback in the prior art was that the thermal covers were impermeable to gasses and water allowing humidity and heat to build up (i.e., “green house effect”), which is detrimental for humidity and temperature sensitive goods. *Id.*, [0005].

63. The Abstract describes the solution to the problem as “a breathable product for protecting mass transportation and cold chain applications.” *Id.*, Abstract. This includes a reflective sheet having at least a first layer made of a highly reflective moisture vapor permeable substrate. The reflective sheet also contains a metal layer. *Id.*

64. Figures 1a and 1b illustrate embodiments of the reflective sheet. *Id.*, [0032]. The low emissivity, breathable reflective cover reflective has a first layer 1 made of Tyvek®. *Id.* There can be a metal layer 2 and lacquer coating 3. *Id.* (Further embodiments relate to flame retardant covers. *Id.*, [0034].)

65. Tyvek® is 100% high-density polyethylene that does not repulp into fibers under the TAPPI tests. Tyvek® is a #2 plastic that is recyclable in the plastics stream, not the paper stream.

66. Rebouillat does not teach anything regarding the repulpable and recyclable packaging of the ‘148 Patent. Indeed, Rebouillat only makes minor mention of the possibility of having cellulose as part of the cover sheet. EX1008, [e.g., 0046].

67. Rebouillat also does not disclose the Voluntary Standard or other industry tests or standards relating to the repulpability or recyclability of paper or cardboard packaging. Instead, the tests relate to such things as light reflectivity, moisture barrier transmission, liquid water penetration, emissivity and flammability. *Id.*, [0069].

68. Rebouillat thus does not disclose all of the requirements of the claims of the ‘148 Patent. Rebouillat neither discloses a recyclable paper containing package, nor does it disclose the Voluntary Standard - the specific treatment claimed in the ‘148 Patent. Finally, Rebouillat fails to disclose the optical density requirement of certain of the claims of the ‘148 Patent.

ANALYSIS OF AND CONCLUSIONS REGARDING THE SIX GROUNDS IN LIGHT OF MR. MAY’S PRIOR ART

69. Mr. May addressed the six grounds of the Petition. I now will address each of the six grounds in light of my above examination of the prior art relied

upon by Mr. May. I conclude that Mr. May has failed to establish invalidity based on the arguments in each of the six grounds.

70. I focus my analysis on three key omissions in Mr. May's prior art: (1) the requirement that the packaging or material be recyclable as set forth in each of the independent claims;[1] (2) the packaging is subjected to or exposed to the "treatment" (i.e., first step of the Voluntary Standard test) as set forth in each of the independent claims; and (3) the optical density requirement as set forth in independent claims 7 and 9. My above discussion of the references is incorporated herein and will not be repeated in full.

71. Ground 1. Mr. May asserts that Gundlach anticipates Claims 1, 2, 4, 6-11, and 13-15 of the '148 Patent. EX1003, ¶ 77. While Mr. May concludes that Gundlach "teaches that when the packaging is subjected to the treatment in element 1(g) to form a recyclable material" *Id.*, ¶ 98, I disagree for the reasons set

[1] I note that the "recyclable packaging" of Claim 7 is referenced in what I understand to be the preamble of Claim 7. While I understand that the preamble may not be interpreted as a limitation in certain circumstances, I believe it is here given the following legal rule that I have been provided and assume to be true: the preamble of a claim is read as a limitation when it recites essential structural elements (necessary to give life, meaning, or vitality to the claim), provides antecedent basis for later claim terms, or defines the purpose or context of an invention in a way that is integral to the claim. Mr. May appears to agree as he too addresses recyclability in the context of a preamble. EX1003, ¶. 72.

forth above. Gundlach discloses material for packaging that has significant recycling problems, not advantages. Gundlach also fails to disclose the Voluntary Standard or treatment of the claims.

72. To the extent Mr. May suggests these elements are inherent in Gundlach, I also disagree. A prior art reference noted above, inherently discloses the claim element only if the prior art reference must necessarily include the undisclosed claim element. Gundlach does not necessarily include recyclability and the Voluntary Standard/treatment where Gundlach's base coat structure includes high molecular weight polymers that are not recyclable under industry standards.

73. I also disagree with Mr. May's conclusion that Gundlach teaches the optical density requirement of certain of the claims (e.g., 7) expressly or inherently. EX1003, ¶¶ 119-120. As discussed, the optical density of the '148 Patent is measured in the context of the repulpability treatment. The optical density measurements disclosed in Gundlach are not taken in the context of a repulpability test and are well above the low claimed range of the '148 Patent – below 0.09 in the claims and the lowest disclosed in Gundlach is 2.0. EX1005, [0044].

74. Ground 2. Mr. May argues that Claims 1-15 are obvious over Gundlach and the Yializis article. I again disagree. Mr. May cannot fill the gaps in Gundlach with the Yializis article because, as discussed above, the Yializis article

has the same omissions. Put another way, even assuming Mr. May has proven a motivation to combine, the Gundlach/Yializis article combination still has the three gaps discussed above – no recyclability, no Voluntary Standard and no optical density measure in the context of the repulpability treatment.

75. Ground 3. Mr. May argues that Claims 1, 2 and 4-15 are obvious over Gundlach and Rebouillat. EX1003, ¶180. I disagree. Mr. May cannot fill the gaps in Gundlach with the Rebouillat because, as discussed above, the Rebouillat has the same omissions. Put another way, even assuming Mr. May has proven a motivation to combine, the Gundlach/Rebouillat combination still has the three gaps discussed above – no recyclability, no Voluntary Standard and no optical density measure in the context of the repulpability treatment.

76. Ground 4. Mr. May argues that Claims 1, 2, 4, 6-11 and 13-15 are obvious over Gundlach and the Voluntary Standard. I disagree. Even assuming a motivation to combine Gundlach and the Voluntary Standard, the Gundlach/Voluntary Standard combination still omits the recyclability and optical density requirements.

77. Ground 5. Mr. May argues that Claims 1-15 are obvious over Gundlach, the Yializis article and the Voluntary Standard. I disagree. Even assuming a motivation to combine these three references, the Gundlach/Yializis article/Voluntary Standard combination still omits the recyclability and optical

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density requirements.

78. Ground 6. Mr. Argues that Claims 1, 2 and 4-15 are obvious over Gundlach, the Rebouillat and the Voluntary Standard. I disagree. Even assuming a motivation to combine these three references, the Gundlach/Rebouillat/Voluntary Standard combination still omits the recyclability and optical density requirements.

CONCLUSION

In view of the facts above, and in accordance with the legal principles described in paragraphs 19-32, a POSITA would have found that Claims 1-15 neither are anticipated nor obvious before January 8, 2018 (the date used by Glenn May in his analysis).

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 01 day of October 2025.

Ruoxi (Rachel) Ma, Ph.D.