

IPR2024-00887
Patent 11,050,097

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

URT UMWELT UND RECYCLINGTECHNIK GMBH
Petitioner,

v.

DUESENFELD GMBH.
Patent Owner

Inter Partes Review No. IPR2024-00887
U.S. Patent No. 11,050,097

PATENT OWNER PRELIMINARY RESPONSE

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PATENT OWNER'S EXHIBIT LIST

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Ex. 2002	U.S. Patent No. 9,450,277 ("Dunagan")
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Ex. 2004	DE 102012024876 A1 to Electrocycling GmbH ("Electrocycling") (English)
Ex. 2005	Certification of Translation of the Electrocycling Patent
Ex. 2006	Gao Liu <i>et al.</i> , <i>Binder Interactions in the Electrodes of the Lithium-ion Batteries</i> , TFUG Conference, February 17, 2009
Ex. 2007	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (German)
Ex. 2008	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (English)
Ex. 2009	Certification of Translation of the LiMotive Patent
Ex. 2010	Declaration of Vani Dantam in support of Patent Owner's Preliminary Response to the Petition
Ex. 2011	U.S. Patent No. 7,198,865 to Sloop ("Ecobat")
Ex. 2012	Kinergy Corporation, <i>Transferring Heat with a Vibratory Bed Dryer</i> (2013) [https://web.archive.org/web/20131015131016/https://kinergy.com/uploads/documents/Transferring%20Heat%20with%20a%20Vibrating%20Fluidized%20Bed%20KDVFB-1.pdf]
Ex. 2013	MEWA User Manual (German)
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Ex. 2015	Certification of Translation of the MEWA User Manual
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Ex. 2021	Duesenfeld GmbH Website – Recycling (https://www.duesenfeld.com/recycling_en.html) [https://perma.cc/3CG6-BDU9]
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Ex. 2024	Scheduling Order in Case No. 23-1194-JFM

I. PRELIMINARY STATEMENT

Pursuant to 37 C.F.R. § 42.107, Patent Owner Duesenfeld GmbH (“Patent Owner”) submits this Preliminary Response to the Petition for *Inter Partes* Review (“IPR”) of U.S. Patent No. 11,050,097 B2 (“the ’097 patent”) (“Petition”).

Petitioner URT Umwelt und Recyclingtechnik GmbH (“URT” or “Petitioner”) challenges the validity of Claims 1-3, 7-10, 12-13, and 15-19 of the ’097 patent.

Recycling of electric vehicle (“EV”) batteries requires transporting used batteries to a central location. Because transport of used batteries is hazardous, prior art attempts to “inactivate” the battery materials focused on adding foreign substances, such as fire retardants and brines. Addition of substances contaminates the materials, making recycling more expensive and less effective. The inventors of the ’097 patent realized that these battery materials could be inactivated through the drying process itself, under vacuum, at a pressure of 300 hPa or lower.

Ground 1 of Petitioner’s argument, that LithoRec in view of Perry and DIN 28400 renders the ’097 patent obvious, fails because LithoRec does not teach vacuum drying at a maximum pressure of 300 hPa. To the contrary, LithoRec recommends using a vibratory fluidized bed dryer, which relies on a forceful stream of gas, counter to vacuum drying. The proposed combination with Perry is untenable, because Perry is directed to drying by batch processing, whereas LithoRec specifically rejects batch processing. The proposed combination with

DIN 28400 to establish the 300 hPa limitation is improper; whereas Petitioner suggests that 300 hPa is definitional of a vacuum, DIN 28400 and the international standard it cites confirms that a vacuum is defined in relation to prevailing atmospheric pressure. The reference in DIN 28400 to 300 hPa only pertains to low pressure environments such as Mount Everest, inapposite here.

Ground 3 of Petitioner's argument, that LithoRec anticipates Claim 12 and its dependent claims, fails because LithoRec does not teach a vacuum installation "configured to generate a vacuum in the drying device." To the contrary, LithoRec expressly teaches the use of a "blower" in a "vibratory fluidized bed dryer," which generates a positive pressure to force air upwards through the drying bed to fluidize the material. Furthermore, there is no showing that the disclosed system would be "configured to inactivate" the shredded battery material. Rather, the continuous process disclosed would be poorly designed to dry the material to the point of inactivation.

Grounds 2 and 4 are directed to dependent claims, and accordingly fail for the reasons set forth concerning Grounds 1 and 3.

Throughout the Petition, references to what a person of skill would understand are asserted as bare attorney argument. Where Petitioner does cite an expert, those assertions are conclusory, unsupported, and should be disregarded.

Accordingly, Patent Owner requests that the Board deny institution of *inter partes* review.

II. FACTUAL BACKGROUND

A. The growth of the electric vehicle market in the 2010's spurred demand for battery recycling

In the early 2010's the growing market for electric vehicles prompted the question of how to safely recycle the batteries from these cars. Ex. 2001 at 1:18-21. It was well-understood that there would be an ecological and economic benefit if parties could achieve efficient recycling of electric vehicle ("EV") batteries and the precious metals contained therein. Ex. 2002 at 1:23-25. However, the complex design of the EV batteries and the toxic nature of active compounds therein posed challenges in designing a safe and effective EV battery recycling system. Ex. 1020 at 1; Ex. 2001 at 1:22-27; Ex. 2002 at 2:37-40; Ex. 2010 at ¶¶48-50.

It was generally recognized that centralized recycling plants would be necessary to perform many of the steps in the recycling process. Ex. 1016 at 51-53, Figure A-18; Ex. 2010 at ¶48. In particular, the energy-intensive process of stripping the most precious metals from the battery involved hazardous chemicals, calling for centralized recycling facilities. Ex. 1016 at 24 ("the battery systems contain a highly reactive battery electrolyte as the main chemical hazard carrier"); Ex. 2010 at ¶48-49. A basic question arose—how to transport batteries to the

central processing facilities for extracting the metals. Ex. 1016 at 33; Ex. 2010 at ¶48-49.

Transportation of used batteries was a fundamental problem. Ex. 1016 at 21; Ex. 2010 at ¶48. It was understood that EV batteries contained toxic chemicals, which could react in hazardous ways during shipment and storage. Ex. 2004 at 002:0002; Ex. 1016 at 33; Ex. 2010 at ¶49. Thus, there was a need for collecting the batteries locally and inactivating their chemical constituents, to ensure safe transport to a centralized facility for further processing. Ex. 1016 at 33 (“The danger posed by defective batteries must be eliminated by suitable measures before transportation (deactivation).”); Ex. 2010 at ¶49.

B. EV battery chemistry and its hazards

Each EV battery contains a collection of cells, at the heart of which is a pair of electrodes between which the electric current flows. Ex. 2010 at ¶40. Figure 1 below is an image of an EV battery. Ex. 2006 at 005; Ex. 2010 at ¶40. At the bottom right of this diagram is a cutaway cross-section of a battery cell, showing the layers of foils and separators making up the cell. Ex. 2006 at 005; Ex. 2010 at ¶40. The schematic illustrates the primary components of the cell. Ex. 2006 at 005; Ex. 2010 at ¶40.

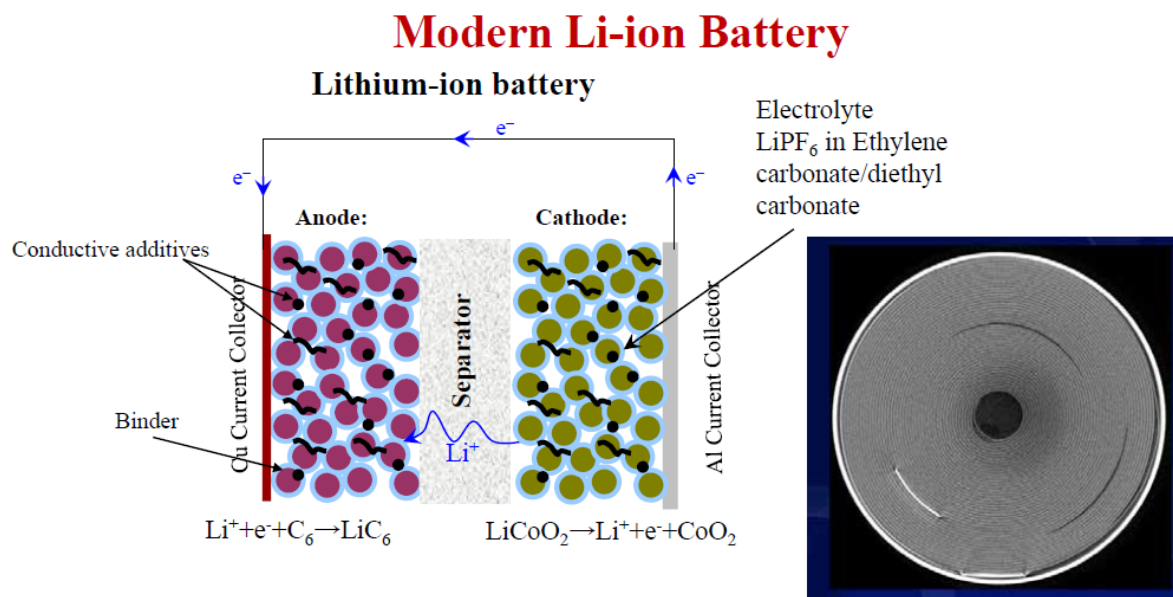


Figure 1: Schematic of Lithium-Ion Battery

Electrodes. The positive electrode is the cathode, which is typically composed of lithium metal oxides such as lithium cobalt oxide (LiCoO₂), lithium iron phosphate (LiFePO₄), or nickel manganese cobalt oxide (NMC). Ex. 1020 at 4; Ex. 2010 at ¶41. These metal oxides are mounted onto a support, with the aid of a binder, discussed below. Ex. 2006 at 005; Ex. 2010 at ¶41. The support of the cathode is typically aluminum foil. Ex. 2006 at 005; Ex. 2010 at ¶41. The negative electrode is the anode, which is usually made from graphite. Ex. 1020 at 4; Ex. 2010 at ¶42. The support for the anode is typically copper foil. Ex. 2006 at 005; Ex. 2010 at ¶42.

Separator. The cathode and the anode are separated by a thin, porous membrane called a separator. Ex. 2006 at 005; Ex. 2010 at ¶43. Without the

separator, the two electrodes would touch, causing the EV battery to short-circuit. Ex. 2010 at ¶43. The separator allows the lithium ions to pass freely between the cathode and the anode. Ex. 2006 at 005; Ex. 2010 at ¶43. In order for lithium to travel between the electrodes, the lithium needs to be dissolved in a liquid solvent. Ex. 2006 at 005; Ex. 2010 at ¶¶43-44.

Solvent and lithium salt. The solvent typically consists of one or more organic compounds such as ethylene carbonate or dimethyl carbonate, among others. Ex. 2006 at 005; Ex. 2010 at ¶44. Lithium is typically introduced in the form of lithium hexafluorophosphate (LiPF_6), which dissolves in the solvent, producing the lithium ions. Ex. 2006 at 005; Ex. 2010 at ¶44. The lithium salt, dissolved in the solvent, is referred to as the electrolyte, which transits back and forth between the cathode and the anode as the battery is charged and discharged. Ex. 2006 at 005; Ex. 2010 at ¶44.

Binder. The binder, shown in blue in Figure 1 above, holds the metal oxides onto electrode support foils, and is typically a polymer like polyvinylidene fluoride (PVDF). Ex. 2006 at 005; Ex. 1020 at 4; Ex. 2010 at ¶45. The binder affixes the precious metal oxides onto the surface of the foils, thereby maintaining the structural integrity of the electrodes. Ex. 1020 at 1; Ex. 2010 at ¶45. The binder is chemically stable and designed to withstand the battery's chemical environment and the mechanical stresses over its lifetime. Ex. 2010 at ¶45.

Decomposition of binder. During the recycling process, in order to retrieve the metal oxides from the cells, conventionally, high heat processes were used to decompose the binder. Ex. 1020 at 3; Ex. 2010 at ¶46. Due to the stable nature of the binder, a high heat furnace (typically temperatures of 350-800°C) is used to decompose the binder. Ex. 1020 at 5. Once the binder decomposes, the shredded material is reduced to a black powder. Ex. 2010 at ¶46.

The high heat environment in the decomposition furnace can create unwanted by-products. Ex. 2010 at ¶47. For example, the conducting salt lithium hexafluorophosphate (LiPF_6) and the binder PVDF may decompose into a toxic gas, including hydrogen fluoride (“HF”). Ex. 2001 at 1:22-27. This volatile gas will corrode glass, break seals on industrial machinery, and, if inhaled by humans, it can be fatal. Ex. 2010 at ¶47.

In order to make these batteries more amenable to storage and transport, it was advantageous to shred (*i.e.*, comminute) them. Ex. 2010 at ¶48.

“Comminuting” is the term used in the art for shredding the material. *Id.*

Shredding the batteries grinds the structures of the cells, making them more compact and facilitating the downstream processing. Ex. 1016 at 177; Ex. 2010 at ¶48. The shredders break down the batteries into an unstructured bulk, resulting in a stew of various chemical compounds all mixed together. Ex. 1016 at 177.

By the early 2010's, the literature recognized that shredded batteries presented hazards of ignition, explosion, and other chemical reactions. Ex. 2004 at 002:0004; Ex. 2010 at ¶49.

C. Prior attempts to solve the inactivation-transport problem

Many companies tried and failed to develop methods for inactivating lithium-ion batteries for safe storage and transport. Companies proposed various additives to mix with the comminuted material to suppress the hazards, including: flame retardants (Ex. 2008 at 4:1-6); aqueous solution or a deactivating powder (Ex. 2004 at 005:0034-0035); mineral acids (Ex. 2001 at 11:13-17, 4:38-47, 5:18-52, 5:64-67); brine solutions (Ex. 2002 at 5:4-11, 5:18-25, 5:31-34, 5:40-42); and pressurized solvents (Ex. 2011 at 3:3-5). Ex. 2010 at ¶¶50-56.

All these prior art techniques proposed adding foreign substances to the shredded bulk for inactivation. Ex. 2010 at ¶¶50-56. However, adding foreign substances to the batteries had deleterious effects on the recycling process. *See* Ex. 1001 at 2:6-12 (teaching that avoiding the addition of foreign substances has great benefits because it “decreases the complexity of the battery processing, reduces the weight of the inactivated comminuted material and increases the purity in the subsequent separation and recycling steps”); Ex. 2010 at ¶56. Moreover, treatment with aqueous solutions risks partial electrolysis, which could lead to hazards from gas formation. Ex. 2010 at ¶56.

D. The '097 patent

The advance at the heart of the '097 patent was recognizing that shredded batteries could be inactivated through the drying process itself by vacuum drying at a maximum pressure of 300 hPa. Ex. 2010 at ¶57. In particular, the inventors discovered that additives, as had been used in the prior art, were unnecessary. Ex. 2010 at ¶57. Rather, they determined that these additives acted as contaminants and compromised the quality of the recycled product. Furthermore, the inventors recognized the opportunity to avoid the use of high heat during the drying process to prevent the formation of toxic gases, particularly hydrogen fluoride. Ex. 1001 at 2:5-12; Ex. 2010 at ¶57.

Surprisingly, the inventors were able to vacuum-dry the shredded material at a maximum pressure of 300 hPa and achieve inactivation of the material without addition of contaminants. Shredded material is rendered “inactivated” after the drying process is complete. *See* Ex. 1001 8:54-55 (“The drying of the comminuted material results in inactivated comminuted material.”); Ex. 2010 at ¶¶57-59. The '097 patent explains the goal of inactivating the battery material as follows:

The advantage of the invention is that the amount of electrolyte that can be obtained from the comminuted material through drying is such that an electrochemical reaction is no longer possible, or only to a negligibly small extent. In addition, no flammable or explosive gas phase forms above the battery fragments, as the organic carbonates of

the electrolyte have been removed [from the fragments]. The comminuted material is therefore largely inert and can be transported safely, especially if it is packed under vacuum.

Ex. 1001 at 1:63-2:4. The inactivated comminuted material can be shipped to a central facility for further processing, such as decomposing the binder and extracting the precious metal oxides. Ex. 1001 at 5:46-6:15; Ex. 2010 at ¶59.

On April 28, 2015, the underlying patent application (DE 10 2015 207 843.4) was filed in Germany by Lion Engineering, the predecessor to Duesenfeld (the “German Application”). Ex. 1002 at 345. On April 28, 2016, Lion Engineering filed PCT Application No. PCT /EP1016/059526, assigning it to Duesenfeld that same day. Ex. 1002 at 337-338. On October 26, 2017, Duesenfeld filed corresponding U.S. Patent Application No. 15/569,484 (the “U.S. Application”). Ex. 1002 at 264. In recognition of the merit of the invention, the USPTO issued U.S. Patent No. 11,050,097. The ’097 patent claims priority through the German Application. Ex. 1001.

Independent Claim 1 of the ’097 patent recites a method for safely inactivating batteries for secure storage or transport:

1. A method for the treatment of used batteries, comprising the steps:

- (a) comminuting the batteries such that comminuted material is obtained;

- (b) inactivating the comminuted material such that an inactivated comminuted material is obtained, wherein the inactivating step is performed during or after the comminuting step; and
- (c) filling a transport container with the inactivated comminuted material;

wherein the inactivating step is performed by drying the comminuted material, and

wherein the drying occurs at a maximum pressure of 300 hPa.

Ex. 1001 at 10:45-59; Ex. 2010 at ¶61. Claims 2–11 depend from Claim 1. Ex. 1001 at 10:60-11:47.

Independent Claim 12 recites a battery processing installation configured to inactivate batteries via a drying process for transport:

12. A battery processing installation for treatment of used batteries, comprising:

- (a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;
- (b) an inactivation device comprising a drying device configured to inactivate the comminuted material, wherein the inactivation device is configured to perform

the inactivating step during or after the comminuting step of the comminution unit;

- (c) a filling device configured to fill a test transport container with the inactivated comminuted material; and
- (d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.

Ex. 1001 at 11:50-62; Ex. 2010 at ¶62. Claims 13–21 depend from Claim 12.

Ex. 1001 at 11:62-12:62.

The specification teaches how to obtain inactivated comminuted material that is suitable for transport. *Id.* at 1:64-2:12; Ex. 2010 at ¶63. The specification emphasizes drying under low pressure, while avoiding high temperatures. *Id.* at 3:7-9 (“It is beneficial if the drying occurs at a maximum pressure of 300 hPa, in particular a maximum of 100 hPa.”); *see id.* at 3:5-7 (“The size of the vacuum is preferably selected such that the vapour pressure of dimethyl carbonate at 80°C., especially at 70° C., is not reached.”); Ex. 2010 at ¶64. These conditions contribute to safe inactivation of electrolytes and associated solvents without formation of hydrogen fluoride. Ex. 1001 at 3:9-14; Ex. 2010 at ¶64.

The comminuted material is dried until its electrolyte content is low enough to prevent any electrochemical reactions. Ex. 1001 at 4:5-7 (“The comminuted material is preferably dried until an electrolyte content in the comminuted material

is so low that an electrochemical reaction is impossible.”); Ex. 2010 at ¶58. The inactivated comminuted material is safe for transport, and thus can be filled into a transport container under a vacuum or inert gas and safely shipped. Ex. 1001 8:56-58 (“A transport container **46** is then filled with the inactivated comminuted material **42** under vacuum and/or shielding gas.”); Ex. 2010 at ¶¶58-59.

E. Related parties, litigation, and proceedings

The invention arose out of work being done at the German Technische Universität Braunschweig (“TU Braunschweig”) by four researchers: Christian Hanisch, Bastian Georg Westphal, Wolfgang Haselrieder, and Martin Schoenitz. Ex. 1001. In 2011, based on their work at TU Braunschweig, they formed Lion Engineering, which filed the German Application. Ex. 1002 at 345. As the promise of this technology grew, Mr. Hanisch worked to form a successor company, Duesenfeld GmbH, to which the ’097 patent is assigned. Ex. 1002 at 337.

Duesenfeld. Since its founding in 2016, Duesenfeld has been at the forefront of safe and energy-efficient EV battery recycling. Today, Duesenfeld operates a recycling plant in Wendeburg, Germany. Ex. 2021. Duesenfeld’s dedication to research and development has made Duesenfeld a technology leader in the recycling of lithium-ion batteries, as evidenced by the 2024 German Sustainability Award Duesenfeld received. Ex. 2021.

Ascend. In March 2023, Ascend Elements, Inc. (“Ascend”) opened an EV battery recycling plant in Covington, Georgia. Ex. 2022. Ascend purchased its vacuum drying equipment from Petitioner URT. Ex. 2023 at ¶7.

URT. URT is a German company that builds equipment for recycling EV batteries. Ascend purchased its infringing vacuum drying equipment from URT.

District court litigation. On October 23, 2023, Duesenfeld filed a lawsuit against Ascend in the U.S. District Court for the District of Delaware, asserting that Ascend’s use of its vacuum drying equipment supplied by URT infringes the ’097 patent. *See Duesenfeld GmbH v. Ascend Elements, Inc.*, Case No. 1-23-cv-01194 (D. Del.). The parties are in discovery, and the claim construction hearing is set for December 19, 2024. Ex. 2024.

Overlapping IPR petitions. On May 1, 2024, Petitioner URT filed the present Petition. On May 21, 2024, Ascend filed a parallel petition, Case No. IPR2024-00948 (“Ascend Petition”). The two parties challenge almost the same claims: URT challenges Claims 1-3, 7-10, 12-13, and 15-19 of the ’097 patent. *See* Pet. at 4-5. Ascend challenges Claims 1-3, 7-10, 12-13, and 19 of the ’097 patent. *See* Ascend Petition at 3.

III. URT’S PETITION

URT asserts as the basis of its challenge a non-patent publication, *LithoRec – Recycling Lithium Ion Batteries* (“LithoRec”), in the following grounds:

Grounds	Bases	References	Challenged Claims
Ground 1	103	Over LithoRec in view of DIN 58400 and Perry	1-2, 7-8, 10
Ground 2	103	LithoRec	9
Ground 3	102	LithoRec	12-13, 15-16, 18-19
Ground 4	103	Over LithoRec in view of Hanisch, DIN 58400 and Perry	17

A. LithoRec

In 2009, a group of researchers from TU Braunschweig, along with several EV industry partners (together, the “LithoRec Partners”), embarked on a two-year study of EV battery recycling techniques. Ex. 2010 at ¶¶65-66. The LithoRec Partners investigated of a wide range of considerations for EV battery recycling, including: supply and demand considerations (Ex. 1016 at 21-23); storage and transport constraints (Ex. 1016 at 32-33); disassembly techniques (Ex. 1016 at 1-2); separation of foils from active materials (Ex. 1016 at 101); hydrometallurgical processing (Ex. 1016 at 110-124); and synthesis of new electrodes from recycled materials (Ex. 1016 at 143-155). Ex. 2010 at ¶67.

Having determined that they could manufacture electrodes from recycled materials, the LithoRec Partners considered next steps. They envisioned a concept

for a pilot plant for shredding batteries for subsequent processing. Ex. 2010 at ¶68. LithoRec introduces this proposal in a section entitled “*Conceptual design of a recycling pilot plant*” by saying that “a possible recycling plant was conceptualized.” Ex. 1016 at 222. LithoRec emphasizes that this would be an entirely new and untested concept. *Id.* (“The entire facility is a new design, *i.e.*, no existing facility is being converted or extended, but a completely new facility is being built on a greenfield site.”); Ex. 2010 at ¶68. Although LithoRec mentions the possibility of drying, the LithoRec Partners emphasized that they were offering only a sketch of a possible plant, without input from the industry manufacturers, and not based on data. *See* Ex. 1016 at 226 (“As there is currently no reliable data on the substances contained in the battery cells that would allow drying to be reliably designed, only a rough estimate of drying can be made at this point.”); Ex. 2010 at ¶68. The LithoRec Partners requested quotes from dryer manufacturers, but no company responded to that request. Ex. 1016 at 226 (“The manufacturers of drying systems could not be persuaded to submit an offer under the given circumstances.”); Ex. 2010 at ¶68.

The LithoRec Partners also included a suggestion of a specific dryer: a vibratory fluidized bed dryer. Ex. 1016 at 227; Ex. 2010 at ¶¶69. A vibratory fluidized bed dryer is a machine that uses hot gases blown at high velocity to agitate and dry the material. Ex. 2012 at 1; Ex. 2010 at ¶¶69-72. It is not a

vacuum dryer. Ex. 2012 at 1; Ex. 2010 at ¶97. LithoRec specifies that the drying system contains a “blower,” which generates positive pressure. Ex. 1016 at 235; Ex. 2010 at ¶¶71, 74 & 98. For shredding the batteries, LithoRec specifies the use of a “cross-flow hogger,” which does not work under vacuum. Ex. 1016 at 235; Ex. 2010 at ¶¶ 100-108.

LithoRec discusses the hazards arising from the chemical properties of batteries and notes that their flammability “speaks in favor of drying under vacuum, as the drying temperature can be kept low.” Ex. 1016 at 226; Ex. 2010 at ¶94. However, drying under vacuum is contrary to LithoRec’s instruction to use a vibratory fluidized bed dryer and a cross-flow hogger. Ex. 2010 at, ¶¶97-99, 100-108.

LithoRec also recommended that the system be a continuous drying process, and specifically rejected a batch process. Ex. 1016 at 226; Ex. 2010 at ¶115. In a continuous drying process, wet material is fluidized with partially-dried material, and quantities of this heterogeneous mass exit the dryer on a continuous basis. Ex. 2010 at ¶118-120. LithoRec does not provide any mechanism for determining if the material exiting the system would be sufficiently inactivated to be safe for transport in light of the continuous addition of wet material into the system. Ex. 1016 at 222-236; Ex. 2010 at ¶120.

B. Perry

Perry's Chemical Engineers' Handbook is a reference book. Ex. 1006; Ex. 2010 at ¶78. The portion of Perry relied on by Petitioner is entitled "*Batch Through-Circulation Dryers*." Ex. 1006 at 12-44; Ex. 2010 at ¶78. This section is dedicated entirely to batch drying. Ex. 1006 at 12-44; Ex. 2010 at ¶78. Where Perry does talk about a vacuum dryer, it is expressly directed to small items that are placed on shelves and dried in small batches, such as pharmaceuticals. Ex. 1006 at 12-44; Ex. 2010 at ¶81. Perry discloses nothing about EV battery recycling. Ex. 1006 at 12-44; Ex. 2010 at ¶82. Perry is also silent as to the continuous drying systems recommended in LithoRec. Ex. 1016 at 226; Ex. 2010 at ¶78; 82.

C. DIN 28400

DIN 28400 is a German glossary of terms related to vacuum technology. Ex. 1018; Ex. 2010 at ¶83. DIN 28400 lists different ranges of vacuum pressures, from low vacuum to ultra-high vacuum. Ex. 1018 at 1 DIN 28400 Part 1, Section 1; Ex. 2010 at ¶83. DIN 28400 defines the pressure range for a low vacuum as extending from 1000 hPa to 1 hPa (or 1000 mbar to 1 mbar). Ex. 1018 at 1 DIN 28400 Part 1, Section 1, Table 1; Ex. 2010 at ¶88. The mention in DIN 28400 of "300 mbar" (*i.e.*, 300 hPa) is merely a reference to the "lowest atmospheric pressure on the Earth's surface," *i.e.*, atop Mount Everest, which is inapposite here, and would not

teach a person of skill anything about the proper pressure for drying EV batteries.

Ex. 2010 at ¶¶130-135. DIN 28400 provides no teachings related to any particular application of vacuum technology. Ex. 2010 at ¶89.

IV. PERSON OF ORDINARY SKILL IN THE ART

Petitioner contends that at the time the U.S. Application was filed, an ordinarily skilled artisan “would have had a B.S. degree in electrical engineering, materials science, chemical engineering, or an equivalent field, as well as at least 2 to 3 years of academic or industry in the recycling or processing of lithium-ion batteries.” *See* Pet. at 14. For the purpose of this POPR, the Patent Owner is not contesting Petitioner’s definition. Under any definition of person skilled in the art, Petitioner has failed to establish that there is a reasonable likelihood of prevailing with respect to any of the challenged claims.

V. LEGAL STANDARD

A. The legal standard for obviousness

In an IPR, “the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 1016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

The legal question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of obviousness or nonobviousness. *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1 (1966). “[O]bviousness requires a suggestion of all limitations in a claim.” *CFMT, Inc. v. Yieldup Int’l Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) (citing *In re Royka*, 490 F.2d 981, 985 (CCPA 1974)). Further, obviousness determinations must be made without “any hint of hindsight.” See *Star Sci., Inc. v. R.J. Reynolds Tobacco Co.*, 655 F.3d 1364, 1375 (Fed. Cir. 2011). The patent-in-suit may not be used “as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.” *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011).

Petitioner must establish with specificity that a person skilled in the art would have been motivated to combine the asserted references. *In re Nuvasive, Inc.*, 842 F.3d 1376, 1381–82 (Fed. Cir. 1016) (To establish a motivation to combine, the factual inquiry into the reasons for “combin[ing] references must be thorough and searching, and the need for specificity pervades.”).

To invalidate a claim as obvious, Petitioner must also show “that the skilled artisan would have had a reasonable expectation of success in doing so.” *Proctor*

& Gamble Co. v. Teva Pharms. USA Inc., 566 F.3d 989, 994 (Fed. Cir. 2009) (citations omitted); *see also Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013) (ruling that “[a]n invention is not obvious just because all of the elements that comprise the invention were known in the prior art; rather a finding of obviousness at the time of invention requires a plausible rationale as to why the prior art references would have worked together,” and noting that the rejected prior art combination “would not have worked for its intended purpose”).

If an independent claim is not obvious then its dependent claims also cannot be obvious because they all depend from a nonobvious claim. *Ortho-McNeil Pharmaceutical, Inc. v. Mylan Laboratories, Inc.*, 520 F.3d 1358, 1365 (Fed. Cir. 2008).

B. The legal standard for anticipation

Prior art does not anticipate a claimed invention unless it discloses all elements of the claim within the four corners of the document. *Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1068 (Fed. Cir. 2017). “To anticipate, the reference must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements arranged as in the claim.” *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1083 (Fed. Cir. 2008); *see also Microboards Tech., LLC d/b/a Afinia v. Stratasys Inc.*, IPR2015-00287, Paper 13 at 10 (PTAB May 28, 2015) (citing *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d

1359, 1369 (Fed. Cir. 2008)). A single reference must “describe the claimed invention *with sufficient precision and detail* to establish that the subject matter existed in the prior art,” and “ambiguous references do not, as a matter of law, anticipate a claim.” *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1284 (Fed. Cir. 2017).

C. The legal requirement that prior art be enabling

To render a claim unpatentable, either for anticipation or obviousness, prior art must be enabling. *Impax Labs., Inc. v. Aventis Pharms. Inc.*, 545 F.3d 1312, 1314 (Fed. Cir. 2008) (“A prior art reference must enable one of ordinary skill in the art make the invention without undue experimentation. In other words, the prior art must enable the claimed invention.”); *United States v. Telectronics, Inc.*, 857 F.2d 778, 785 (Fed. Cir. 1988) (“The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation.”).

For anticipation, the prior art must be enabling, and the specific anticipatory disclosure must be enabled. *Elan Pharms., Inc. v. Mayo Found. for Med. Educ. & Research*, 346 F.3d 1051, 1054 (Fed. Cir. 2003) (“To serve as an anticipating reference, the reference must enable that which it is asserted to anticipate.”); *see also Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354 (Fed. Cir.

2003) (“A claimed invention cannot be anticipated by a prior art reference if the allegedly anticipatory disclosures cited as prior art are not enabled.”).

The requirement for prior art to be enabling extends to obviousness challenges. “To render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention.” *Raytheon Techs. Corp. v. General Elec. Co.*, 993 F.3d 1374, 1380 (Fed. Cir. 2021); *see also Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 (Fed. Cir. 1985) (“The test of whether a particular compound described in the prior art may have been relied upon to show that the claimed subject matter at issue would have been obvious is whether the prior art provided an enabling disclosure with respect to the disclosed prior art compound.”). While a non-enabling prior reference asserted under Section 103 may still be considered for all that it teaches, it nonetheless remains the rule that “the reference must necessarily enable the relied-upon portion of its own disclosure.” *Raytheon*, 993 F.3d at 1380-81. In this sense, the requirement that Section 103 prior art be enabling is “the same standard applied to anticipatory references.” *Id.* (“the evidence of record must still establish that a skilled artisan could have made the claimed invention”).

The burden to prove invalidity rests on Petitioner. 35 U.S.C. § 316(e). The burden to prove that the prior art is enabling, or not enabling, in PTAB proceedings has not been fully resolved. *See Samsung Elecs. Co., Ltd. v. Arbor Glob.*

Strategies LLC, No. IPR2020-01021, 2021 WL 6340993, at *16 (PTAB November 24, 2021) (“*Corephotonics* suggests but does not specify the contours of the enablement burden in an obviousness context in an AIA proceeding.”) (citing to *Apple Inc. v. Corephotonics, Ltd.*, 861 Fed. App’x. 443, 450 (Fed. Cir. 2021) (non-precedential) and relying on rule that “prior art patents and printed publications like Konno, a Japanese patent publication, are presumed enabled”).

Patent Owner is unaware of precedential authority relieving a challenger of the burden to prove enablement of the prior art in the context of non-patent publications that have not been considered by the Patent Office, such as LithoRec. *C.f. Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 457 F.3d 1293, 1307 (Fed. Cir. 2006) (“We established in *Amgen II* that when a piece of prior art is a patent, like the Sugimoto patent, there is a presumption of enablement.”); *In re Antor Media Corp.*, 689 F.3d 1282, 1288 (Fed. Cir. 2012) (“As the issue regarding non-patent publications is squarely before the court today, we now hold that a prior art printed publication cited by an examiner is presumptively enabling barring any showing to the contrary by a patent applicant or patentee.”). The LithoRec publication is non-patent literature that was never considered by the Patent Office. Therefore, the presumptions of enablement afforded by *Amgen* and *Antor* do not apply. The burden to prove that prior art is enabling should properly rest on Petitioner.

D. The requirement for specificity of evidence

IPR petitions must be properly supported with citations to the prior art and to a declaration presenting the perspectives of a person of ordinary skill in the art. *See* 35 U.S.C. § 312(a)(3) (providing that a Petition is required to identify “with particularity[] the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge”). Attorney argument is no substitute for properly asserted evidence. *Vivid Technologies, Inc. v. American Science & Engineering, Inc.*, 200 F.3d 795, 812 (Fed. Cir. 1999) (“The truth of a disputed material fact cannot be established on attorney statement alone.”). General statements of what a person skilled in the art would know or do must be supported by citations to the evidence on record. *See Estee Lauder Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 595 (Fed. Cir. 1997) (“Arguments of counsel cannot take the place of evidence lacking in the record.”); *C.R. Bard, Inc. v. Medline Indus., Inc.*, IPR2015-00511, Paper 9 at 15 (PTAB July 15, 2015) (“mere conclusory statements fail to meet the statutory requirements”); *see also Ariosa Diagnostics v. Verinata Health, Inc.*, IPR2013-00276, Paper 43, 16-17 (PTAB October 23, 2014) (declining to “search through the record and piece together those teachings that might support Petitioner’s position”); *DeSilva v. DiLeonardi*, 181 F.3d 865, 867 (Fed. Cir. 1999) (“A brief must make all arguments accessible to the judges, rather than ask them to play archeologist with the record.”).

Moreover, conclusory assertions from an expert are entitled to little or no weight. 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

VI. CLAIM CONSTRUCTION

Claim construction is not required to deny the Petition. Petitioner has not sought claim construction. Accordingly, the claims should be given their ordinary and customary meaning, in light of the specification and prosecution history, as understood by a person of ordinary skill in the art. 37 C.F.R. § 100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Patent Owner reserves the right to respond to claim construction arguments that may be asserted subsequently by Petitioner.

VII. URT’S PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT AT LEAST ONE OF THE CHALLENGED CLAIMS IS INVALID

A. Ground 1: LithoRec does not teach the “inactivating” and “maximum pressure of 300hPa” limitations, and Petitioner’s proposed combinations are untenable

Ground 1 of the Petition fails to raise a reasonable likelihood that one or more of the challenged Claims (1-3, 7-8, and 10) are invalid for obviousness.

1. LithoRec does not teach the limitations of “inactivating the comminuted material such that an inactivated comminuted material is obtained,” and drying “at a maximum pressure of 300 hPa”

Petitioner contends that LithoRec teaches the use of vacuum drying to inactivate the comminuted battery material. However, it is undisputed that LithoRec does not teach drying the comminuted material “at a maximum pressure of 300 hPa.” *See* Pet. at 25. Moreover, LithoRec does not disclose “inactivating the comminuted material such that an inactivated comminuted material is obtained.” Ex. 2010 at ¶¶91, 93.

LithoRec’s discussion of a pilot plant for recycling EV batteries is conceptual. Ex. 1016 at 222-236; Ex. 2010 at ¶68. Following the writeup of their research, the LithoRec Partners concluded with a section positing a “[c]onceptual design of a recycling pilot plant.” Ex. 1016 at 222. The report introduces this proposal by saying that “a possible recycling plant was conceptualized.” *Id.* The LithoRec Partners emphasized that they were offering only a sketch of a possible plant, without input from the industry manufacturers, and not based on data. *See* Ex. 1016 at 226; Ex. 2010 at ¶68. This conceptual proposal does not teach vacuum drying. Ex. 2010 at ¶¶93-94.

i. Vibratory fluidized bed dryers do not operate under vacuum

The device that LithoRec recommends for performing drying is a vibratory fluidized bed dryer. Ex. 1016 at 227; Ex. 2010 at ¶¶69, 95. The LithoRec Partners explained that the liquid to be evaporated adheres to the foils, and therefore they recommended the use of “mechanical stress” to agitate the materials. Ex. 1016 at 227; Ex. 2010 at ¶¶69-70. LithoRec counseled the use of a dryer “that can ensure material transport by exciting the flow bottom.” Ex. 1016 at 227; Ex. 2010 at ¶70. LithoRec recommended a vibratory fluidized bed dryer. Ex. 1016 at 227; Ex. 2010 at ¶¶71, 95.

A vibratory fluidized bed dryer utilizes high-velocity heated gas, typically air or nitrogen, to simultaneously agitate and dry materials. Ex. 2010 at ¶¶ 69, 95-96; Ex. 2012 at 1. The combination of gas flow and vibratory motion creates a fluidized state where materials are suspended and in constant motion. Ex. 2010 at ¶¶95-96. Fluidized bed dryers typically operate under atmospheric pressure, not vacuum. Ex. 2012 at 1 (“Thermodynamically, it is a constant heat process which makes it adiabatic, and it typically occurs at *atmospheric pressure.*”); Ex. 2010 at ¶97 (emphasis added).

LithoRec specifies that the drying system contain a “blower.” Ex. 1016 at 235; Ex. 2010 at ¶¶71-72, 74, 98. Blowers are used in fluidized bed dryers to

generate a forceful flow of gas to fluidize the material being dried. Ex. 2012 at 1 (“Add air that is simultaneously forced up openings in the conveying surface so it permeates through the mat depth of material.”); Ex. 2010 at ¶98. A blower generates positive pressure, not a vacuum. Ex. 2010 at ¶98.

ii. Cross-flow hoggers do not operate under vacuum

The shredder specified by LithoRec is called a “cross-flow hogger” in Table G-7, also referred to as a “cross flow flaker,” or “QZ” (from German “Querstromzerspaner”). Ex. 1016 at 227, 235; Ex. 1004 at 265; Ex. 2010 at ¶ 100. LithoRec specifies the use of a “QZ 1200 depressurized” cross-flow hogger from MEWA. Ex. 1016 at 235. A manual for this device (in German), dated 2009, is attached as Exhibit 2013. A certified copy of the English translation of the MEWA manual is attached as Exhibit 2014. A cross-flow hogger contains a rotary hammer mounted on a chain, that whirls at high forces and smashes into materials (like EV batteries), breaking them into pieces. Ex. 2010 at ¶¶101-103; Ex. 2014 at 81. The metal-on-metal smashing generates a tremendous amount of heat. Ex. 2010 at ¶104. A flow of gas is needed to cool the device and additionally to carry away dust particles generated by the hammering. Ex. 2010 at ¶104. LithoRec depicts this flow of gas to remove the dust, with a dotted line going from the cross-flow hogger to the Jet filter. Ex. 1016 at 230; Ex. 2010 at ¶104.

Cross-flow hoggers typically run at atmosphere pressure. Ex. 2010 at ¶107. These systems cannot run in a vacuum, because the convective heat capacity of the gas at atmospheric pressure is needed to cool the system, and a robust flow of gas is needed to carry away the dust. Ex. 2010 at ¶107. The QZ 1200 specified in LithoRec can be equipped with an inert gas system, to run the device under nitrogen. Ex. 2014 at 52. As confirmation that the system does not run under vacuum, it states that a fault may trigger if the nitrogen pressure drops. Ex. 2014 at 52 (“Leakage in the gas-tight enclosure. Insufficient nitrogen inertization (tank pressure dropped?).”); Ex. 2010 at ¶107. The only time the QZ 1200 manual mentions the word “vacuum” is in the context of the occasional need to clean the unit with a vacuum cleaner. Ex. 2010 at ¶106.

LithoRec specifies the cross-flow hogger as “QZ 1200 depressurized.” Ex. 1016 at 235. The description of “depressurized” refers to the ability to depressurize the device due to the build-up of solvent vapors in the controlled nitrogen atmosphere as heat is generated by the hammering action and the solvents volatilize. Ex. 2010 at ¶105. This is further confirmation that the cross-flow hogger does not run under vacuum—there would be no need to depressurize it if it operated at less than atmospheric pressure. Ex. 2010 at ¶105.

LithoRec depicts the cross-flow hogger as being connected to the same nitrogen circuit as the dryer. Ex. 1016 at 230; *see also id.* at 227 (“It is planned to

combine the drying gas of the dryer and the purge gas of the pre-shredder in a common gas circuit, the nitrogen circuit, as both units require gas circuits with a comparable structure.”). Because the cross-flow hogger operates at atmospheric pressure, emptying into the dryer, and the two devices share the same nitrogen circuit, both devices are at atmospheric pressure. Ex. 2010 at ¶¶100, 107, 143.

iii. The suggestions in LithoRec do not establish vacuum drying

Petitioner relies on a suggestion in LithoRec concerning the use of vacuum drying: “As some of the liquids to be vaporized are highly flammable solvents, the drying temperature should probably be severely restricted. This in turn speaks in favor of drying under vacuum, as the drying temperature can be kept low.” *Id.* at 226. However, LithoRec does not disclose a vacuum pressure; it does not disclose the target of inactivation; nor does it disclose a vacuum pump. Ex. 2010 at ¶¶109-110, 121-122. The only disclosure of a device that could generate a negative pressure is a “Fan.” *See* Ex. 1016 at 230 (Figure G-1). A “fan” is not a “vacuum pump.” Ex. 2010 at ¶¶109-110.

The “Fan” disclosed in LithoRec might be able to achieve a slight underpressure in the nitrogen circuit, which is consistent with workplace safety goals. Ex. 1016 at 227 (stating the need “to ensure the negative pressure in the gas circuit at all times”). By keeping a slight negative pressure, if there is leak, then ambient air is pulled into the system, and dust and toxic substances cannot escape.

Ex. 2010 at ¶113. Typically, a negative pressure of less than 1 hPa would be sufficient to ensure this workplace safety goal. Ex. 2010 at ¶113; Ex. 2017.

LithoRec depicts the fan as being positioned in the exhaust system, diverting some of the nitrogen gas through an “activated carbon filter” to the environment. Ex. 1016 at 230; Ex. 2010 at ¶111; *see also* Ex. 1016 at 227 (“In order to ensure the negative pressure in the gas circuit at all times, a partial quantity of gas must be discharged from the system into the environment. Due to the solvent residue it contains, the discharged gas must be cleaned using an activated carbon filter (3.09) before it can be released into the atmosphere.”). Ex. 2010 at ¶111.

Because the fan is venting to atmospheric pressure, the output of the fan is approximately atmospheric pressure. Ex. 2010 at ¶112. As depicted in LithoRec, this same output of the fan is circulated throughout the nitrogen circuit. Ex. 1016 at 230 (dotted line exiting the fan, and branching off to the filter and back to the shredding/drying system); Ex. 2010 at ¶112. Thus, the flow diagram indicates that the fan is supplying approximately atmospheric pressure back to the shredding/drying system. Ex. 2010 at ¶112. This makes sense, because the cross-flow hogger and the vibratory fluidized bed dryer need atmospheric pressure. Ex. 2010 at ¶114. If the fan were to generate any negative pressure at all, for workplace safety reasons, it would only be a slight underpressure. Ex. 2010 at ¶113; Ex. 2017. Having a slight underpressure in the exhaust system says nothing

about the pressure in the dryer, where there is a blower generating positive pressure. Ex. 2010 at ¶¶98, 109-114, 157-158.

Thus, despite LithoRec's stated objective that the process "speaks in favor of drying under vacuum" and "eliminates the potential hazard of flammable solvents," the conceptual system discussed does not teach or enable realizing this target. Ex. 1016 at 226; Ex. 2010 at ¶¶99, 107, 120-121, 123. Rather, it is only "assumed" that the flammable solvents are removed. Ex. 1016 at 229 ("If it is assumed that all volatile, highly flammable solvents have been removed during the drying process, no explosion protection is required for the dedusting of the sorting plant from the dryer discharge."); Ex. 2010 at ¶¶123, 164-168. This assumption is unfounded and cannot support a determination of obviousness. *Star Scientific, Inc. v. R.J. Reynolds Tobacco Co.*, 655 F.3d 1364, 1375–76 (Fed. Cir. 2011) (prior art's "speculative and tentative disclosure of what 'might' or 'may' [occur] does not sufficiently direct or instruct one of skill in this art").

To try to justify its argument that LithoRec discloses inactivating the comminuted material, Petitioner attempts to use teachings from the '097 patent, regarding the goal of removing dimethyl carbonate, to underpin its argument about the teachings of LithoRec. *See* Pet. at 22. It is impermissible hindsight to use the teachings of the '097 patent. *See Otsuka Pharm. Co. v. Sandoz, Inc.*, 678 F.3d 1280, 1296 (Fed. Cir. 2012) (explaining that an obviousness conclusion may not be

derived based on hindsight from “[t]he inventor’s own path”); *NTP*, 654 F.3d at 1299.

Moreover, Petitioner mischaracterizes the ’097 patent in arguing that once some solvent is removed through a drying process, the material is “inactivated.” *See* Pet. at 23 (“Thus, a POSITA would understand that according to the ’097 patent, the comminuted material is considered to be inactivated when at least one solvent in a conducting salt (e.g., dimethyl carbonate and/or ethyl methyl carbonate) is removed by way of a drying process – which LithoRec clearly does.”); Ex. 2010 at ¶58. This attorney argument cites no expert declaration and is therefore insufficient to carry Petitioner’s burden. *See, e.g., Samsung Elecs. Co. v. Elm 3DS Innovations*, IPR2016-00393, Paper 62, 37 (PTAB Jun. 23, 2017); *Netflix Inc. v. DivX LLC*, IPR2020-00558, Paper 50, 21 fn. 5 (PTAB Aug. 23, 2021). Moreover, Petitioner’s argument is contrary to the teachings of the ’097 patent that inactivation is the end result of drying, not just a result of a portion of the solvent being dried. *See, e.g.,* Ex. 1001 at 8:54-55 (“The drying of the comminuted material results in inactivated comminuted material.”); *see also id.* at 3:49-4:7 (describing how to determine if the drying of the comminuted material is complete).

Accordingly, LithoRec does not disclose the limitations of: “inactivating the comminuted material such than an inactivated comminuted material is obtained” or “at a maximum pressure of 300 hPa.”

2. The combination of LithoRec in view of Perry and DIN 28400 is untenable

Because LithoRec does not disclose a vacuum drying system with a maximum pressure of 300 hPa, Petitioner attempts to combine LithoRec with Perry and DIN 28400. However, a person of skill would not be motivated to combine these references.

i. The combination of LithoRec with Perry fails

Perry is incompatible with LithoRec. Ex. 2010 at ¶127. The portion of Perry relied on by Petitioner is entitled “*Batch Through-Circulation Dryers*.” Ex 1006 at 12-44; Ex. 2010 at ¶126. This section is dedicated entirely to batch drying. Ex. 1006 at 12-44; Ex. 2010 at ¶126. Perry’s discussion of a vacuum dryer is expressly directed to items that are placed on shelves and dried in batches, such as pharmaceuticals. Ex. 1006 at 12-44 (“The material to be dried is placed in pans or trays onto heated shelves.”); Ex. 2010 at ¶81. As noted above, LithoRec specifically instructs not to use batch drying. Ex. 1016 at 226. Batch dryers and continuous dryers have fundamentally different designs. Ex. 2010 at ¶127.

Petitioner attempts to elicit teachings from Perry as to the pressure to use for vacuum drying shredded EV batteries. *See* Pet. at 26. However, Perry is unrelated to EV battery recycling; rather, Perry is focused on drying items like pharmaceuticals, food, and seeds. Ex 1006 at 12-44-45; Ex. 2010 at ¶82. Perry does not discuss evaporating the kinds of organic solvents at issue in LithoRec. Ex. 2010 at ¶81. Perry does not address pressure ranges for performing vacuum drying in combination with the vibratory fluidized bed dryer taught in LithoRec, wherein a blower uses positive pressure to force high gas densities up into the shredded battery material. Ex. 1006 at 12-44; 1016 at 227; Ex. 2010 at ¶¶82, 127.

Tellingly, Petitioner cites to no expert opinion to explain why LithoRec could or would be combined with Perry, asserting only bare attorney argument. *See, e.g.*, Pet. at 25-26. This attorney argument is entitled to no weight. *See* 35 U.S.C. § 312(a)(3); *see also* *Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15. Thus, Petitioner fails to present evidence in support of combining Perry with LithoRec to arrive at the 300 hPa limitation that is absent from LithoRec. Ex. 2010 at ¶128.

ii. The combination of LithoRec with DIN 28400 fails

Petitioner introduces DIN 28400 to provide a specific vacuum range to supplement the discussion of LithoRec's pilot plant. Ex. 1018; Ex. 2010 at ¶83.

However, DIN 28400 provides no guidance in selecting a pressure level for drying shredded EV batteries. Ex. 2010 at ¶¶89, 137.

DIN 28400 provides a table stating ranges of low, medium, high, and ultra-high vacuum pressures. Ex. 1018 at 1 DIN 28400 Part 1, Section 1, Table 1 (“Table 1”); Ex. 2010 at ¶87. According to Table 1, a low (or “rough”) vacuum is characterized by pressures ranging from 1000 mbar to 1 mbar (*i.e.*, 1000 hPa to 1 hPa). Ex. 1018 at Table 1; Ex. 2010 at ¶¶87-88, 129-131. Among these various ranges of vacuum, there is nothing in DIN 28400 that would tell a person skilled in the art which level of vacuum to use in the context of EV battery recycling. Ex. 2010 at ¶¶89, 129.

Petitioner identifies a statement in DIN 28400 in support of its assertion that DIN 28400 teaches the use of a pressure of 300 hPa. Ex. 1018 at Section 1.1 (“Vacuum refers to the state of a gas when the pressure of the gas, and thus the number density of molecules, in a container is lower than outside, or when the pressure of the gas is lower than 300 mbar, *i.e.*, lower than the lowest atmospheric pressure on the Earth’s surface.”). The pertinent part of this definition is that a vacuum exists when the pressure “in a container is lower than outside,” as confirmed by the International Standards Organization standard on which DIN 28400 relies. *Id.*; Ex. 2018 at 010, § 1.1.1 (defining a vacuum as a state of a gas having a pressure “below the prevailing atmospheric level”); Ex. 2010 at ¶133-134.

The reference in DIN 28400 to “300 hPa” describes the “lowest atmospheric pressure on the Earth’s surface.” Ex. 1018 at Section 1.1. This refers to the pressure atop Mount Everest, as confirmed by a subsequent version of the ISO standard upon which DIN 28400 is based. Ex. 2019 at 007, § 3.1.2 (“The prevailing atmospheric pressure on ground depends on weather conditions and altitude and ranges from 31 kPa (altitude of the Mount Everest, weather condition ‘low’) up to 110 kPa (altitude Dead Sea, weather condition ‘high’)); Ex. 2010 at ¶135. This fact was likewise known by 2015. Ex. 2020 at 002; Ex. 2010 at ¶135.

A person of ordinary skill in the art would not be motivated to combine the reference to “300 hPa” in DIN 28400 with LithoRec. Ex. 2010 at ¶¶136-137. The reference to “300 hPa” pressure, equivalent to conditions atop Mount Everest, is irrelevant to EV battery recycling processes, which typically operate under vastly different atmospheric conditions, near sea level. *Id.*

Petitioner’s brief offers no evidence that a person of skill would apply this “300 hPa” teaching to the LithoRec context. Pet. at 25 (“One of the conditions that meets the international standard ISO 3529-1:1981 for a vacuum is that the pressure is between 0 and 300 millibars (i.e., between 0 and 300 hPa).”); Ex. 2010 at ¶132. Not only is this statement a tautology, but it is unsupported by any expert evidence. *See also* Pet. at 26 (asserting without support that “it was part of the international standard and thus certainly would have been used by a POSITA who already knew

to implement a dryer with a vacuum from LithoRec”); Ex. 2010 at ¶132. These attorney arguments should be accorded no weight. *See* 35 U.S.C. § 312(a)(3); *see also* *Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15.

iii. Petitioner fails to support its proposed motivation to combine

Petitioner fails to substantiate the proposed obviousness combination with an adequate motivation to combine the references to achieve the claimed invention.

Petitioner fails to provide proper evidentiary support to establish that a person of skill in the art would have combined LithoRec, Perry, and DIN 28400. Ex. 2010 at ¶¶125-128, 136-139. Rather, the Petition is rife with unsupported attorney arguments that go to the core of the supposed motivation to combine, such as:

- “Accordingly, prior to the time the invention of the ’097 patent was made, the claimed pressure range was well known for producing a vacuum. Indeed, it was part of the international standard and thus certainly would have been used by a POSITA who already knew to implement a dryer with a vacuum from LithoRec.” Pet. at 26.
- “Given that one of the conditions that meets the international standard for the presence of a vacuum is the claimed pressure range, Perry provides a concrete example of a vacuum dryer operating within the claimed range, and LithoRec teaches using a vacuum dryer to keep the drying temperature low to prevent a combustion or explosion (which is similar

to the reason provided by the '097 patent), a POSITA would have been motivated to select a vacuum pressure for the dryer of LithoRec within the claimed range to operate the dryer at the optimum pressure to lower the drying temperature and prevent a combustion or explosion.” Pet. at 26.

- “In other words, the '097 Patent discloses that the “300 hPa” upper limit for the pressure in the vacuum chamber was chosen merely in connection with the vapour pressure of dimethyl carbonate at 80°C and could easily be found by looking up a chart or through routine experimentation. Indeed, the claimed range matches the relevant international standard. There simply cannot be anything surprising or unexpected about implementing the agreed-upon international standard. This subject matter would have been obvious to a POSITA from LithoRec, especially when considering DIN 28400 [sic] and Perry.” Pet. at 27-28.

These conjectures regarding what a person of ordinary skill would have understood are attorney argument and should be disregarded. *See* 35 U.S.C. § 312(a)(3); *see also Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15. Once these unsupported assertions are properly discounted, there is nothing left of Petitioner’s argument to suggest that a person of ordinary skill would have combined LithoRec, DIN 28400, and Perry.

Additionally, Petitioner fails to carry its burden to show that the proposed combination of references would have led a person skilled in the art to make the

inventions as disclosed in the '097 patent with a reasonable expectation of success. Ex. 2010 at ¶¶140-144. Petitioner does not address the shortcomings of LithoRec noted above (*e.g.*, unworkability of vacuum pressures in the vibratory fluidized bed dryer and cross-flow hogger). *See supra* at Section VII(A)(1)(ii). Neither Perry nor DIN 28400 provide any teachings to patch over these fundamental problems, and Petitioner offers no evidence that this combination would successfully inactivate the shredded material. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention.”); Ex. 2010 at ¶140-144.

3. The asserted combination is not enabling

“To render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention.” *Raytheon*, 993 F.3d at 1380; *Intel Corp. v. PACT XPP Schweiz AG*, 2021 WL 3506773, IPR2020-00525 (2021) (same); *United States v. Telectronics, Inc.*, 857 F.2d 778, 785 (Fed. Cir. 1988) (“The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation.”).

The proposed combination of LithoRec with Perry and DIN 28400 would not have enabled a person of skill to practice the claimed invention of the '097 patent. Ex. 2010 at ¶141. Too many components of the conceptual pilot plant would have worked at cross-purposes with one another to allow for inactivation of shredded battery material by vacuum drying without undue experimentation. Ex. 2010 at ¶¶95-99, 100-108, 142-143.

The proposed vacuum drying works at odds with the recommended vibratory fluidized bed dryer. Ex. 2010 at ¶¶95-99. As noted above, the vibratory fluidized bed dryer requires a forceful flow of gas molecules to agitate and dry the materials. Ex. 2010 at ¶98. Lowering the pressure would remove the gas density that is needed to power the fluidized drying bed. Ex. 2010 at ¶¶97, 99. By 2013, it was recognized that vibratory fluidized bed dryers operate at atmospheric pressure. Ex. 2012 (“Thermodynamically, it is a constant heat process which makes it adiabatic, and it typically occurs at atmospheric pressure.”); Ex. 2010 at ¶¶95, 97.

Moreover, the proposed system recommends a cross-flow hogger for shredding the batteries, which, again, must be operated at atmospheric pressure to cool the device and to displace the dust generated by the hammering. Ex. 2010 at ¶¶100-108. The cross-flow hogger and the vibratory fluidized bed dryer are operated on the same nitrogen circuit, and thus both must be at atmospheric pressure. Ex. 2010 at ¶143.

LithoRec does not enable vacuum drying of shredded batteries at a maximum pressure of 300 hPa. To the contrary, LithoRec's recommendation to use a cross-flow hogger and a vibratory fluidized bed dryer, which operate at atmospheric pressure, is opposed to this goal. Ex. 2010 at ¶142-143. If there was any amount of experimentation that could be applied to the combined teachings of LithoRec, Perry, and DIN 28400 to practice Claim 1 of the '097 patent, it would be undue experimentation. Ex. 2010 at ¶144.

Petitioner is silent as to enablement. Regardless of whether the burden rests on Petitioner to prove that the prior art is enabling (as it should, *see* 35 U.S.C. § 316(e)), Petitioner has provided no evidence to suggest that LithoRec's conceptual pilot plant, taken in view of Perry and DIN 28400, would have enabled a person of skill to practice Claim 1 of the '097 patent.

For the reasons stated above, Petitioner fails to establish that the claimed combination would have enabled a person skilled in the art to practice Claim 1, and the evidence shows that this proposed combination would not be enabling.

4. Dependent Claims 2-3, 7-8 and 10 are not obvious

Claims 2-3, 7-8, and 10 depend from the independent Claim 1. If an independent claim is not obvious then its dependent claims also cannot be obvious because they all depend from a nonobvious claim. *Ortho-McNeil*, 520 F.3d at 1365. Thus, Ground 1 of the Petition fails.

B. Ground 2: Addressed by Ground 1 of the Petition

Ground 2 of the Petition targets Claim 9 of the '097 patent, which depends from Claim 1. *See* Pet. at 35. Petitioner's discussion of Claim 9 is directed to the temperature limitation of that dependent claim. Accordingly, the reasons set forth above with respect to Claim 1 apply equally to this dependent claim. Moreover, Petitioner's reliance on Hanisch (Ex. 1020) does not attempt to cure any of the foregoing deficiencies noted in Ground 1 and is limited to discussing the temperature limitation in Claim 9. Patent Owner relies on the arguments set forth for Ground 1 and will not separately address the temperature aspects of dependent Claim 9 at this time.

C. Ground 3: Petitioner fails to establish anticipation by LithoRec

Ground 3 of the Petition fails to raise a reasonable likelihood that one or more of the challenged Claims (12-13, 15-16, and 18-19) are invalid as anticipated by LithoRec.

1. LithoRec does not anticipate Claim 12

Petitioner fails to show that LithoRec discloses, either expressly or inherently, all the limitations of Claim 12 as recited in the '097 patent. LithoRec does not disclose the following limitations of Claim 12: "an inactivation device comprising a drying device configured to inactivate the comminuted material;" and

“a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.”

Petitioner admits that LithoRec does not expressly disclose “a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device” as required in the ’097 patent. *See* Pet. at 47 (“LithoRec is silent regarding the device that produces the vacuum for the dryer.”).

Nevertheless, Petitioner asserts that the mere existence of a vacuum dryer is sufficient to disclose a vacuum installation that inactivates the shredded materials. *See* Pet. at 48 (“Thus, the mere existence of a vacuum dryer (such as the one disclosed in LithoRec (EX1016, p. 226: 37-38)) means that a vacuum installation to the extent recited in Claim 12 will be present with that vacuum dryer.”).

LithoRec discloses the details of the proposed system, including valves, filters, and fans. Ex. 1016 at 230. But LithoRec does not disclose a vacuum.

Petitioner cannot show express disclosure of all the elements of Claim 12 of the ’097 patent in LithoRec, and is thus arguing inherent anticipation. Petitioner asserts that there is necessarily a “vacuum installation” that is necessarily “configured to generate a vacuum in the drying device” and that is necessarily “configured to inactivate the comminuted material.” *See* Pet. at 47-49. Petitioner is wrong.

i. The fluidized bed dryer recommended by LithoRec uses a blower, not a vacuum

First, LithoRec does not disclose a “vacuum installation” that is “configured to generate a vacuum in the drying device.” Ex. 2010 at ¶¶94, 147-158. As Petitioner admits, “LithoRec is silent regarding the device that produces the vacuum for the dryer.” *See* Pet. at 47; Ex. 2010 at ¶¶109-110. The drying device recommended by LithoRec is a vibratory fluidized bed dryer, which is not a vacuum dryer. Ex. 1016 at 227; Ex. 2010 at ¶¶69-77, 95-99, 150. By the time of the invention, it was known that vibratory fluidized bed dryers operate at atmospheric pressure. Ex. 2012 at 1 (“Thermodynamically, it is a constant heat process which makes it adiabatic, and it typically occurs at atmospheric pressure.”); Ex. 2010 at ¶150.

Furthermore, LithoRec states that the drying system contains a “blower.” Ex. 1016 at 235. Blowers generate positive pressure, not vacuum. Ex. 2010 at ¶¶ 98-99, 151-152. Thus, LithoRec’s own recommended components teach generating a positive pressure, not a vacuum, in the drying device. Ex. 2010 at ¶¶71, 74, 112-114, 98-99, 151-152.

ii. The fluidized bed dryer is connected to a cross-flow hogger, which cannot run under vacuum

LithoRec teaches shredding the batteries using a cross-flow hogger. Ex. 1016 at 227, 230, 235. These devices must run at atmospheric pressure, or they

would overheat and fail to displace the dust. Ex. 2010 at ¶¶100-108, 153-158. The manual for the MEWA QZ 1200 unit recommended by LithoRec has no mention of the word “vacuum,” other than noting the need for an occasional cleaning by a vacuum cleaner. Ex. 2014; Ex. 2010 at ¶106. LithoRec itself specifies the “QZ 1200 *depressurized*” which means that the unit can purge the build-up of solvent vapors generated during the heat-intensive hammering process. Ex. 1016 at 235; Ex. 2010 at ¶¶100, 105, 154. Indeed, the MEWA QZ1200 manual identifies that a “fault” may trigger if the pressure of nitrogen drops. Ex. 2014 at 53; Ex. 2010 at ¶¶107, 167.

The cross-flow hogger feeds into the dryer; both devices share the same nitrogen circuit. Ex. 1016 at 227, 230. Because the cross-flow hogger does not operate at vacuum, this confirms that the system is not “configured to generate a vacuum in the drying device.” Ex. 2010 at ¶¶100-108, 154.

iii. The goal to run the nitrogen circuit under “negative pressure” does not concern the dryer mechanism

LithoRec teaches a “Fan” to exhaust a portion of the nitrogen gas through an activated carbon filter into the environment. Ex. 1016 at 227, 230. This fan might potentially be sufficient to run the nitrogen circuit at a slight negative pressure (e.g., under 1 hPa), to promote workplace safety by preventing dust from escaping. Ex. 2010 at ¶¶109-114, 155-157. Whatever negative pressure there might be in the

exhaust line says nothing about the pressure in the dryer, which contains a “blower,” which runs at positive pressure. Ex. 1016 at 2035; Ex. 2010 at ¶¶98, 109-114, 157-158.

iv. The continuous processing described by LithoRec would not necessarily result in inactivating the shredded material

The system disclosed in LithoRec is a continuous process. Ex. 1016 at 227. There are a series of complications relating to continuous processing, contrary to Petitioner’s argument that the LithoRec system would necessarily be “configured to inactivate the comminuted material.” Ex. 2010 at ¶¶118-123, 160-163.

LithoRec recommends using a vibratory fluidized dryer in a continuous process. Ex. 1016 at 226-27; Ex. 2010 at ¶¶115-123, 126-127, 160. LithoRec describes that this device should “ensure material transport by exciting the flow bottom.” Ex. 1016 at 227. LithoRec describes the shredded material, noting that there is a “very wide range of unit sizes (from coarse metal parts to fine powder).” Ex. 1016 at 227. In the continuous process prescribed by LithoRec, the fluidizing action of the dryer may result in a mixing of wet material that is newly exiting the shredder with material that has been in the dryer for some time. Ex. 2010 at ¶¶119-120, 160. This mix of partially wet and partially dry material could hinder the effective inactivation of the comminuted material. *Id.* LithoRec does not

provide for any controls to ensure that the material that continuously exits the dryer is not a mix of partially wet and partially dry material. Ex. 2010 at ¶¶120, 160.

Another complication of the continuous process described by LithoRec arises because batteries may contain a mixture of solvents, with some evaporating easily (*i.e.*, low-boiling solvents”), and some evaporating with more difficulty (*i.e.*, high-boiling solvents). Ex. 1016 at 227 (noting that the solvent “adheres more or less strongly to the arrester foils”). In a continuous process, there will be a steady supply of new shredded material containing both low- and high-boiling solvents, and the low-boiling solvents will preferentially evaporate. Ex. 2010 at ¶¶119-120, 161. The evaporation of the low-boiling solvents will delay the evaporation of the high-boiling solvents from the material that is already in the dryer. Ex. 2010 at ¶¶120, 161. This is because the evaporation of the low-boiling solvents increases the overall vapor pressure in the system with the vapors of low boiling point solvents, making it thermodynamically less favorable for the higher-boiling solvents to transition from the liquid to the vapor phase. Ex. 2010 at ¶120. There is no mechanism described in LithoRec to ensure that the material exiting the dryer be dried to the point of inactivation. Ex. 2010 at ¶¶120, 160.

Inactivation is what results when the drying process is complete. Ex. 1001 at 8:54-55 (“The drying of the comminuted material results in inactivated comminuted material.”); Ex. 2010 at ¶¶57-58, 63. The ’097 patent discusses how

to ascertain that the drying is sufficiently complete that the material is inactivated. Ex. 1001 at 3:49-4:18; Ex. 2010 at ¶¶63-64. Petitioner does not attempt to establish that the LithoRec system would actually be configured to inactivate the comminuted material. Ex. 2010 at ¶¶95-99, 100-108, 109-114, 115-123, 144, 163. Possibilities and probabilities that the material might be inactivated are insufficient to establish inherent anticipation. *See Bettcher Indus., Inc. v. Bunzl USA, Inc.*, 661 F.3d 629, 639 (Fed. Cir. 2011) (inherency “may not be established by probabilities or possibilities”).

Regarding the statement in LithoRec suggesting that the proposed drying operation “eliminates the potential hazard of flammable substances,” this is merely an aspiration. Ex. 1016 at 226; Ex. 2010 at ¶¶122, 164-168. Expressly, it is only “assumed.” Ex. 1016 at 229; Ex. 2010 at ¶¶122, 164-168. This aspiration does not describe the necessary result of the system described. *Metabolite Labs.*, 370 F.3d at 1367 (“Stated somewhat differently, inherency requires description of action that inevitably produces a result, not merely description of action that might have been carried out, but was not, and might have yielded a particular result, but did not.”); Ex. 2010 at ¶¶163, 168. Therefore, it is not necessary that the system in LithoRec is “configured to inactivate the comminuted material.” Ex. 1001 at 11:53; Ex. 2010 at ¶¶120-123, 163.

v. Petitioner’s broad assertions cannot establish anticipation

Petitioner fails to identify a structure amounting to a vacuum installation, precluding anticipation. *See Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1083 (Fed. Cir. 2008) (“To anticipate, the reference must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements arranged as in the claim.”); Ex. 2010 at ¶¶147, 148-158, 159, 160-163, 164-167. A single reference must “describe the claimed invention *with sufficient precision and detail* to establish that the subject matter existed in the prior art,” and “ambiguous references do not, as a matter of law, anticipate a claim.” *Wasica*, 853 F.3d at 1284.

A person skilled in the art reading LithoRec would not be able to “at once envisage” the claimed vacuum installation. *See Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1068 (Fed. Cir. 2017) (“If [the reference] does not expressly spell out all the limitations arranged or combined as in the claim,” it can still anticipate “if a person of skill in the art, reading the reference, would at once envisage the claimed arrangement or combination”); Ex. 2010 at ¶¶94, 148-158, 159-163, 164, 168. To the contrary, for the reasons stated above, it is evident that LithoRec does not disclose a “vacuum installation ... configured to generate a vacuum in the drying device.”

As discussed above, Petitioner relies on a section in LithoRec that is entirely hypothetical and amount to nothing more than an invitation for others in the battery recycling industry to investigate the possibility of a pilot plant. Ex. 2010 at ¶¶68, 168. Such a theoretical and ambiguous reference cannot serve as evidence of an inherent disclosure. *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1367 (Fed. Cir. 2004) (“On this point, our precedent is straightforward: ‘An invitation to investigate is not an inherent disclosure.’”).

Fundamentally, Petitioner’s arguments are unsupported. Throughout Ground 3, Petitioner asserts unsupported and conclusory attorney argument to establish what a person of skill would have understood LithoRec to mean. The following assertions are representative:

- “A POSITA would have understood that the dismantling of the batteries and the ‘pre-shredding’ taught by LithoRec falls within the scope of ‘comminute the batteries,’ as recited in claim 12 of the '097 patent. In particular, LithoRec uses the term ‘comminution’ to describe the ‘pre-shredding’ process.” Pet. at 42.
- “A POSITA would understand that the electrolyte evaporating process of LithoRec teaches ‘a drying device configured to inactivate the comminuted material,’ as recited in claim 12 based on the disclosure of the '097 patent.” Pet. at 44.

- “Accordingly, a POSITA would understand that once packaged, the active mass is in condition for transport and that the packaged active mass is in a transport container. Thus, a POSITA would understand that LithoRec’s drum filler is a filling device within the meaning of the ’097 patent.” Pet. at 47.
- “Although LithoRec is silent regarding the device that produces the vacuum for the dryer, a POSITA would understand that the battery processing installation of LithoRec includes the ‘vacuum installation’ recited in claim 12.” Pet. at 47.
- “A POSITA would understand that the only requirement for the ‘vacuum installation’ is that it be able to produce a vacuum in the dryer.” *See* Pet. at 48.
- “Thus, the mere existence of a vacuum dryer (such as the one disclosed in LithoRec (EX1016, p.226: 37-38)) means that a vacuum installation to the extent recited in claim 12 will be present with that vacuum dryer.” Pet. at 48.

None of these assertions are supported by expert evidence, and they should be disregarded. *See* 35 U.S.C. § 312(a)(3); *see also* *Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15. Once these unsupported assertions are properly discounted, there is nothing left of Petitioner’s argument to suggest that a person of ordinary skill would have understood these references to disclose the invention claimed in the ’097 patent. Ex. 2010 at ¶¶148-158, 159-163,

164-168. Thus, Petitioner has failed to establish a reasonable likelihood that Claim 12 is anticipated by LithoRec.

2. Petitioner fails to establish that LithoRec is enabling

For the same reasons as stated above showing that the asserted prior art combination of Ground 1 is not enabling, LithoRec is not enabling for purposes of Ground 3. Ex. 2010 at ¶¶92-94, 140-144, 164-168. The rationale applies all the more strongly here, because Petitioner asserts that LithoRec, alone, anticipates. *Elan*, 346 F.3d at 1054; *Amgen*, 314 F.3d at 1354.

3. Dependent Claims 13, 15-16, and 18-19 are not invalid

Petitioner fails to prove that LithoRec anticipates Claim 12. Claims 13, 15-16, and 18-19 depend from the independent Claim 12. If an independent Claim is not anticipated by prior art, dependent claims including that independent claim's limitation that is missing from the prior art are also not anticipated. *See Trintec Indus., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1296 (Fed. Cir. 2002). Ground 3 of the Petition fails.

D. Ground 4: Petitioner fails to establish that LithoRec, in view of Hanisch renders the '097 patent obvious

Ground 4 of the Petition targets Claim 17 of the '097 patent, which depends from Claim 12. *See* Pet. at 55. Petitioner's discussion of Claim 17 is directed to the air jet sieving device limitation of that independent claim. Accordingly, the reasons set forth above with respect to Claim 12 apply equally to this dependent

Claim 17. Moreover, Petitioner's reliance on Hanisch does not attempt to cure any of the foregoing deficiencies noted in Ground 12 and is limited to discussing the air jet sieving limitation in Claim 17. Patent Owner relies on the arguments set forth for Ground 12 and will not separately address the air jet sieving device aspects of dependent Claim 17 at this time.

E. Throughout, Petitioner's allegations are unsupported

The Petition is largely unsupported by evidence. Assertions as to what a person of skill would understand the prior art to teach, and how a person of skill would have combined references, are made simply with attorney argument. The Board should not consider Petitioner's unsupported and conclusory attorney arguments. *See* 35 U.S.C. § 312(a)(3); *see also* *Estee Lauder*, 129 F.3d at 595 *C.R. Bard*, IPR2015-00511, Paper 9 at 15.

The unsupported statements by counsel go to the core issues presented by the Petition, such as what the prior art teaches, the extent to which a person of ordinary skill would be motivated to combine the references, and what is inherently disclosed in the prior art. In addition to the conclusory, unsupported attorney statements discussed above, no fewer than 27 more statements by counsel, asserting what a person of skill would know, are also unsupported by evidence:

- “A POSITA would have understood that the dismantling of the batteries and the “pre-shredding” taught by LithoRec falls within the scope of

- “comminuting the batteries,” as recited in claim 1 of the '097 patent.” Pet. at 21.
- “A POSITA would understand that the electrolyte evaporating process of LithoRec teaches “inactivating the comminuted material such that an inactivated comminuted material is obtained,” as recited in claim 1 based on the disclosure the '097 patent.” Pet. at 22.
 - “Thus, a POSITA would understand that according to the '097 patent, the comminuted material is considered to be inactivated when at least one solvent in a conducting salt (e.g., dimethyl carbonate and/or ethyl methyl carbonate) is removed by way of a drying process—which LithoRec clearly does.” Pet. at 23.
 - “As discussed above, LithoRec teaches inactivating the active mass (comminuted material) via drying: “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass, it is necessary to evaporate the electrolytes.” EX1016, p. 226: 30-31.” Pet. at 24.
 - “Accordingly, prior to the time the invention of the '097 patent was made, the claimed pressure range was well known for producing a vacuum. Indeed, it was part of the international standard and thus certainly would have been used by a POSITA who already knew to implement a dryer with a vacuum from LithoRec.” Pet. at 26.
 - “Given that one of the conditions that meets the international standard for the presence of a vacuum is the claimed pressure range, Perry provides a

concrete example of a vacuum dryer operating within the claimed range, and LithoRec teaches using a vacuum dryer to keep the drying temperature low to prevent a combustion or explosion (which is similar to the reason provided by the '097 patent), a POSITA would have been motivated to select a vacuum pressure for the dryer of LithoRec within the claimed range to operate the dryer at the optimum pressure to lower the drying temperature and prevent a combustion or explosion.” Pet. at 26.

- “Here, there is no evidence available to show criticality of the claimed range (i.e., there is no evidence the claimed range achieves an unexpected result relative to the prior art range). Under that standard, it is not inventive to discover optimum or workable ranges by routine experimentation.” Pet. at 27.
- “This subject matter would have been obvious to a POSITA from LithoRec, especially when considering DIN 24800 and Perry.” Pet. at 27-28.
- “LithoRec thus explicitly teaches “eliminating” the potential hazard of flammable solvents by evaporating electrolytes in the solvents and, as a result, the electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.” Pet. at 28.
- “A POSITA thus would understand that LithoRec teaches that the electrolyte content in the active mass (comminuted material) is so low that an electrochemical reaction (e.g., explosion) is impossible.” Pet. at 29.

- “A POSITA would have used the drying process to ensure that the electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible because that is exactly what LithoRec teaches, and why.” Pet. at 29.
- “Further, a POSITA would be motivated to do so because that implementation advantageously would mitigate the need for explosion protection, as taught by LithoRec.” Pet. at 29.
- “A POSITA would understand that LithoRec expressly teaches drying under vacuum.” Pet. at 29.
- “A POSITA would understand that LithoRec is teaching complete evaporation and, thus, completely avoiding formation of a flammable or explosive gas mixture.” Pet. at 31.
- “Since LithoRec teaches that all of the flammable or explosive gas has been evaporated in the drying step, a POSITA would understand that there is no flammable or explosive gas mixture that is formable above the active mass whether active mass is delivered to the transport container.” Pet. at 32.
- “In addition, if all volatile, highly flammable solvents are removed, a POSITA would understand that all of the conditions discussed in col. 3, lines 56-64 of the '097 patent are inherently met.” Pet. at 32.
- “Given the guidance provided by LithoRec, Perry, and Hanisch, regarding the drying temperature for combustible or explosive materials such as electrolytes, a POSITA would have selected a low temperature

for drying an electrolyte of a processed lithium ion battery typically and, more particularly, a POSITA would have used a temperature no higher than 80° C as specifically taught by Hanisch.” Pet. at 38.

- “A POSITA would have done so because the references all teach using low temperatures to avoid combustion and explosion for electrolytes including those specifically mentioned in the '097 patent.” Pet. at 38
- “Thus, a POSITA would understand that according to the '097 patent, the comminuted material is considered to be inactivated when at least one solvent in a conducting salt (e.g., dimethyl carbonate and/or ethyl methyl carbonate) is removed by way of a drying process-which LithoRec clearly does.” Pet. at 45.
- “LithoRec therefore discloses the same structure being used in the same way for the same purpose and with the same timing as in the '097 patent.” Pet. at 46.
- “Therefore, because LithoRec discloses a vacuum dryer, LithoRec also discloses the “vacuum installation” of the type recited in claim 12.” Pet. at 49.
- “A POSITA thus would understand that LithoRec teaches that the electrolyte content in the active mass (comminuted material) is so low that an electrochemical reaction (e.g., explosion) is impossible.” Pet. at 50.
- “LithoRec therefore discloses this part of claim 15.” Pet. at 51.

- “LithoRec therefore also discloses this part of claim 15.” Pet. at 52.
- “A POSITA would understand that the copper and the aluminum foil must be filled in the separate containers by a “second filling device” because the copper and aluminum foils and the active mass are sent to different storage containers.” Pet. at 53-54.
- “Therefore, it would have been obvious for a POSITA to utilize the air jet sieve of Hanisch as the “separation device” of LithoRec in order to achieve a high level of separation between the active material and the foil.” Pet. at 57.
- “Claim 17 thus would have been obvious to a POSITA based on the LithoRec/Hanisch combination.” Pet. at 57.

The above 27 instances of conclusory attorney statement, as well as the unsupported attorney statements discussed above, *supra* at Section VII(A)(2)(iii) & Section VII(C)(v), make up the bulk of Petitioner’s argument. Each one of these unsupported assertions should be disregarded when evaluating the grounds for invalidity asserted by Petitioner. *See* 35 U.S.C. § 312(a)(3); *see also* *Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15. Once these unsupported allegations are properly discounted, whatever remains is insufficient to carry Petitioner’s burden of proof.

There are only seven instances where Petitioner does cite to the declaration of Volker Spies (“Spies Declaration”) to support its arguments. *See* Pet. at 18; 22;

33; 35; 39, 43-44. In those instances, the cited opinions are unsupported by facts or data. The Board should give little or no weight to Petitioner's expert declaration and the opinions provided therein, because they are conclusory. 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."). Expert statements that simply repeat Petitioner's arguments, without providing additional evidentiary support, are not given weight. *See TRW Automotive US LLC v. Magna Elecs., Inc.*, IPR2014-00258, Paper 18 at 11 (P.T.A.B. Aug. 27, 2014) (denying institution and noting that, "Dr. Miller's testimony (Ex. 1012 ¶ 38) likewise is conclusory, as it simply repeats the above statements verbatim, and thus does not provide any support for TRW's position"); *Dell Inc. v. Electronics and Telecom. Res. Inst.*, IPR2014-00152, Paper 12 at 19-21 (PTAB May 16, 2014) (giving no weight to expert testimony when it was not supported by underlying facts) ("Dr. Mercer's testimony on this point, which is not supported by underlying facts or data, is not persuasive. *See* 37 C.F.R. § 42.65(a).").

VIII. CONCLUSION

For at least the foregoing reasons, Petitioner has not demonstrated a reasonable likelihood that it would prevail with respect to even one challenged claim of the '097 patent. Duesenfeld respectfully requests that the Board deny the Petition.

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Patent 11,050,097

Date: August 23, 2024

Respectfully submitted,

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WORD COUNT CERTIFICATION

Pursuant to 37 C.F.R. § 42.24(d), Patent Owner certifies that this Patent Owner Preliminary Response has a total of 13,898 words as counted by Microsoft Word, exclusive of the cover page, table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, word count, appendix of exhibits or claim listing, and signature block (37 C.F.R. § 42.24(a)). The word count includes all other text, including headings, footnotes, and quotations. This is within the 14,000-word limit allowed under § 42.24(a)(1)(i).

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CERTIFICATE OF SERVICE

I hereby certify that on August 23, 2024, a true and correct copy of this Patent Owner Preliminary Response, including all accompanying attachments, and exhibits, has been served in its entirety via e-mail upon the following:

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