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Application Number: 16547728 Document Date: 08/22/2019

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- Drawing

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PTO/AIA/15 (10-17)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	GBL0007/US/2
First Named Inventor	Stephen Richard COULSON
Title	COATINGS
Priority Mail Express® Label No.	N/A

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✔] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✔] **Specification** [*Total Pages* 31] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✔] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 6]
6. **Inventor's Oath or Declaration** [*Total Pages* 6] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [✔] A copy from a prior application (37 CFR 1.63(d))
7. [✔] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

ACCOMPANYING APPLICATION PAPERS

10. [ ] **Assignment Papers** (cover sheet & document(s))
    Name of Assignee _____
11. [ ] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✔] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [✔] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [✔] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [ ] **Other:** _____

*__Note__: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✔] The address associated with Customer Number: 33072 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/Paul J. Parins/	Date	August 22, 2019
Name (Print/Type)	Paul J. Parins	Registration No. (Attorney/Agent)	54,358

This collection of information is required by 37 CFR 1.53(b). 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 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.

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.
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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.

PTO/SB/17 (01-18)
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FEE TRANSMITTAL

Complete if known	
Application Number	Not Yet Assigned
Filing Date	Herewith
First Named Inventor	Stephen Richard COULSON
Examiner Name	Not Yet Assigned
Art Unit	Not Yet Assigned
Practitioner Docket No.	GBL0007/US/2

☐ 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 ($) 1720.00

METHOD OF PAYMENT (check all that apply)

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

■ Deposit Account Deposit Account Number: 50-1775 Deposit Account Name: _____

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	1,720.00
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 ($)**		**Fee Paid ($)**
20	-20 or HP =	0 x		=	

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

Indep. Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
1	-3 or HP =	0 x		=	

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	/Paul J. Parins/	Registration No. (Attorney/Agent) 54,358	Telephone 651-275-9831
Name (Print/Type)	Paul J. Parins		Date August 22, 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.**

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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.
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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.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	**COATINGS**
Attorney Docket No.	**GBL0007/US (P2494US00-CD7QC)**

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application; and/or
- ☒ United States application or PCT international application no. **PCT/GB2016/051688** filed on **June 8, 2016**; and/or
- ☐ The application having the above-identified attorney docket number on the specification as filed, or the above-identified title on the specification as filed.

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 state that I have reviewed and understand the contents of the above-identified application, including the claims.

I am aware of the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

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.

LEGAL NAME OF INVENTOR

Inventor: **Stephen Richard COULSON** Date (optional): 6.3.19

Signature: S.R.C.

#117251

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	**COATINGS**
Attorney Docket No.	**GBL0007/US (P2494US00-CD7QC)**

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application; and/or
- ☒ United States application or PCT international application no. **PCT/GB2016/051688** filed on **June 8, 2016**; and/or
- ☐ The application having the above-identified attorney docket number on the specification as filed, or the above-identified title on the specification as filed.

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 state that I have reviewed and understand the contents of the above-identified application, including the claims.

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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.

LEGAL NAME OF INVENTOR

Inventor: **Delwyn EVANS** Date (optional): 27 FEB 2019

Signature: 

#117251

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	**COATINGS**
Attorney Docket No.	**GBL0007/US (P2494US00-CD7QC)**

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application; and/or
- ☒ United States application or PCT international application no. **PCT/GB2016/051688** filed on **June 8, 2016**; and/or
- ☐ The application having the above-identified attorney docket number on the specification as filed, or the above-identified title on the specification as filed.

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

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LEGAL NAME OF INVENTOR

Inventor: **Angeliki SIOKOU** Date (optional): 27.02.19

Signature: 

#117251

Doc code: Oath
Document Description: Oath or declaration filed

PTO/AIA/02 (07-13)
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SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

Title of Invention	COATINGS

This statement is directed to:

☐ The attached application,

OR

☒ United States application or PCT international application number 15/735,130 filed on December 8, 2017

LEGAL NAME of inventor to whom this substitute statement applies:

(*E.g.*, Given Name (first and middle (if any)) and Family Name or Surname)

Clive Telford

Residence (except for a deceased or legally incapacitated inventor):

City	State	Country

Mailing Address (except for a deceased or legally incapacitated inventor):

City	State	Zip	Country

I believe the above-named inventor or joint inventor to be the original inventor or an original joint inventor of a claimed invention in the application.

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

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

Relationship to the inventor to whom this substitute statement applies:

☐ Legal Representative (for deceased or legally incapacitated inventor only).

☒ Assignee,

☐ Person to whom the inventor is under an obligation to assign,

☐ Person who otherwise shows a sufficient proprietary interest in the matter (petition under 37 CFR 1.46 is required), or

☐ Joint 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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SUBSTITUTE STATEMENT

Circumstances permitting execution of this substitute statement:

- [x] Inventor is deceased,
- [ ] Inventor is under legal incapacity,
- [ ] Inventor cannot be found or reached after diligent effort, or
- [ ] Inventor has refused to execute the oath or declaration under 37 CFR 1.63.

If there are joint inventors, please check the appropriate box below:

- [x] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) naming the entire inventive entity has been or is currently submitted.

OR

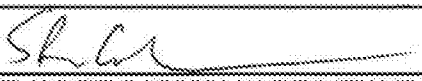
- [ ] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) has not been submitted. Thus, a Substitute Statement Supplemental Sheet (PTO/AIA/11 or equivalent) naming the entire inventive entity and providing inventor information is attached. See 37 CFR 1.64(b).

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

Name: Dr. Stephen Coulson | Date (Optional): 6.3.19

Signature: 

APPLICANT NAME AND TITLE OF PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

If the applicant is a juristic entity, list the applicant name and the title of the signer:

Applicant Name: P2i Ltd

Title of Person Executing This Substitute Statement: CSO, Founder, President Information Security

The signer, whose title is supplied above, is authorized to act on behalf of the applicant.

Residence of the signer (unless provided in an application data sheet, PTO/AIA/14 or equivalent):

City: Abingdon | State: | Country: GB

Mailing Address of the signer (unless provided in an application data sheet, PTO/AIA/14 or equivalent)

9-12 North Central, 127 Olympic Avenue, Milton Park

City: Abingdon | State: | Zip: OX14 4SA | Country: GB

Note: Use an additional PTO/AIA/02 form for each inventor who is deceased, legally incapacitated, cannot be found or reached after diligent effort, or has refused to execute the oath or declaration under 37 CFR 1.63.

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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.

Doc Code: PA..
Document Description: Power of Attorney

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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Assigned
Filing Date	Herewith
First Named Inventor	Stephen Richard COULSON
Title	COATINGS
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket Number	GBL0007/US/2

SIGNATURE of Applicant or Patent Practitioner

Signature	/Paul J. Parins/	Date (Optional)	August 22, 2019
Name	Paul J. Parins	Registration Number	54,358
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 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.

Doc Code: PA..
Document Description: Power of Attorney

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 33072

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

P2i Ltd

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	K. Armour	Date (Optional)	26 October 2016
Name	Dr. Kenneth Armour		
Title	In-House Counsel	, P2I LTD	

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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
	Stephen	Richard	COULSON	

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

City	Abingdon	Country of Residence i	GB

Mailing Address of Inventor:

Address 1	c/o P2i Ltd 9-12 North Central, 127 Olympic Avenue
Address 2	Milton Park
City	Abingdon
State/Province	
Postal Code	OX14 4SA
Country i	GB

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Delwyn		EVANS	

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

City	Abingdon	Country of Residence i	GB

Mailing Address of Inventor:

Address 1	c/o P2i Ltd 9-12 North Central, 127 Olympic Avenue
Address 2	Milton Park
City	Abingdon
State/Province	
Postal Code	OX14 4SA
Country i	GB

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Angeliki		SIOKOU	

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

City	Abingdon	Country of Residence [i]	GB

Mailing Address of Inventor:

Address 1	c/o P2i Ltd 9-12 North Central, 127 Olympic Avenue		
Address 2	Milton Park		
City	Abingdon	State/Province	
Postal Code	OX14 4SA	Country [i]	GB

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Clive		TELFORD	

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

City	Abingdon	Country of Residence [i]	GB

Mailing Address of Inventor:

Address 1	c/o P2i Ltd 9-12 North Central, 127 Olympic Avenue		
Address 2	Milton Park		
City	Abingdon	State/Province	
Postal Code	OX14 4SA	Country [i]	GB

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).

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

Customer Number	33072		
Email Address		Add Email	Remove Email

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

Application Information:

Title of the Invention	COATINGS		
Attorney Docket Number	GBL0007/US/2	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	**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	33072		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15735130	2017-12-08
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15735130	a 371 of international	PCT/GB2016/051688	2016-06-08

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).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
15386017.6	EP	2015-06-09	

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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	P2i Ltd		
Mailing Address Information For Applicant:			
Address 1	9-12 North Central, 127 Olympic Avenue		
Address 2	Milton Park		
City	Abingdon	**State/Province**	
Country	GB	Postal Code	OX14 4SA
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	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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	/Paul J. Parins/			Date (YYYY-MM-DD)	2019-08-22
First Name	Paul J.	Last Name	Parins	Registration Number	54,358

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

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	GBL0007/US/2
	Application Number	
Title of Invention	COATINGS	

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.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Stephen Richard COULSON
Art Unit	
Examiner Name	
Attorney Docket Number	GBL0007/US/2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4822632	A	1989-04-18	Williams et al.	
	2	6613393	B1	2003-09-02	Rauschnabel et al.	
	3	6764758	B1	2004-07-20	Grunze et al.	
	4	8852693	B2	2014-10-07	Legein et al.	
	5	RE43651	E	2012-09-11	Badyal et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040028931	A1	2004-02-12	Bletsos et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

	2	20040046165	A1	2004-03-11	Hunze et al.	
	3	20090267489	A1	2009-10-29	Arita et al.	
	4	20100021998	A1	2010-01-28	Sanyal et al.	
	5	20100189914	A1	2010-07-29	Coulson	
	6	20100203347	A1	2010-08-12	Coulson	
	7	20120009231	A1	2012-01-12	Herbert et al.	
	8	20120051018	A1	2012-03-01	Ollgaard	
	9	20120171386	A1	2012-07-05	Bicker et al.	
	10	20120321775	A1	2012-12-20	Parker	
	11	20140010969	A1	2014-01-09	Bicker et al.	
	12	20140322525	A1	2014-10-30	Legein et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
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	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

	13	20140342103	A1	2014-11-20	Petersen et al.	
	14	20150291830	A1	2015-10-15	Galbreath et al.	
	15	20160284518	A1	2016-09-29	Legein et al.	
	16	20180171171	A1	2018-06-21	Coulson et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	103881013	CN	A	2014-06-25	Chen et al.		
	2	2434368	GB	A	2007-07-25	P2i Limited		
	3	2493264	GB	A	2013-01-30	P2i Limited		
	4	0834352	EP	A1	1998-04-08	CIBA-GEIGY AG		
	5	1557489	EP	A1	2005-07-27	Badyal et al.		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

	6	2711153	EP	A1	2014-03-26	The Goodyear Tire and Rubber Company		
	7	9858117	WO	A1	1998-12-23	THE SECRETARY OF STATE FOR DEFENCE		
	8	0228548	WO	A2	2002-04-11	DOW CORNING CORPORATION		
	9	03063938	WO	A1	2003-08-07	ASTRAZENECA AB		
	10	2003097245	WO	A2	2003-11-27	SURFACE INNOVATIONS LIMITED		
	11	03/101621	WO	A2	2003-12-11	SURFACE INNOVATIONS LIMITED		
	12	2004065684	WO	A2	2004-08-05	York et al.		
	13	2005021833	WO	A2	2005-03-10	SURFACE NNOVATIONS LIMITED		
	14	2005089961	WO	A1	2005-09-29	THE SECRETARY OF STATE OF DEFENCE		
	15	2006129800	WO	A1	2006-12-07	Morita et al.		
	16	2007083122	WO	A1	2007-07-26	P2i LTD		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
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	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

	17	2009046093	WO	A2	2009-04-09	EXOGENESIS CORPORATION		
	18	2009030435	WO	A1	2009-03-12	UNIV AUGSBURG		
	19	2011029628	WO	A1	2011-03-17	SCHOTT AG		
	20	2012158953	WO	A1	2012-11-22	GADGET IP LLC		
	21	2013132250	WO	A1	2013-09-12	SEMBLANT LTD		
	22	2014026967	WO	A2	2014-02-20	EUROPLASMA NV		
	23	2014155099	WO	A1	2014-10-02	SEMBLANT LTD		
	24	2015128627	WO	A1	2015-09-03	P2i LTD		
	25	2016198855	WO	A1	2016-12-15	P2i LTD		
	26	2016198856	WO	A1	2016-12-15	P2i LTD		

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report and Written Opinion for International Application No. PCT/GB2016/051688, mailed November 8, 2016 (9 pages).	
	2	Bongiovanni et al. "High performance UV-cured coatings for wood protection", Progress in Organic Coatings, 2002, 45, 359-363.	
	3	Search Report under Section 17(5) from UK Patent Application No. GB1403558.8, mailed on August 13, 2014 (4 pages).	
	4	International Search Report and Written Opinion from International Application No. PCT/GB2015/050521, mailed June 5, 2015 (16 pages).	
	5	Search Report under Section 17(5) from UK Patent Application No. GB1503054.7, mailed on November 30, 2015 (4 pages).	
	6	"Plasma treatment can apply liquid repellency to any material", Technical Textiles International, May 2005, pages 23-25 (3 pages).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul J. Parins/	Date (YYYY-MM-DD)	2019-08-22
Name/Print	Paul J. Parins	Registration Number	54,358

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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.**

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 record s.

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 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.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
P2494PC00		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB2016/051688	8 June 2016 (08-06-2016)	9 June 2015 (09-06-2015)
Applicant		
P2I LTD		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. _____
      [ ] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [X] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/051688

A. CLASSIFICATION OF SUBJECT MATTER
INV. C09D5/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/083122 A1 (P2I LTD [GB]; COULSON STEPHEN [GB]) 26 July 2007 (2007-07-26) claims 10, 11, 27; example 1	1-91
Y	EP 0 834 352 A1 (CIBA GEIGY AG [CH]) 8 April 1998 (1998-04-08) claim 8; page 5 line 59 - page 6 lines 1-2; example B-14	1-91
A	WO 2014/155099 A1 (SEMBLANT LTD [GB]) 2 October 2014 (2014-10-02) claims 1, 5 together with examples 1, 2 and 3	1-91

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 October 2016	08/11/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kositza, Matthias

3

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2016/051688

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007083122 A1	26-07-2007	AU 2007206779 A1	26-07-2007
		CA 2637625 A1	26-07-2007
		CN 101370877 A	18-02-2009
		CN 103396688 A	20-11-2013
		EP 1976942 A1	08-10-2008
		GB 2434369 A	25-07-2007
		IL 192905 A	27-06-2013
		JP 2009523914 A	25-06-2009
		KR 20080097201 A	04-11-2008
		KR 20140063887 A	27-05-2014
		NZ 570462 A	26-11-2010
		TW I400014 B	21-06-2013
		US 2010189914 A1	29-07-2010
		WO 2007083122 A1	26-07-2007
		ZA 200806846 B	25-11-2009
EP 0834352 A1	08-04-1998	AR 004877 A1	10-03-1999
		EP 0834352 A1	08-04-1998
		US 6169127 B1	02-01-2001
WO 2014155099 A1	02-10-2014	CN 105075408 A	18-11-2015
		EP 2979524 A1	03-02-2016
		JP 2016521296 A	21-07-2016
		KR 20150135420 A	02-12-2015
		TW 201446890 A	16-12-2014
		WO 2014155099 A1	02-10-2014

Information on Search Strategy - Pilot phase (see OJ 2015, A86)
The type of information contained in this sheet may change during the pilot for improving the usefulness of this new service.

Application Number
PCT/GB2016/051688

TITLE: COATINGS

APPLICANT: P2I LTD

IPC CLASSIFICATION: C09D5/00

EXAMINER: Kositza, Matthias

CONSULTED DATABASES: EPODOC, WPI, NPL

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: C09D5/++

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:

EPO FORM P04A42

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2016/051688	08.06.2016	09.06.2015

International Patent Classification (IPC) or both national classification and IPC
INV. C09D5/00

Applicant
P2I LTD

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Kositza, Matthias Telephone No. +49 89 2399-0

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-91
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-91
Industrial applicability (IA)	Yes:	Claims	1-91
	No:	Claims	

2. Citations and explanations

see separate sheet

item V

1. Documents

D1 WO 2007/083122 A1

D2 EP 0 834 352 A1

D3 WO 2014/155099 A1

2. Independent claims

Claim 1 relates to an electronic or electrical device or component thereof having a protective cross-linked polymeric coating made by plasma polymerization of a combination of components (1) + (2):

(1) unsaturated monomer having the formula detailed in the claim

(2) (poly)unsaturated cross-linking agent.

Claim 40 relates to a method for providing an electronic or electrical device or component thereof having a protective cross-linked polymeric coating made

by plasma polymerization of a combination of components (1) + (2) according to claim 1.

3. Novelty

Claims 1 and 40, and the claims dependent thereon, are considered novel.

4. Inventive step

Claims 1 and 40 do not involve an inventive step. Starting from document D1 (see claims 10, 11, 27; example 1) describing the plasma polymerization of component (1) for making protective coatings for electronic / electrical components the skilled person would easily recognize by combining document D2 (see claim 8; p. 5 l. 59 - p. 6, l. 1-2, example B-14) that adding an additional cross-linking component (2) allows to vary / control the degree of cross-linking of the coating. See the application page 2, lines 1-10. At present it cannot be seen that the addition of the cross-linking component (2) is connected with any surprising beneficial technical effect which could substantiate the presence of an inventive step. The dependent claims represent trivial modifications of claims 1 and 40 which are obvious to the skilled person familiar with the present technical field.

5. Industrial applicability

The claimed subject-matter is industrially applicable.

Coatings

This application is a Continuation of application Serial No. 15/735,130 filed December 8, 2017, which is a U.S. national stage filing of Patent Cooperation Treaty (PCT) application serial number PCT/GB2016/051688 filed on June 8, 2016, which claims the benefit of European Application Serial Number 15386017.6, filed June 9, 2015, wherein the entirety of each of said patent applications is incorporated herein by reference.

Field of the invention

This invention relates to protective coatings. Specifically, the present invention relates to protective coatings for electronic or electrical devices and components thereof, and methods of forming such coatings. The coatings can protect by being hydrophobic and so resist the ingress of water-based liquid into electronic devices, or they can protect by forming a barrier coating and so provide electrical resistance between the electrical parts of the phone and water based liquid.

Background of the invention

Monounsaturated monomers are used to make barrier coatings using plasma polymerisation processes (see co-pending application).

The perfluoroalkyl chain monomers are also used for generating hydrophobic surfaces from pulsed plasma deposition processes (see WO 9858117 A1).

The power of the plasma initiated polymerisation affects the nature of the polymer produced. The higher average energy inputs of continuous wave plasmas lead to more fragmentation of the monomer, and so the polymer loses structural properties of the monomer. In the case of 1H,1H,2H,2H- perfluorodecyl acrylate (PFAC8), there's less retention of the perfluoroalkyl chain and the contact angle of the surface coating is compromised. Higher plasma energies also lead to more crosslinking. For the lower average energy inputs of pulsed plasmas, there's better retention of monomer structure and less crosslinking. The greater retention of the perfluoro chain under low energy, pulsed plasma conditions leads to best levels of contact angles for the surface coating.

When the perfluoroalkyl chains have eight or more fluorinated carbons (long chain), the polymer made from the monomer has a crystalline structure. When the perfluoroalkyl chains have less than eight fluorinated carbons, the resulting polymer is amorphous and so can be unstable in the presence of water (see "Molecular Aggregation Structure and Surface Properties of Poly(fluoroalkyl acrylate) Thin Films, Marcomolecules, 2005, vol 38, p5699-5705)

When long chain perfluoroalkyl polymers are produced by high average power (continuous wave or CW) or low average power (pulsed wave or PW) plasmas, then because of the crystalline structure of the long chains, the polymers are non-stick to the touch and stable in the presence of water. However, the feel and water stability of shorter chain polymer coatings is affected by the plasma power levels used. For example, when PFAC6 (1H,1H,2H,2H-perfluorooctyl acrylate) is polymerised in low power plasma conditions, the resulting polymer coating can have several disadvantages. For example the coating can cause water drops to spread out a little (slump), be marked by the presence of a water drop on its surface, have a tacky feel, or can be easily smeared (for example on substrates of silicon wafer and ABS plastic).

By increasing the power of the plasma used for polymerisation, the polymer becomes more crosslinked and becomes more resistant to smearing. However, increasing the power has the concomitant effect of decreasing the water contact angle through more monomer fragmentation (as described above). Figure 1 shows the effect of increasing the power to monomer flow ratio for CW plasmas in a 125 litre chamber: at a ratio of 4 W/µl/min, the water contact angle is ~85-95 degrees and the coating is tack-free. However, as the ratio drops, the contact angle increases and the occurrence of tacky/smudgy coatings increases too. Figure 2 shows the same effect for pulsed plasma conditions. These results show that the process window for producing tack and smudge-free coatings have a limited plasma processing range and the final coating has a compromised water contact angle.

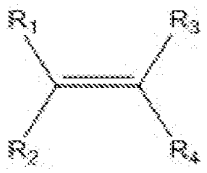
Accordingly, it is an aim to solve one or more of the above-mentioned problems with the prior art coatings.

Statement of Invention

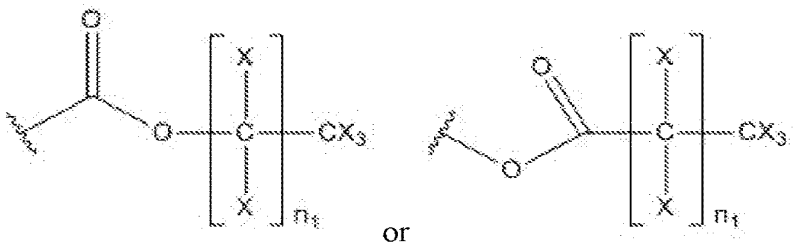
An aspect of the present invention provides an electronic or electrical device or component thereof comprising a protective cross-linked polymeric coating on a surface of the electronic or electrical device or component thereof;

wherein the protective cross-linked polymeric coating is obtainable by exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point of less than 500 °C at standard pressure.

High levels of polymer crosslinking (formerly only achievable with high average power continuous wave plasmas) can be achieved by adding a crosslinking molecule to the monomer to produce a cross-linked co-polymer. This has the advantage of increasing the

plasma processing range so stable coatings can now be produced in low average energy pulse plasma conditions.

The high degree of retention of the hydrophobic monomer structures from the low energy pulsed plasma gives coatings of the co-polymer a good hydrophobic coating (as evidenced by water contact angles) and a coating that is not sticky or smeary to the touch. Thus, these properties make it suitable for the coating of electronic devices to prevent the ingress of water-based liquids from accidental damage. Such coatings typically have a thickness between 1 and 100 nm, preferably 1 and 50 nm.

The coating may be described as a liquid repellant layer, typically a water repellant layer. The coating may repel water, an aqueous liquid such as rainwater, or oil.

Alternatively, or in addition to providing a liquid repellent layer, the coating may be a physical barrier layer.

The coating may be a physical barrier i.e. it provides a physical barrier to mass and electron transport.

The physical barrier layer restricts diffusion of water, oxygen and ions. When the coating is a physical barrier it typically has a thickness of greater than 50 nm.

The coating is a protective layer i.e. it prevents damage by contact with water or other liquids. The coating may provide is protective functionality by forming a liquid repellent layer and/or a physical barrier layer.

The coating is preferably substantially pin-hole free to enable it to provide a physical barrier. Preferably $\Delta Z/d < 0.15$, where ΔZ is the average height variation on an AFM line scan in nm (as shown in Figure 3) and d is coating thickness in nm.

The value of $\Delta Z/d$ tells us to what extent defects/voids on the surface of the coating extend into the coating, i.e. the percentage value of the depth of defect over total coating thickness. For example, $\Delta Z/d = 0.15$ means that the voids on the surface only extend down to 15% of the coating thickness. A coating with a $\Delta Z/d < 0.15$ is defined herein as being substantially pinhole free. If voids are bigger than this, the desired functionality is unlikely to be achieved.

The coating is preferably conformal, which means that it takes the 3D shape of the electronic or electrical device or component thereof and covers substantially an entire surface of the device. This has the advantage of ensuring that the coating has sufficient thickness to give optimal functionality over an entire surface of the device or component. The meaning of the term "covers substantially an entire surface" will depend to some extent on the type of surface to be covered. For example, for some components, it may be necessary for there to be complete coverage of the surface in order for the component to function after submersion in water. However, for other components or housings, small gaps in coverage may be tolerated.

The coating may have a thickness of 50 to 10,000nm, optionally 50 to 8000nm, 100 to 5000nm, preferably 250nm – 5000nm, most preferably 250nm – 2000nm.

The coating may be electrically insulating and be sufficiently compliant that electrical connectors can be joined to the electronic or electrical device or component thereof and an electrical connection made between the electrical connectors and electronic or electrical device or component thereof without the requirement to first remove the coating. In this case, the force exerted by the electrical connector on the coating is sufficient to alter the structure of or even break through the coating local to the electrical connector, allowing the electrical connection to be made. Electrical connectors can typically be joined to the electronic or electrical device or component in this way for coating thicknesses of under 5000nm, and for high performance coatings below 2000nm.

The electronic or electrical device or component thereof can typically withstand immersion in up to 1m of water for over 30 minutes without failure or corrosion whilst power applied to the electronic or electrical device or component. The effectiveness of the coating can be determined by measuring its electrical resistance at a fixed voltage when submerged in water for a set time period; for example, applying a voltage of 8V to the coating of a device which is submerged in water for 13 minutes. Coatings having a resistance value of $1x10^7$ Ohms or higher in this test are effective barrier coatings and the coated electronic or electrical device or component thereof will pass successfully an IPX7 test. The IPX7 test is the Ingress Protection Marking which classifies and rates the degree of protection provided against water. In the IPX7 test for phones, the device is immersed in water under defined conditions of pressure and time (up to 1 m of submersion) for a duration of 30 minutes. The device has to be powered on during testing and functional after 24 hrs.

In one embodiment, the coating is electrically insulating and has a thickness of less than 1 micron and wherein a force of 5- 20g applied to the coating using a round probe with 1 mm diameter allows an electrical connection to be made with the electronic or electrical device or component thereof in the local area where the force has been applied.

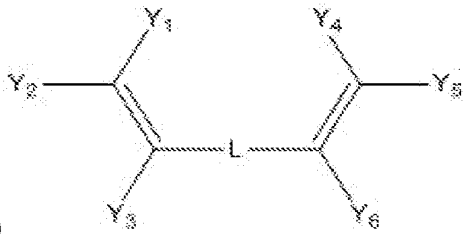
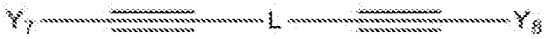
In another embodiment, the coating is electrically insulating and has a thickness of 1-2.5 microns and wherein a force of 20-100g applied to the coating using a round probe with 1 mm diameter allows an electrical connection to be made in the local area of the coating where the force has been applied.

The coating may have a higher density than that of the corresponding monomer from which it is formed. For example, the increase in density may be at least 0.1 g/cm^3. The increase in density is explained by the highly crosslinked coating. The high density of the coating improves the barrier properties of the coating.

The coating may form a surface defined by a static water contact angle (WCA) of at least 70°. A coating with a WCA of at least 90° is a liquid repellent, typically a water repellent layer. For fluorinated polymers, the coating may have a static water contact angle of at least 100°. The contact angle of a liquid on a solid substrate gives an indication of the surface energy which in turn illustrates the substrate's liquid repellence. Contact angles were measured on a VCA Optima contact angle analyser, using 3 µl droplets of deionised water at room temperature.

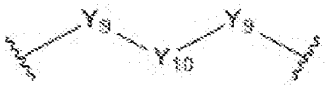
Crosslinker

A basic requirement for the cross-linking reagent is the presence two or more unsaturated bonds, for example, -C=C- or alkyne groups. The unsaturated bonds are attached by one or more linker moieties. The linker moiety is not especially limited provided it joins together the two or more unsaturated bonds. The cross-linking reagent must have a boiling point of less than 500 °C, preferably from -10 to 300°C, optionally 180 to 270°C, most preferably 205 to 260°C at standard pressure. It is a preference, but not a requirement, that the cross-linking reagent is not unduly hazardous for use in plasma processing, that is to say it can be used in a production environment where low levels of vapour do not present any significant health and safety issues (e.g. strongly oxidising, explosive, toxic, or has an offensive odour (e.g. stench reagent)). The crosslinking reagent preferably has one of the following structures:

(i)  (ii) 

where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_6 alkyl or aryl; and L is a linker moiety.

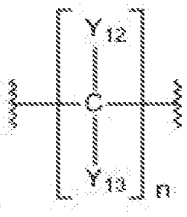
Most preferably L has the following formula:

(iii) 

where each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and

Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane containing group.

In one most preferred embodiment Y_{10} has the following formula:

(iv) 

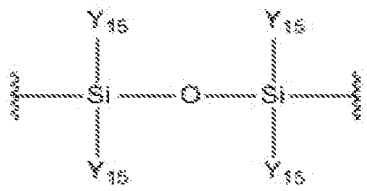
wherein each Y_{12} and Y_{13} is independently selected from H, halo, optionally substituted cyclic, branched or straight chain C_1-C_8 alkyl, or –OY_{14}, where Y_{14} is selected from optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl, and n is an integer from 1 to 10.

Optionally, each Y_{12} is H and each Y_{13} is H, i.e. Y_{10}, is a linear alkylene chain. For this embodiment Y_9 is preferably a vinyl ester or vinyl ether group.

Optionally, each Y_{12} is fluoro and each Y_{13} is fluoro, i.e. Y_{10} is a linear perfluoroalkylene chain.

Typically, n is from 4 to 6.

In another embodiment Y_{10} has the following formula:

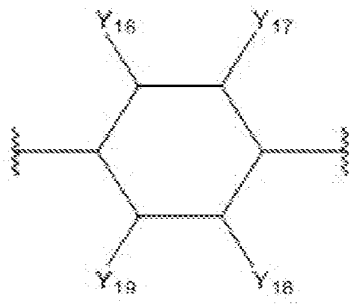


(v)

wherein each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl.

In one embodiment each Y_{15} is methyl, and each Y_9 is a bond.

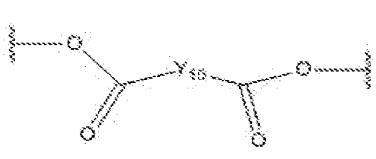
In a further embodiment Y_{10} has the following formula:



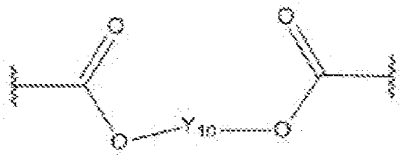
(vi)

wherein Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl. A preferred alkenyl group is vinyl. Optionally Y_{18} is H or vinyl, and Y_{16}, Y_{17} and Y_{19} are each H. In one embodiment each of Y_{16} to Y_{19} is H. In another embodiment Y_{18} is vinyl, and Y_{16}, Y_{17} and Y_{19} are each H.

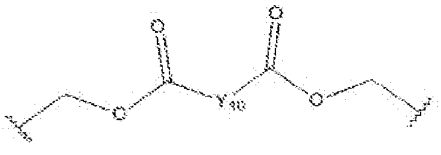
In preferable embodiments for compound (i), L has one of the following structures:

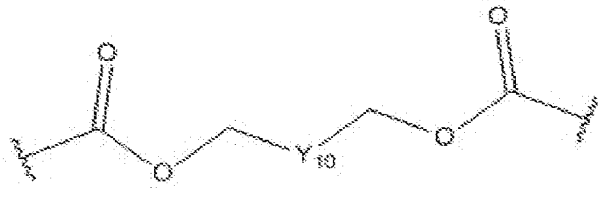


(vii)

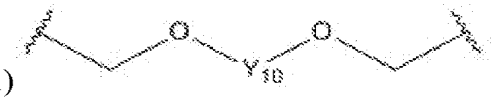


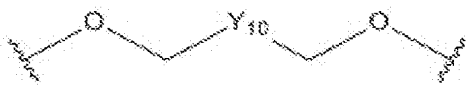
(viii)

(ix) 

(x) 

In another embodiment for compound (i) L has one of the following structures:

(xi) 

(xii) 

For L according structure (vii), Y_{10} is preferably an alkylene chain or a cycloalkylene, such as those shown in structures iv) and vi) above. The alkylene chain may be a straight chain alkylene chain. When Y_{10} is a cycloalkylene, cyclohexylene is preferred, most preferably 1,4 cyclohexylene.

For L according to structure (viii), Y_{10} is preferably structure (iv), i.e. an alkylene or fluoroalkylene chain.

For L according to structure (ix), Y_{10} is preferably cycloalkylene, such as the cyclohexylene according to structure (vi).

For L according to structure (x), Y_{10} is preferably structure (iv) wherein each Y_{12} and Y_{13} is F, i.e. a perfluoroalkylene chain.

For L according to structure (xi) or structure (xii) Y_{10} is preferably alkylene or cycloalkylene. Optionally the alkylene or cycloalkylene may be substituted with one or more vinyl groups or alkenyl ether groups, preferably one or more vinyl ether groups.

When each Y_9 is a bond, each Y_{10} may be any of structures (iv), (v) and (vi). Preferably Y_{10} is a straight chain alkylene such that the crosslinking reagent is a diene, such as a heptadiene, octadiene, or nonadiene, most preferably 1,7-octadiene.

When each Y_9 is O, each Y_{10} is preferably a branched or straight chain C_1- C_6 alkylene, preferably a straight chain alkylene, most preferably a C_4 straight chain alkylene, i.e the crosslinking reagent is 1,4-butanediol divinyl ether

It will be understood that each Y_9 group can be combined with any other Y_9 group and Y_{10} group to form the crosslinking reagent.

The skilled person will be aware of possible substituents for each of the cyclic, branched or straight chain C_1-C_8 alkylene groups mentioned above. The alkylene groups may be substituted at one or more positions by a suitable chemical group. Halo substituents are preferred, with fluoro substituents most preferred. Each C_1-C_8 alkylene group may be a C_1-C_3, C_2-C_6, or C_6-C_8 alkylene group.

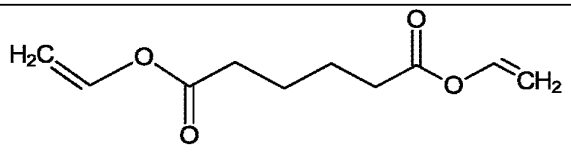
Particularly preferred embodiments of the crosslinker have alkyl chains for Y_{10} and vinyl ester or vinyl ether groups on either side.

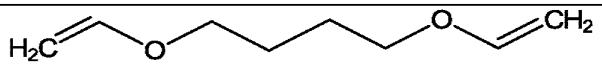
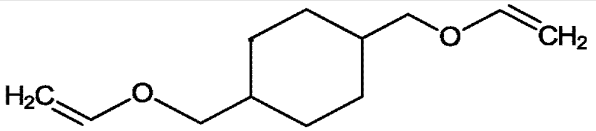
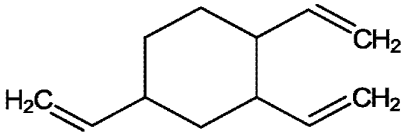
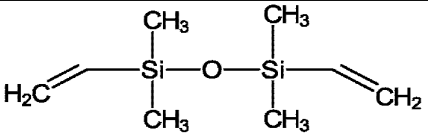
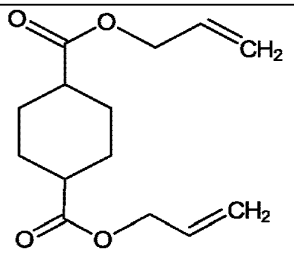
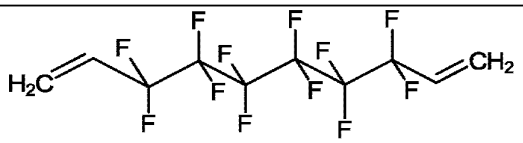
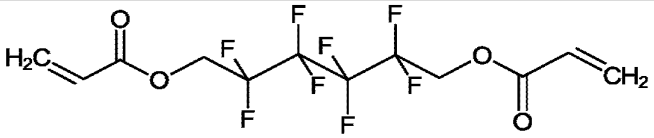
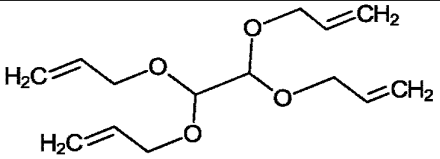
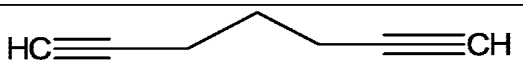
A particularly preferred cross-linking reagent is divinyl adipate. (a divinyl ester)

Another preferred cross-linking reagent is 1,4-butanediol divinyl ether (a divinyl ether)

For the most preferred embodiments the crosslinking reagent is selected from Divinyl Adipate (DVA), 1,4 Butanediol divinyl ether (BDVE), 1,4 Cyclohexanedimethanol divinyl ether (CDDE), 1,7 -Octadiene (17OD), 1,2,4 -Trivinylcyclohexane (TVCH), 1,3-Divinyltetramethyldisiloxane (DVTMDS), Diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-Divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

For the alkyne crosslinking reagents according to compound (ii), L is preferably selected from a branched or straight chain C_1-C_8 alkylene or an ether group. L may be a C_3, C_4, C_5, or C_6 alkylene, preferably a straight chain alkylene.Chemical structures for the particularly preferred crosslinking reagents are set out below in Table 1:

Divinyl Adipate (DVA)	

1,4 Butanediol divinyl ether (BDVE)	
1,4 Cyclohexanedimethanol divinyl ether (CDDE)	
1,7 -Octadiene (17OD)	
1,2,4 -Trivinylcyclohexane (TVCH)	
1,3-Divinyltetramethyldisiloxane (DVTMDS)	
Diallyl 1,4-cyclohexanedicarboxylate (DCHD)	
1,6-Divinylperfluorohexane (DVPFH)	
1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA)	
GBDA	
1,6-heptadiyne	

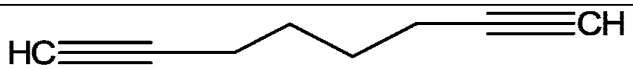
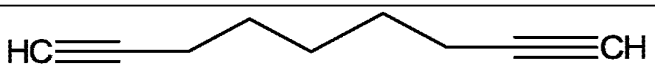
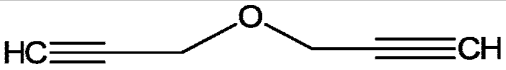
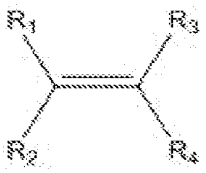
1,7-heptadiyne	
1,8-heptadiyne	
Propargyl ether	

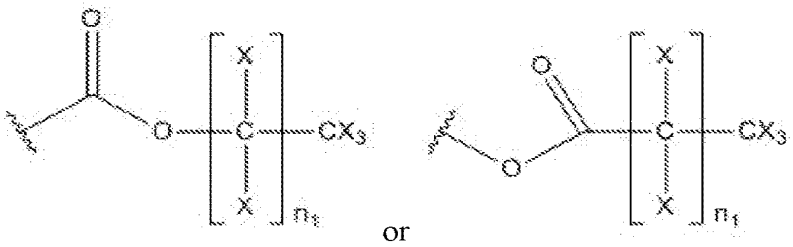
Table 1

Monomer Compound

The monomer compound has the following formula:

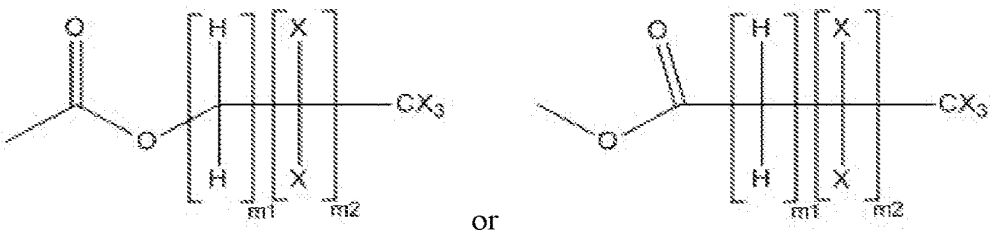


where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27. Preferably, n_1 is from 1 to 12. Optionally n_1 is from 4 to 12, optionally 6 to 8.

In a preferred embodiment R_3 is selected from:

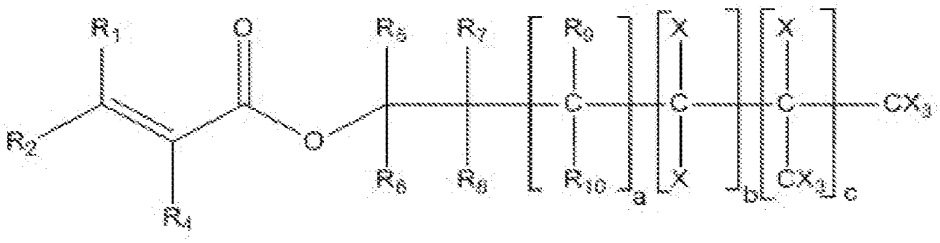


or

where m_1 is an integer from 0 to 13 and each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and m2 is an integer from 2 to 14;

In a particularly preferred embodiment the monomer is a compound of formula I(a):

I(a)

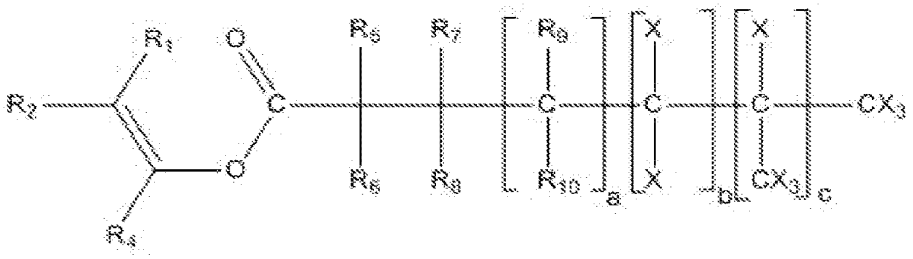


wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1;

; or

the monomer is a compound of formula I(b):

I(b)



wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1.

The halogen may be chlorine or bromine, but is preferably fluorine for compliance with RoHS regulations (Restriction of Hazardous Substances).

a is from 0 to 10, preferably from 0 to 6, optionally 2 to 4, most preferably 0 or 1. b is from 2 to 14, optionally from 2 to 10, preferably 3 to 7.

Each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or a C_1-C_6 branched or straight chain alkyl group. The alkyl group may be substituted or unsubstituted, saturated or unsaturated. When the alkyl group is substituted, the location or type of the substituent is not especially limited provided the resultant polymer provides an appropriate liquid repellent and/or barrier layer. The skilled person would be aware of suitable substituents. If the alkyl group is substituted, a preferred substituent is halo, i.e. any of R_1, R_2, R_4, and R_5 to R_{10} may be haloalkyl, preferably fluoro alkyl. Other possible substituents may be hydroxyl or amine groups. If the alkyl group is unsaturated it may comprise one or more alkene or alkyne groups.

Each of R_1, R_2, R_4, and R_5 to R_{10} may be independently selected from hydrogen, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, neopentyl, n-hexyl, isohexyl, and 3-methylpentyl.

In a preferred embodiment each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or methyl.

In a preferred embodiment, a and c are each independently 0 or 1; and b is from 3 to 7.

In one preferred embodiment each X is H. In an alternative preferred embodiment each X is F.

Optionally R_1 and R_2 are both hydrogen.

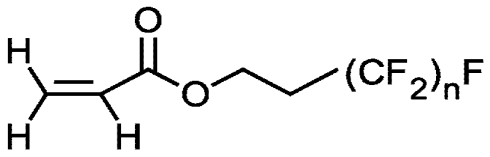
Optionally R_4 is hydrogen or methyl. Preferably R_1 and R_2 are both hydrogen and R_4 is hydrogen or methyl.

Optionally R_9 is hydrogen and R_{10} is branched or straight chain C_1-C_6 alkyl group. In a preferred embodiment R_{10} is methyl.

In one embodiment each of R_5 to R_8 is hydrogen.

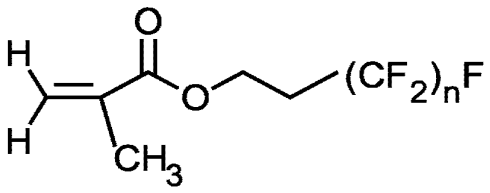
In one embodiment each of R_1, R_2, R_4, and R_5 to R_{10} is hydrogen, each X is H, a=0 and c=0.

In a particularly preferred embodiment the monomer compound has the following formula:



where n is from 2 to 10.

In another preferred embodiment the monomer compound has the following formula:

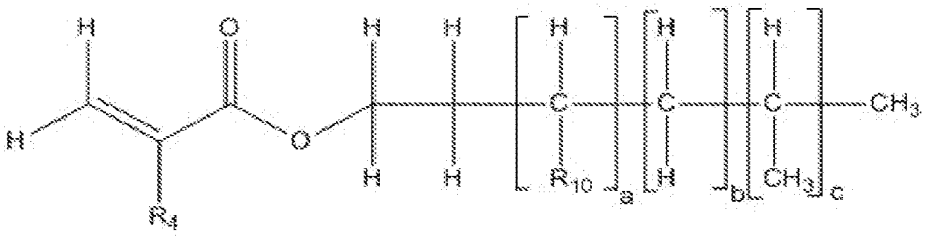


where n is from 2 to 10.

The monomer compound may be selected from 1H,1H,2H,2H-perfluorohexyl acrylate (PFAC4), 1H,1H,2H,2H-perfluorooctyl acrylate (PFAC6), 1H,1H,2H,2H-perfluorodecyl acrylate (PFAC8) and 1H,1H,2H,2H-perfluorododecyl acrylate (PFAC10).

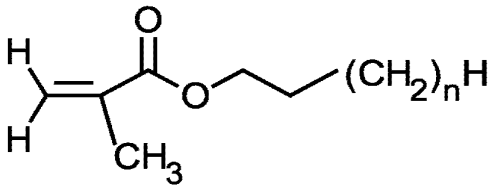
The monomer compound may be selected from 1H,1H,2H,2H-pefluorohexyl methacrylate (PFMAC4), 1H,1H,2H,2H-perfluorooctyl methacrylate (PFMAC6) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8).

The monomer compound of formula I(a) may have the following formula:



wherein a and c are each independently 0 or 1, b =3-7 and n is 4 to 10, where n=a+b+c+1.

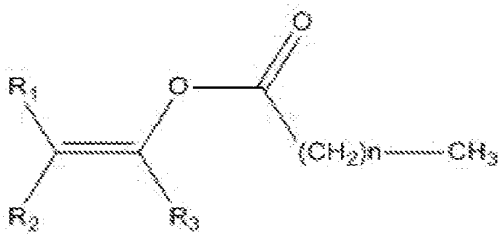
The monomer ccompound of formula I(a) may have the following formula:



where n is 2 to 12.

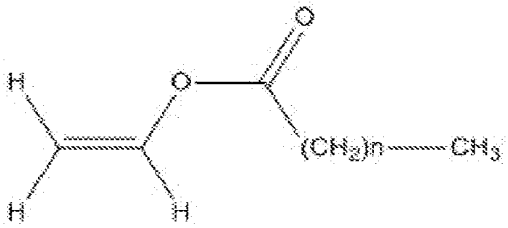
The monomer compound may be selected from ethyl hexyl acrylate, hexyl acrylate, decyl acrylate, lauryl dodecyl acrylate and iso decyl acrylate.

The monomer may have the following formula:



where n is from 4 to 14.

The monomer may have the following formula:

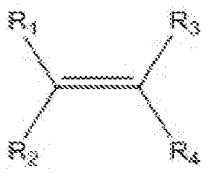


where n is from 4 to 14.

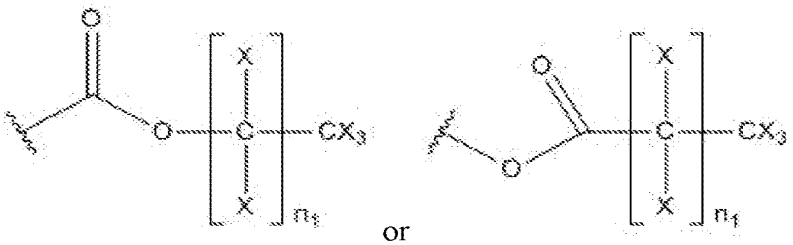
In an additional aspect, the present invention provides a method for treating an electronic device or component thereof comprising:

exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow a protective cross-linked polymeric coating to form on a surface of the electronic or electrical device or component thereof;

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds and has a boiling point of less than 500 °C at standard pressure.

The monomer compound and the crosslinking reagent utilised in the method are described in further detail above.

Typically the electronic or electrical device or component thereof is placed in a plasma deposition chamber, a glow discharge is ignited within said chamber, and a voltage applied as a pulsed field. .

Preferably the applied voltage is at a power of from 30 to 800W. Optionally the voltage is pulsed in a sequence in which the ratio of the time on/time off is in the range of from 0.001 to 1, optionally 0.002 to 0.5. For example, time on may be 10-500 μs, preferably 35-45 μs, or 30-40 μs, such as about 36 μs and time off may be from 0.1 to 30 ms, preferably 0.1 to 20 ms, optionally from 5 to 15 ms, for example 6ms. Time on may be 35 μs, 40 μs, 45 μs. Time off may be 0.1, 1, 2, 3, 6, 8, 10, 15, 20, 25 or 30 ms.

The term pulsed may mean that the plasma cycles between a state of no (or substantially no) plasma emission (off-state) and a state where a particular amount of plasma is emitted (on-state). Alternatively, pulsed may mean that there is continuous emission of plasma but that the amount of plasma cycles between an upper limit (on-state) and lower limit (off-state).

In a further embodiment, the invention resides in a method of forming a coating on an electronic or electrical device or component thereof as defined above, the method comprising: exposing said substrate in a chamber to a plasma comprising a monomer compound, preferably a continuous plasma, for a sufficient period of time to allow a protective polymeric coating to form on the substrate, wherein during exposure of the substrate the continuous plasma has a power density of at least 2W/litre, preferably 20W/litre.

Optionally the voltage is applied as a pulsed field for a period of from 30 seconds to 90 minutes. Optionally the voltage is applied as a pulsed field for from 5 to 60 minutes. Optionally in a preliminary step, a continuous power plasma is applied to the electronic or electrical device or component thereof. The preliminary step may be conducted in the presence of an inert gas.

Before the crosslinker and/or the monomer compound enter the deposition chamber each may be in the form of a gas, liquid or a solid (for example a powder) at room temperature. However, it is the preferred that the crosslinking reagent and the monomer compound are both liquid at room temperature, and most preferably that the monomer and crosslinker liquids are miscible.

The monomer compound and/or the crosslinker will suitably be in a gaseous state in the plasma. The plasma may simply comprise a vapour of the monomer compound and the crosslinker. Such a vapour may be formed in-situ, with the compounds being introduced into the chamber in liquid form. The monomer may also be combined with a carrier gas, in particular, an inert gas such as helium or argon.

In preferred embodiments, the monomer and/or the crosslinker may be delivered into the chamber by way of an aerosol device such as a nebuliser or the like, as described for example in WO2003/097245 and WO03/101621, the content of which is incorporated herein by reference. In such an arrangement a carrier gas may not be required, which advantageously assists in achieving high flow rates.

In one embodiment the monomer compound and/or the crosslinking reagent are in gaseous form and are fed into the plasma at a rate of from 10-5000 mg/minute depending on chamber volume, whilst the pulsed voltage is applied.

Optionally the plasma is created with an average power of from 0.001 to 40W/litre.

The crosslinker may be miscible with the monomer and so introduced together or separately into the plasma chamber. Or the crosslinker may be immiscible with the monomer and introduced separately into the plasma chamber. In this context, the term "miscible" means that the crosslinker is soluble in the monomer, and when mixed they form a solution of uniform composition. The term "immiscible" is used to mean that the crosslinker is only partly soluble or insoluble in the monomer, and so either forms an emulsion or separates out into two layers.

The crosslinking reagent is preferably present in an amount of from 10 to 60 (v/v) %, optionally 20 to 40 (v/v) %, optionally 25 to 30 (v/v)% , optionally 30 to 50 (v/v)% of the total volume of monomer compound and crosslinking reagent, depending on the specific crosslinker. The skilled person would understand that the amount will vary to some extent depending on whether the coating is required to be liquid repellent or provide a barrier to mass and electron transport. The skilled person would understand that the (v/v) percentages are those which give a stable crosslinked polymer coating and the highest water contact angle.

Electronic or electrical device or component thereof

Although the invention is of benefit in the context of a wide variety of substrates, the substrate may, in all aspects of the invention, advantageously be an electronic substrate.

In some embodiments of the invention, the electronic substrate may comprise an electronic or electrical device, i.e. any piece of electrical or electronic equipment. Non-limiting examples of electrical and electronic devices include communications devices such as mobile phones, smartphones and pagers, radios, and sound and audio systems such as loudspeakers, microphones, ringers or buzzers, hearing aids, personal audio equipment such as personal CD, tape cassette or MP3 players, televisions, DVD players including portable DVD players, video recorders, digi and other set-top boxes such as Sky, computers and related components such as laptop, notebook, tablet, phablet or palmtop computers, personal digital assistants (PDAs), keyboards, or instrumentation, games consoles in particular hand-held playstations and the like, data storage devices, outdoor lighting systems or radio antenna and other forms of communication equipment.

In preferred embodiments of the invention, the substrate may comprise or consist of an electronic component, e.g. a printed circuit board (PCB), a printed circuit board array (PCBA), a transistor, resistor, or semi-conductor chip. The electronic component may thus be an internal component of an electronic device, e.g. a mobile phone. The coatings of the invention are particularly valuable in preventing electrochemical migration in such components.

In all aspects of the invention, the precise conditions under which the protective polymeric coating is formed in an effective manner will vary depending upon factors such as, without limitation, the nature of the monomer compound, the crosslinking reagent, the substrate, as well as the desired properties of the coating. These conditions can be determined using routine methods or, preferably, using the techniques and preferred features of the invention described herein, which work in particular synergy with the invention.

The present invention will now be further described with reference to the following non-limiting examples and the accompanying illustrative drawings, of which:

Figure 1 illustrates shows the effect of increasing the power to monomer flow ratio for CW plasmas in a 3 litre chamber in a prior art process.

Figure 2 shows the same effect for pulsed plasma conditions.

Figure 3 shows a tapping mode image over 10x10 μm^2 field of view of a specimen example (thickness d=1230 nm) prepared according to Example 1 (left hand side) and a contour line

plot showing the data used for calculation of RMS roughness (right hand side). The ΔZ value indicated on the plot has been taken over an area of the graph that represents the majority of the coating. Peaks that lie above the ΔZ range indicate large particles and troughs that fall below the ΔZ range show voids or pinholes in the coating. The width of the peaks also gives an indication of the particle size.

Figure 4 illustrates the effect of adding the divinyl adipate crosslinker to perfluorooctyl acrylate on water contact angle from a process on a 125 Litre chamber.

Figure 5 shows the effect of adding crosslinkers in accordance with the invention on the electrical resistance per nm of the coatings.

Figure 6 shows a tapping mode image of a 90 nm thick coating, prepared as described in Example 3, over $2x2\mu m^2$ field of view (top left), a representative contour line indicating height variation (z-axis) of the coating (top right) and a phase image indicating full substrate coverage (bottom left) ;RMS roughness of the coating is 1.65 nm and $\Delta z/d = 0.05$

Figure 7 shows a FTIR/ATR spectrum of a coating formed according to Example 5.

Example 1

Example of plasma polymerising PFAC6 with no crosslinker in a 3 litre chamber

PFAC6 was polymerised in a 3 litre glass chamber using a continuous plasma process. In the experimental matrix, the continuous plasma was produced using RF power levels of 50, 100 and 200 Watts. The process pressure was run at 30, 60 and 90 mTorr and the monomer flow rate run at 50, 100 and 200 microlitres of liquid per minute. The duration of the process was either 10 or 40 minutes. The coated substrate was silicon wafer and whether the coating was tacky or not was determined by wiping the substrate with a finger and determining by eye if the coating had smeared. The results in Figure 1 indicate that for lower CW powers, the coating could easily be smeared (i.e. tacky), but by increasing the power to flow ratio, the coating became resistant to smearing (i.e. non-tacky) and this is expected to be due to additional crosslinking caused by more monomer fragmentation. The water contact angle was also seen to decline with increasing power to flow ratio, and this too is indicative of more power increasing the level of monomer fragmentation.

The same 3 litre chamber was used to also look at the effect of power to flow ratios with pulsed plasma polymerisation. In these experiments, the peak power was either 250 or 500 W. The RF power feed was pulsed with an on time of 35 microseconds and off times of 5.5 and 1 millisecond. Process pressure was either 20, 35, 60 or 80 mTorr. The monomer flow was either 50 or 200 microlitres of liquid per minute. Figure 2 shows that low power to flow conditions can generate coatings that can be smeared (tacky) and only by increasing the power could the smear be reduced. This too had a concomitant decline in water contact angle.

The results from Figures 1 and 2 show that plasma processing PFAC6 on its own could only lead to smear –free coatings when the powers were high enough to decrease the other desirable property of the water contact angle This illustrates the need to add a crosslinker to prevent the coating smearing and maintain the water contact angle.

Example 2

Examples of Perfluoro Alkyl Acrylate co-polymerisation with Crosslinker to show improvements in electrical resistance

Perfluorooctyl acrylate monomer was mixed with a single crosslinker from the following list:

VINYL ESTERS: Divinyl adipate (DVA)

VINYL ETHERS: 1,4-Butanediol divinyl ether (BDVE); 1,4 Cyclohexanedimethanol divinyl ether (CDDE)

DI- or TRI- VINYLS: 1,7-Octadiene (1,7-OD); 1,2,4-Trivinylcyclohexane (TVCH);

DI VINYL with alkyl fluoro group: 1,6-divinylperfluorohexane (DVPFH)

DI VINYL with silicon group: 1,3-Divinyl tetramethyldisiloxane (DVTMDS)

DI VINYL with cyclic ring and carboxylate groups: Diallyl 1,4-cyclohexanedicarboxylate (DCHC)

DI ACRYLATE: 1H1H,6H,6H-perfluorohexanediol diacrylate (PFHDA)

The crosslinker was mixed with the PFAC6 as a percentage by volume for the following percentages: 20, 40 , 60 , 80, and 100%.

Plasma initiated polymerisation reactions were carried out in a 3 litre glass plasma chamber. The substrates were test circuit boards. The PFAC6/crosslinker mixture was introduced at a rate of 0.04 – 0.06 ul/min and the process pressure was 40 mTorr. The process plasma consisted of a 1 minute continuous plasma (CW) step of 50W followed by 10 - 20 minute pulsed plasma (PW) step of 50W and RF power being delivered by a pulse sequence with a duty cycle of 6.9%. The coated circuit boards were immersed in tap water and an 8V potential was applied for 13 minutes. The final current readings, together with coating thickness measurements, were used to calculate the electrical resistance per nm of coating. Figure 5 below shows the effect of adding a range of crosslinkers on the electrical resistance per nm of the barrier coatings. Figure 5 clearly shows the improvement in resistance that can be gained by adding the crosslinker to the PFAC6 monomer. Furthermore, all of the crosslinkers tested gave non-smear/non-tacky coatings with concentration levels of 20% and above, with the exceptions of DVTMDS, DCHD, PFHDA and DVPFH which were non-smear at levels of 40% and above.

Example 3

Example of crosslinker concentration on water repellent coating.

Water repellent coatings were prepared in a 125 litre volume chamber using PFAC6 with different levels of divinyl adipate (DVA) and using helium as a carrier gas. The deposition process consisted of a 3 minute CW step with 300W power and a pulsed step with 150W power and an RF pulse duty cycle of 0.018%. Silicon wafer was used as the test substrates and the contact angle of the coated wafer was determined by applying a 3ul drop of deionised wafer onto the coated wafer and measuring the contact angle using a VCA Optima (AST products) with image analysis software. The variation of contact angle with (v/v)% DVA crosslinker is shown in Figure 4. It was also noted that for the 10 (v/v) % DVA concentration, the water drop left a mark on the coated wafer where it's circumference had been. This indicated that a higher level of crosslinker was required to give a more stable coating. This observation, in combination with the results in figure 4, suggest an optimum range of 20 – 40 (v/v) % DVA crosslinker, though this is likely to vary, typically within the range of from 10-60 (v/v) % for different monomers and crosslinkers and different chamber sizes.

Pulsed plasma polymerisation of perfluoro alkyl acrylate in the presence of divinyl adipate (DVA) was carried out in a 125 litre chamber. Figure 4 shows the effect of adding different liquid volume percentages of DVA crosslinker to perfluorooctyl acrylate on water contact angle on a silicon wafer substrate.

Example 4

Example of AFM measurement of monomer/crosslinker co-polymer coating

A barrier-style coating was prepared in a 22 litre volume chamber using PFAC6 with 10% DVA. The deposition process consisted of a 1 minute CW step with a CW power to flow ratio of 3.9 (W/microliter/min), and a pulsed step with a PW power/monomer flow ratio of 0.28 (W/microlitres/min). Figure 6 shows the representative topographical and phase contrast images were obtained from all the samples. High spatial resolution images show mainly the structures of areas between the raised features. The RMS roughness of the coating is 1.65 nm and the $\Delta z/d = 0.05$. As the $\Delta z/d$ value is < 0.15, then this indicates that the physical layer is substantially pinhole free.

Example 5

Example of FTIR/ATR measurement of monomer/crosslinker co-polymer coating

Two barrier-style coatings were prepared in a 22 litre volume chamber using PFAC6 only and PFAC6 with 10% DVA as described in example 4. The deposition process consisted of a 1 minute CW step with a CW power to flow ratio of 3.9 (W/microliter/min), and a pulsed step with a PW power/monomer flow ratio of 0.28 (W/microlitres/min). Figure 7 shows the representative FTIR/ATR spectrum obtained from both samples.

The FTIR/ATR intensity ratios of peaks attributed to stretching mode of CF_3 and C=O groups, CF_3/C=O, of the coating is indicative of sufficient cross linking in the coating to form a physical barrier. CF_3 refers to the terminal groups in the side chain of PFAC6.

Formation of the barrier coatings is believed to be caused by a mixture of cross linking and controlled fragmentation of the monomers during polymerisation. Cross linking is believed to be predominantly via the CF2-CF3 chain, whilst fragmentation is thought to be predominantly through loss of the C=O group during polymerisation and to a lesser extent shortening of the CF2 chain. Cross linking effects the abundance of –CF3 groups in the

coating and controlled fragmentation controls the amount of C=O groups in the coating. The ratio of these two functional groups is an indication that sufficient cross-linking and fragmentation has taken place and can be measured by the ratio of the intensities of the corresponding FTIR/ATR peaks.

It has been shown that coatings with reduced CF_3 / C=O ratios give higher resistance values in the electrical test, as described in Example 2, showing an improved coating performance on increased cross linking (for CF_3) and fragmentation (for C=O). If the FTIR/ATR intensity ratio of the peaks attributed to -CF_3 stretching and C=O stretching, CF_3/C=O, is less than $0.6e^{-0.1n}$ (where n=6 for PFAC6) the resistance of the coating at the electrical test is expected to be higher than 8MOhms.

The peak intensity ratio CF_3/C=O the coating thickness and the final current readings during the electrical test are shown in table 2:

	Thickness (nm)	**Resistance in water at 8V (Ohms)**	**CF_3/C=O ATR peak intensity ratio**
PFAC6	1480	$2.1x10^7$	0.23
PFAC6 and 10%DVA (in volume)	1450	$9.2x10^9$	0.11

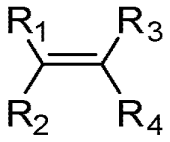
Table 2

WHAT IS CLAIMED IS:

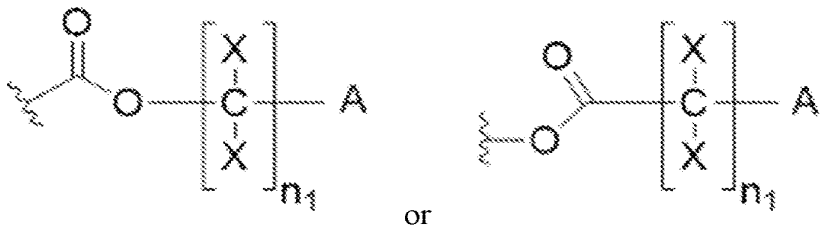
1. An electronic or electrical device or electronic or electrical component thereof comprising a protective cross-linked polymeric coating on a surface of the device or component;

wherein the protective cross-linked polymeric coating is obtained by exposing the device or component to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:

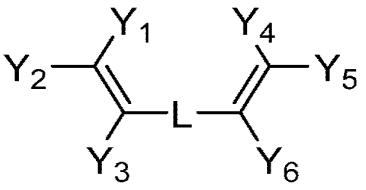


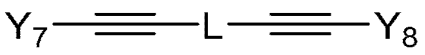
where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; where A is aryl optionally substituted by halo; and n_1 is an integer from 0 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point of less than 500 °C at standard pressure.

2. A device or component according to claim 1, wherein the protective cross-linked polymeric coating is a physical barrier to mass and electron transport.

3. A device or component according to claim 1, wherein the protective cross-linked polymeric coating forms a liquid repellent surface defined by a static water contact angle (WCA) of at least 90°.

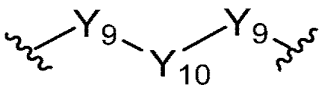
4. A device or component according to claim 1, wherein the crosslinking reagent has one of the following structures:

(i) 

(ii) 

where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_6 alkyl or aryl; and L is a linker moiety.

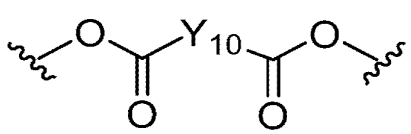
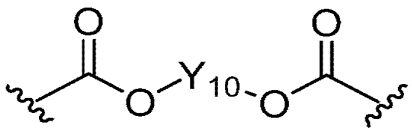
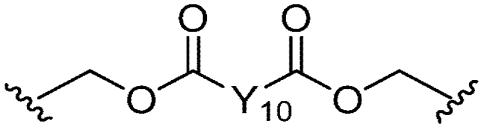
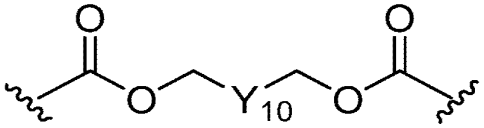
5. A device or component according to claim 4, wherein for compound (i) L has the following formula:



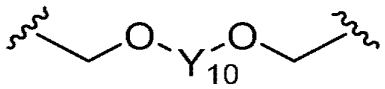
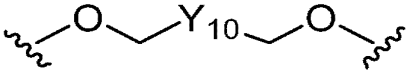
each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and

Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane group.

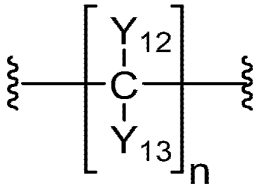
6. A device or component according to claim 5, wherein for compound (i) L has one of the following structures:

7. A device or component according to claim 5, wherein for compound (i) L has one of the following structures:

8. A device or component according to claim 5, wherein Y_{10} has the following formula:



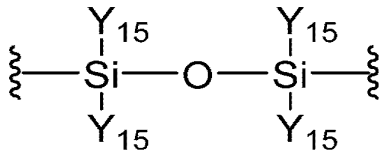
wherein each Y_{12} and Y_{13} is independently selected from H, halo, optionally substituted cyclic, branched or straight chain alkyl, or $-OY_{14}$, where Y_{14} is selected from optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl, and n is an integer from 1 to 10.

9. A device or component according to claim 8, wherein each Y_{12} is H and each Y_{13} is H.

10. A device or component according to claim 8, wherein each Y_{12} is fluoro and each Y_{13} is fluoro.

11. A device or component according to claim 10, wherein n is from 4 to 6.

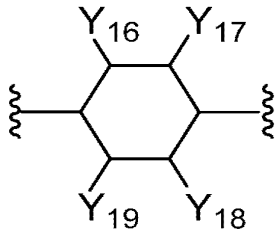
12. A device or component according to claim 5, wherein Y_{10} has the following formula:



wherein each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl.

13. A device or component according to claim 12, wherein each Y_{15} is methyl, and each Y_9 is a bond.

14. A device or component according to claim 5, wherein Y_{10} has the following formula:



wherein Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl.

15. A device or component according to claim 14, wherein Y_{18} is H or vinylene, and Y_{16}, Y_{17} and Y_{19} are each H.

16. A device or component according to claim 1 wherein the crosslinking reagent is selected from divinyl adipate (DVA), 1,4-butanediol divinyl ether (BDVE), 1,4-cyclohexanedimethanol divinyl ether (CDDE), 1,7-octadiene (17OD), 1,2,4-trivinylcyclohexane (TVCH), 1,3-vivinyltetramethyldisiloxane (DVTMDS), diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

17. A device or component according to claim 4, wherein for compound (ii), L is selected from a branched or straight chain C_1-C_8 alkylene or an ether group.

18. A device or component according to claim 1 wherein each X is H.

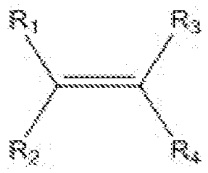
19. A device or component according to claim 1, wherein each X is F.

20. A device or component according to claim 1, wherein the device or component is selected from mobile phones, smartphones, pagers, radios, sound and audio systems such as loudspeakers, microphones, ringers and/or buzzers, hearing aids, personal audio equipment such as personal CD, tape cassette or MP3 players, televisions, DVD players including portable DVD players, video recorders, digi and other set-top boxes, computers and related components such as laptop, notebook, tablet, phablet or palmtop computers, personal digital assistants (PDAs), keyboards, or instrumentation, games consoles, data storage devices, outdoor lighting systems, radio antennae and other forms of communication equipment, and printed circuit boards.

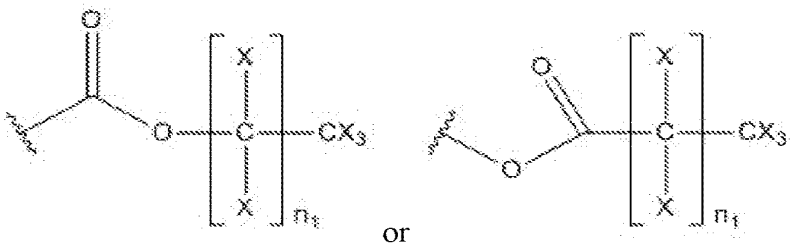
Abstract

The present invention provides an electronic or electrical device or component thereof comprising a cross-linked polymeric coating on a surface of the electronic or electrical device or component thereof; wherein the cross-linked polymeric coating is obtainable by exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the cross-linked polymeric coating on a surface thereof,

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point at standard pressure of less than 500°C.

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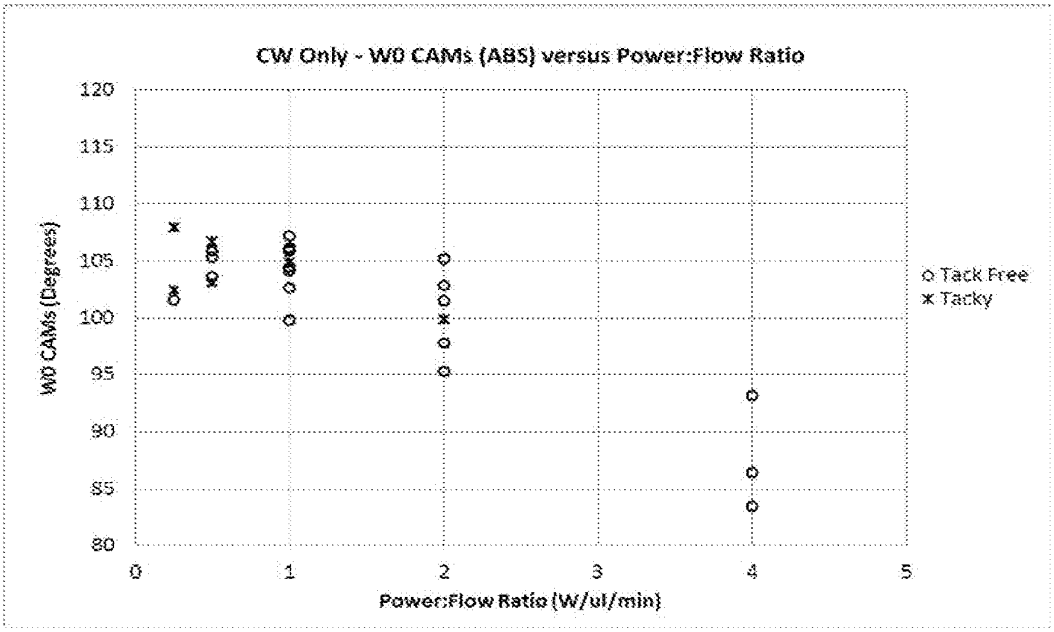

CW Only - W0 CAMs (ABS) versus Power:Flow Ratio
W0 CAMs (Degrees)
120
115
110
105
100
95
90
85
80
0
1
2
3
4
5
Power:Flow Ratio (W/ul/min)
Tack Free
Tacky

Figure 1

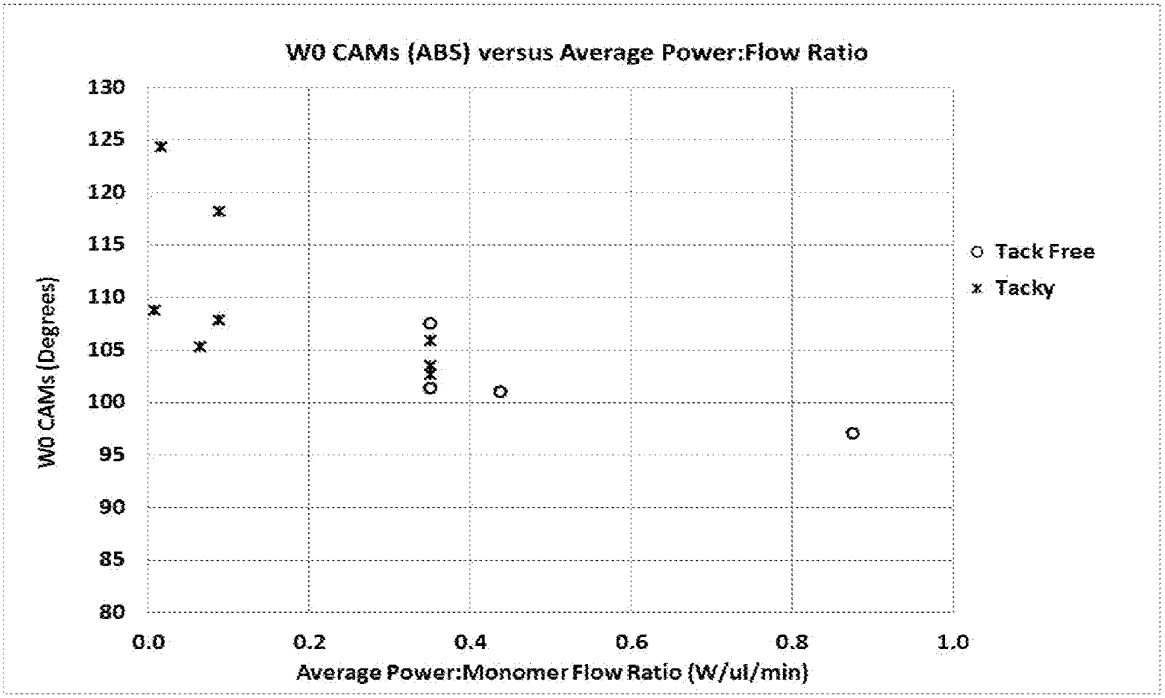

W0 CAMs (ABS) versus Average Power:Flow Ratio
W0 CAMs (Degrees)
130
125
120
115
110
105
100
95
90
85
80
0.0
0.2
0.4
0.6
0.8
1.0
Average Power:Monomer Flow Ratio (W/ul/min)
Tack Free
Tacky

Figure 2

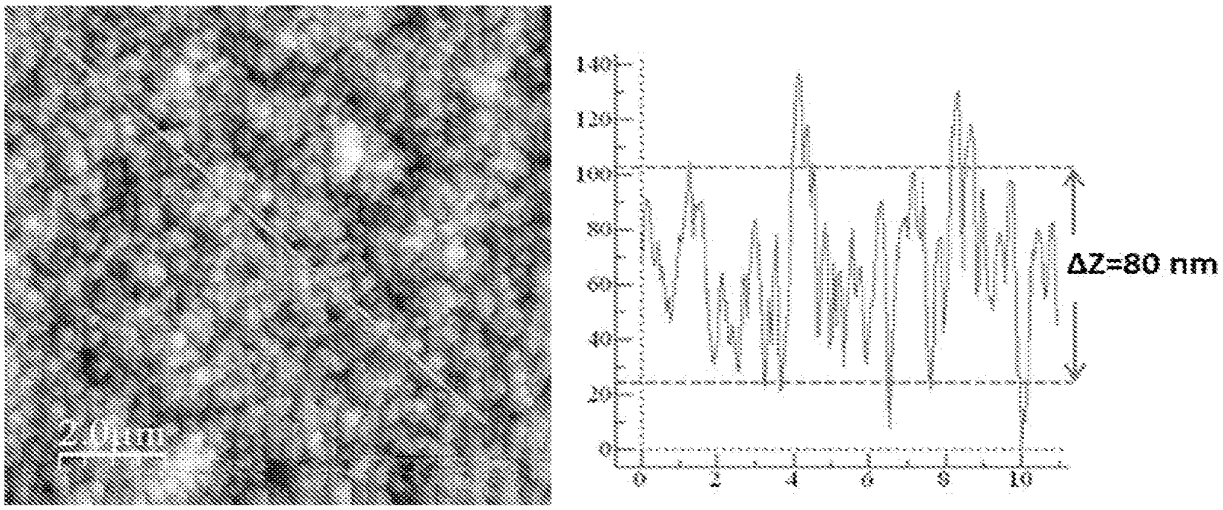


Figure 3

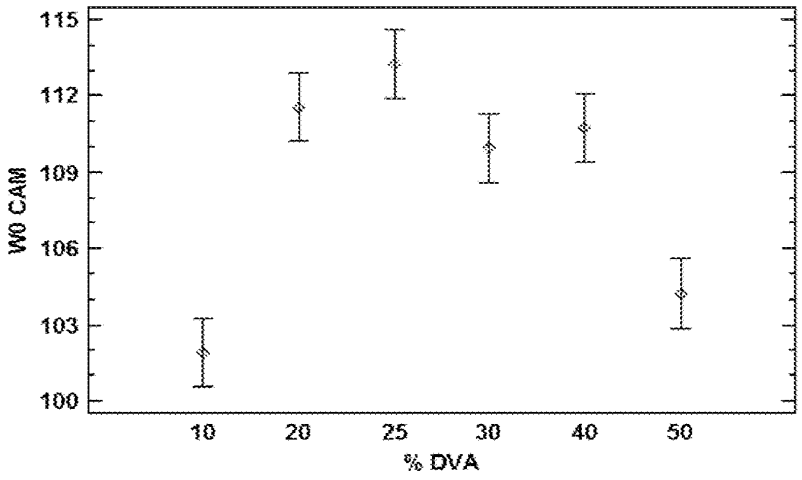


Figure 4

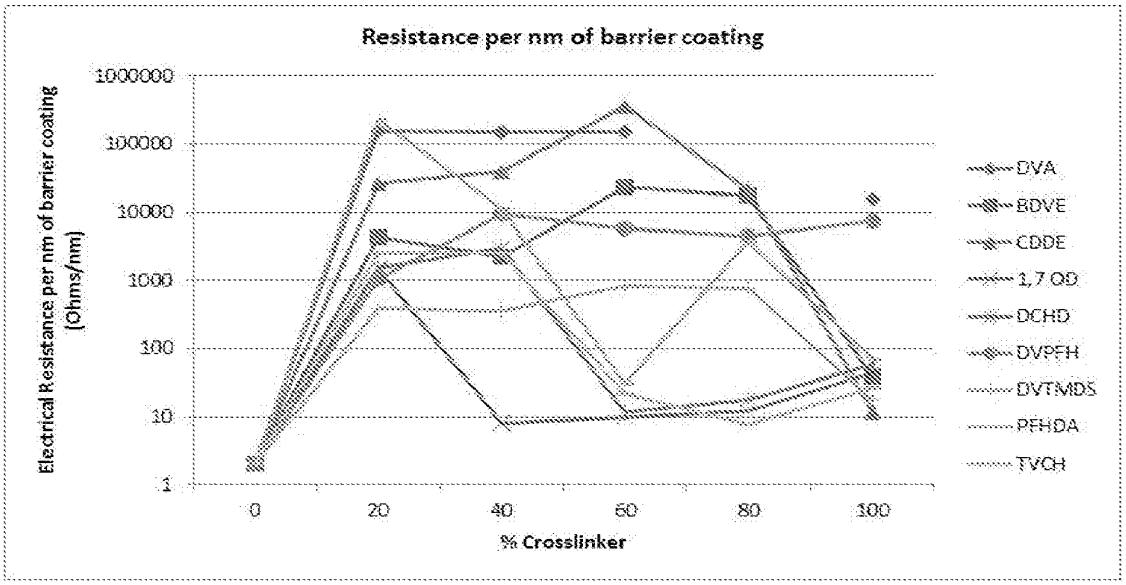

Resistance per nm of barrier coating
Electrical Resistance per nm of barrier coating (Ohms/nm)
1000000
100000
10000
1000
100
10
1
0
20
40
60
80
100
% Crosslinker
DVA
BDVE
CDDE
1,7 OD
DCHD
DVPFH
DVTMDS
PFHDA
TVCH

Figure 5

Figure 6

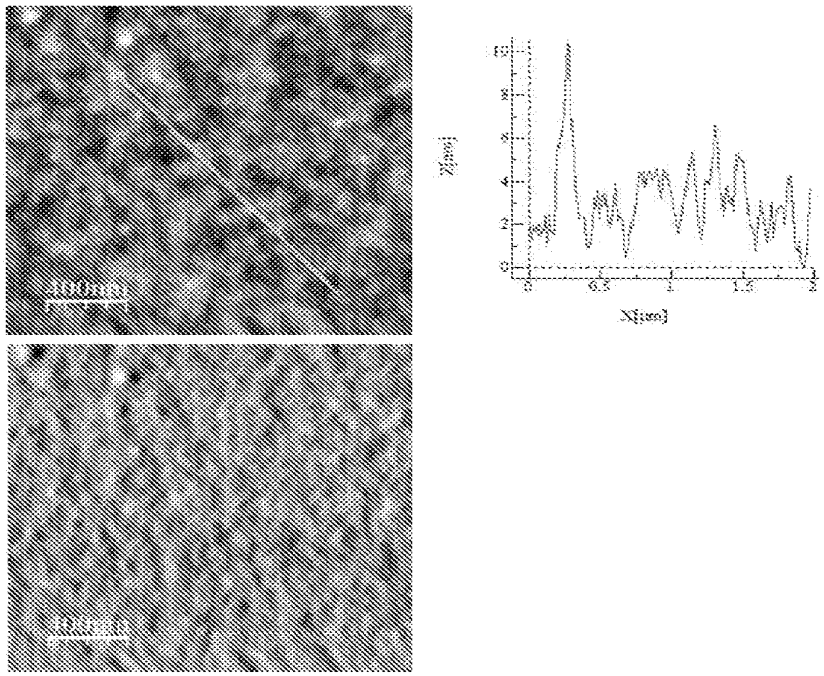
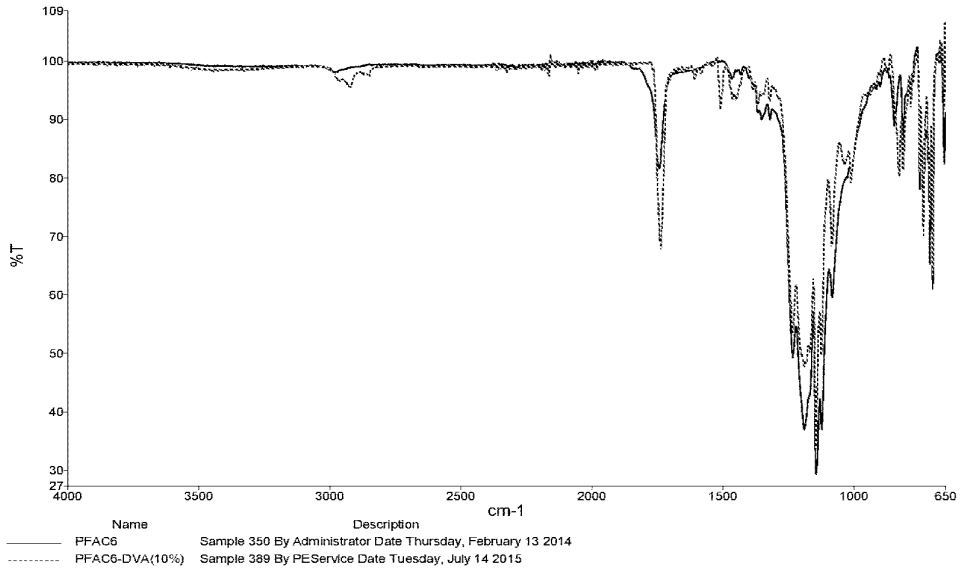


Figure 7



Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large Entity

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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
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UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1720**

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Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	22-AUG-2019
Filing Date:	
Time Stamp:	10:46:59
Application Type:	Utility under 35 USC 111(a)

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	Specification	1	25

	Claims		26	30	
	Abstract		31	31	
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16/547,728	08/22/2019	1715	1720	GBL0007/US/2	20	1

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SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082
UNITED STATES OF AMERICA

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Date Mailed: 09/04/2019

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Inventor(s)

Stephen Richard COULSON, Abingdon, UNITED KINGDOM;
Delwyn EVANS, Abingdon, UNITED KINGDOM;
Angeliki SIOKOU, Abingdon, UNITED KINGDOM;
Clive TELFORD, Abingdon, UNITED KINGDOM, Deceased;

Applicant(s)

P2i Ltd, Abingdon, UNITED KINGDOM;

Power of Attorney: The patent practitioners associated with Customer Number 33072

Domestic Priority data as claimed by applicant

This application is a CON of 15/735,130 12/08/2017
which is a 371 of PCT/GB2016/051688 06/08/2016

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
EUROPEAN PATENT OFFICE (EPO) 15386017.6 06/09/2015 No Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

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If Required, Foreign Filing License Granted: 08/30/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/547,728**

Projected Publication Date: 12/12/2019

Non-Publication Request: No

Early Publication Request: No

Title

COATINGS

Preliminary Class

427

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: 16/547,728

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			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 460 =	0.00
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			TOTAL	1720

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.

Doc Code: PA..
Document Description: Power of Attorney

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Approved for use through 01/31/2018. OMB 0651-0035
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Application Number	16/547,728
Filing Date	August 22, 2019
First Named Inventor	Stephen Richard COULSON
Title	COATINGS
Art Unit	1715
Examiner Name	Not Yet Assigned
Attorney Docket Number	GBL0007/US/2

SIGNATURE of Applicant or Patent Practitioner

Signature		Date (Optional)	04.30.2019
Name	Paul J. Parins	Registration Number	54,358
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

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Doc Code: PA.
Document Description: Power of Attorney

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 33072

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

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OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

P2i Ltd

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	SRC	Date (Optional)	
Name	Stephen Collier		
Title	CSO , P2i Ltd		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

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Electronic Acknowledgement Receipt

EFS ID:	37607374
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	30-OCT-2019
Filing Date:	22-AUG-2019
Time Stamp:	14:56:09
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	Power of Attorney	GBL0007US2_POA.pdf	499360 eca748600765a4f2c946827abceb249a7504fca7	no	2

Warnings:

Information:	
Total Files Size (in bytes):	499360

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.

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

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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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2

CONFIRMATION NO. 6664

POA ACCEPTANCE LETTER

33072
KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082
UNITED STATES OF AMERICA

OC000000112349702

Date Mailed: 11/04/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/30/2019.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

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**.

/sleutchit/

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European Patent Office
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Bescheinigung	Certificate	Attestation
Die angehefteten Unterlagen stimmen mit der als ursprünglich eingereicht geltenden Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.	The attached documents are exact copies of the text in which the European patent application described on the following page is deemed to have been filed.	Les documents joints à la présente attestation sont conformes au texte, considéré comme initialement déposé, de la demande de brevet européen qui est spécifiée à la page suivante.

Patentanmeldung Nr.	**Patent application No.**	**Demande de brevet n°**
	15386017.6 / EP15386017	

The organization code and number of your priority application, to be used for filing abroad under the Paris Convention, is EP15386017.

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le President de l'Office européen des brevets
p.o.

V. Joseph

Anmeldung Nr:
Application no.: 15386017.6
Demande no :

Anmeldetag:
Date of filing: 09.06.15
Date de dépôt :

Anmelder / Applicant(s) / Demandeur(s):

p2i Limited
Global Headquarters
9-12 North Central
127 Olympic Avenue
Milton Park
Abingdon
Oxfordshire OX14 4SA/GB

Bezeichnung der Erfindung / Title of the invention / Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, oder falls die Anmeldung in einer Nicht-Amtssprache des EPA eingereicht wurde, siehe Beschreibung bezüglich ursprünglicher Bezeichnung.
If no title is shown, or if the application has been filed in a non-EPO language, please refer to the description for the original title.
Si aucun titre n'est indiqué, ou si la demande a été déposée dans une langue autre qu'une langue officielle de l'OEB, se référer à la description pour le titre original.)

COATINGS

In Anspruch genommene Priorität(en) / Priority(Priorities) claimed / Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen / State/Date/File no. / Pays/Date/Numéro de dépôt:

Am Anmeldetag benannte Vertragstaaten / Contracting States designated at date of filing / Etats contractants désignées lors du dépôt:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Coatings

Field of the invention

This invention relates to protective coatings. Specifically, the present invention relates to protective coatings for electronic or electrical devices and components thereof, and methods of forming such coatings. The coatings can protect by being hydrophobic and so resist the ingress of water-based liquid into electronic devices, or they can protect by forming a barrier coating and so provide electrical resistance between the electrical parts of the phone and water based liquid.

Background of the invention

Monounsaturated monomers are used to make barrier coatings using plasma polymerisation processes (see co-pending application).

The perfluoroalkyl chain monomers are also used for generating hydrophobic surfaces from pulsed plasma deposition processes (see WO 9858117 A1).

The power of the plasma initiated polymerisation affects the nature of the polymer produced. The higher average energy inputs of continuous wave plasmas lead to more fragmentation of the monomer, and so the polymer loses structural properties of the monomer. In the case of 1H,1H,2H,2H- perfluorodecyl acrylate (PFAC8), there's less retention of the perfluoroalkyl chain and the contact angle of the surface coating is compromised. Higher plasma energies also lead to more crosslinking. For the lower average energy inputs of pulsed plasmas, there's better retention of monomer structure and less crosslinking. The greater retention of the perfluoro chain under low energy, pulsed plasma conditions leads to best levels of contact angles for the surface coating.

When the perfluoroalkyl chains have eight or more fluorinated carbons (long chain), the polymer made from the monomer has a crystalline structure. When the perfluoroalkyl chains have less than eight fluorinated carbons, the resulting polymer is amorphous and so can be unstable in the presence of water (see "Molecular Aggregation Structure and Surface Properties of Poly(fluoroalkyl acrylate) Thin Films, Marcomolecules, 2005, vol 38, p5699-5705)

When long chain perfluoroalkyl polymers are produced by high average power (continuous wave or CW) or low average power (pulsed wave or PW) plasmas, then because of the crystalline structure of the long chains, the polymers are non-stick to the touch and stable in the presence of water. However, the feel and water stability of shorter chain polymer coatings is affected by the plasma power levels used. For example, when PFAC6 (1H,1H,2H,2H-perfluorooctyl acrylate) is polymerised in low power plasma conditions, the resulting polymer coating can have several disadvantages. For example the coating can cause water drops to spread out a little (slump), be marked by the presence of a water drop on its surface, have a tacky feel, or can be easily smeared (for example on substrates of silicon wafer and ABS plastic).

By increasing the power of the plasma used for polymerisation, the polymer becomes more crosslinked and becomes more resistant to smearing. However, increasing the power has the concomitant effect of decreasing the water contact angle through more monomer fragmentation (as described above). Figure 1 shows the effect of increasing the power to monomer flow ratio for CW plasmas in a 125 litre chamber: at a ratio of 4 W/µl/min, the water contact angle is ~85-95 degrees and the coating is tack-free. However, as the ratio drops, the contact angle increases and the occurrence of tacky/smudgy coatings increases too. Figure 2 shows the same effect for pulsed plasma conditions. These results show that the process window for producing tack and smudge-free coatings have a limited plasma processing range and the final coating has a compromised water contact angle.

Accordingly, it is an aim to solve one or more of the above-mentioned problems with the prior art coatings.

Statement of Invention

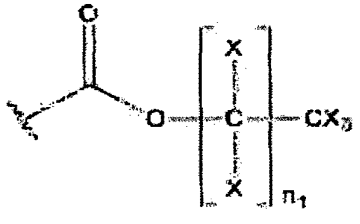
An aspect of the present invention provides an electronic or electrical device or component thereof comprising a protective cross-linked polymeric coating on a surface of the electronic or electrical device or component thereof;

wherein the protective cross-linked polymeric coating is obtainable by exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,

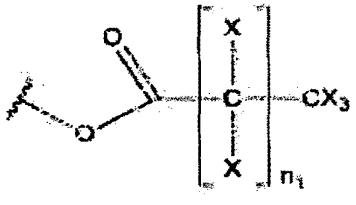
wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



or



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point of less than 500 °C at standard pressure.

High levels of polymer crosslinking (formerly only achievable with high average power continuous wave plasmas) can be achieved by adding a crosslinking molecule to the monomer to produce a cross-linked co-polymer. This has the advantage of increasing the plasma processing range so stable coatings can now be produced in low average energy pulse plasma conditions.

The high degree of retention of the hydrophobic monomer structures from the low energy pulsed plasma gives coatings of the co-polymer a good hydrophobic coating (as evidenced by water contact angles) and a coating that is not sticky or smeary to the touch. Thus, these properties make it suitable for the coating of electronic devices to prevent the ingress of water-based liquids from accidental damage. Such coatings typically have a thickness between 1 and 100 nm, preferably 1 and 50 nm.

The coating may be described as a liquid repellant layer, typically a water repellant layer. The coating may repel water, an aqueous liquid such as rainwater, or oil.

Alternatively, or in addition to providing a liquid repellent layer, the coating may be a physical barrier layer.

The coating may be a physical barrier i.e. it provides a physical barrier to mass and electron transport.

The physical barrier layer restricts diffusion of water, oxygen and ions. When the coating is a physical barrier it typically has a thickness of greater than 50 nm.

The coating is a protective layer i.e. it prevents damage by contact with water or other liquids. The coating may provide is protective functionality by forming a liquid repellent layer and/or a physical barrier layer.

The coating is preferably substantially pin-hole free to enable it to provide a physical barrier. Preferably $\Delta Z/d < 0.15$, where ΔZ is the average height variation on an AFM line scan in nm (as shown in Figure 3) and d is coating thickness in nm.

The value of $\Delta Z/d$ tells us to what extent defects/voids on the surface of the coating extend into the coating, i.e. the percentage value of the depth of defect over total coating thickness. For example, $\Delta Z/d = 0.15$ means that the voids on the surface only extend down to 15% of the coating thickness. A coating with a $\Delta Z/d < 0.15$ is defined herein as being substantially pinhole free. If voids are bigger than this, the desired functionality is unlikely to be achieved.

The coating is preferably conformal, which means that it takes the 3D shape of the electronic or electrical device or component thereof and covers substantially an entire surface of the device. This has the advantage of ensuring that the coating has sufficient thickness to give optimal functionality over an entire surface of the device or component. The meaning of the term "covers substantially an entire surface" will depend to some extent on the type of surface to be covered. For example, for some components, it may be necessary for there to be complete coverage of the surface in order for the component to function after submersion in water. However, for other components or housings, small gaps in coverage may be tolerated.

The coating may have a thickness of 50 to 10,000nm, optionally 50 to 8000nm, 100 to 5000nm, preferably 250nm – 5000nm, most preferably 250nm – 2000nm.

The coating may be electrically insulating and be sufficiently compliant that electrical connectors can be joined to the electronic or electrical device or component thereof and an electrical connection made between the electrical connectors and electronic or electrical device or component thereof without the requirement to first remove the coating. In this case, the force exerted by the electrical connector on the coating is sufficient to alter the structure of or even break through the coating local to the electrical connector, allowing the electrical connection to be made. Electrical connectors can typically be joined to the electronic or electrical device or component in this way for coating thicknesses of under 5000nm, and for high performance coatings below 2000nm.

The electronic or electrical device or component thereof can typically withstand immersion in up to 1m of water for over 30 minutes without failure or corrosion whilst power applied to the electronic or electrical device or component. The effectiveness of the coating can be determined by measuring its electrical resistance at a fixed voltage when submerged in water for a set time period; for example, applying a voltage of 8V to the coating of a device which is submerged in water for 13 minutes. Coatings having a resistance value of $1x10^7$ Ohms or higher in this test are effective barrier coatings and the coated electronic or electrical device or component thereof will pass successfully an IPX7 test. The IPX7 test is the Ingress Protection Marking which classifies and rates the degree of protection provided against water. In the IPX7 test for phones, the device is immersed in water under defined conditions of pressure and time (up to 1 m of submersion) for a duration of 30 minutes. The device has to be powered on during testing and functional after 24 hrs.

In one embodiment, the coating is electrically insulating and has a thickness of less than 1 micron and wherein a force of 5- 20g applied to the coating using a round probe with 1 mm diameter allows an electrical connection to be made with the electronic or electrical device or component thereof in the local area where the force has been applied.

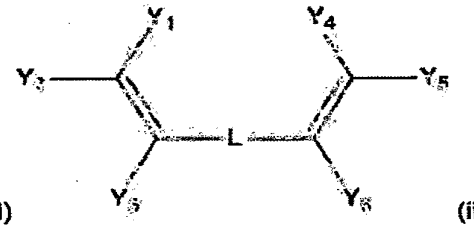
In another embodiment, the coating is electrically insulating and has a thickness of 1-2.5 microns and wherein a force of 20-100g applied to the coating using a round probe with 1 mm diameter allows an electrical connection to be made in the local area of the coating where the force has been applied.

The coating may have a higher density than that of the corresponding monomer from which it is formed. For example, the increase in density may be at least 0.1 g/cm^3. The increase in density is explained by the highly crosslinked coating. The high density of the coating improves the barrier properties of the coating.

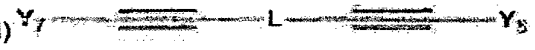
The coating may form a surface defined by a static water contact angle (WCA) of at least 70°. A coating with a WCA of at least 90° is a liquid repellent, typically a water repellent layer. For fluorinated polymers, the coating may have a static water contact angle of at least 100°. The contact angle of a liquid on a solid substrate gives an indication of the surface energy which in turn illustrates the substrate's liquid repellence. Contact angles were measured on a VCA Optima contact angle analyser, using 3 µl droplets of deionised water at room temperature.

Crosslinker

A basic requirement for the cross-linking reagent is the presence two or more unsaturated bonds, for example, -C=C- or alkyne groups. The unsaturated bonds are attached by one or more linker moieties. The linker moiety is not especially limited provided it joins together the two or more unsaturated bonds. The cross-linking reagent must have a boiling point of less than 500 °C, preferably from -10 to 300°C, optionally 180 to 270°C, most preferably 205 to 260°C at standard pressure. It is a preference, but not a requirement, that the cross-linking reagent is not unduly hazardous for use in plasma processing, that is to say it can be used in a production environment where low levels of vapour do not present any significant health and safety issues (e.g. strongly oxidising, explosive, toxic, or has an offensive odour (e.g. stench reagent)). The crosslinking reagent preferably has one of the following structures:



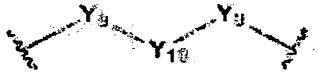
(i)



(ii)

where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_8 alkyl or aryl; and L is a linker moiety.

Most preferably L has the following formula:

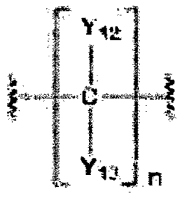


(iii)

where each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and

Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane containing group.

In one most preferred embodiment Y_{10} has the following formula:



(iv)

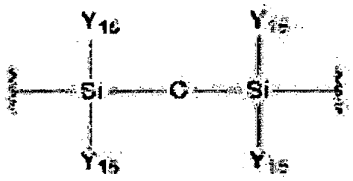
wherein each Y_{12} and Y_{13} is independently selected from H, halo, optionally substituted cyclic, branched or straight chain C_1-C_8 alkyl, or $-OY_{14}$, where Y_{14} is selected from optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl, and n is an integer from 1 to 10.

Optionally, each Y_{12} is H and each Y_{13} is H, i.e. Y_{10}, is a linear alkylene chain. For this embodiment Y_9 is preferably a vinyl ester or vinyl ether group.

Optionally, each Y_{12} is fluoro and each Y_{13} is fluoro, i.e. Y_{10} is a linear perfluoroalkylene chain.

Typically, n is from 4 to 6.

In another embodiment Y_{10} has the following formula:

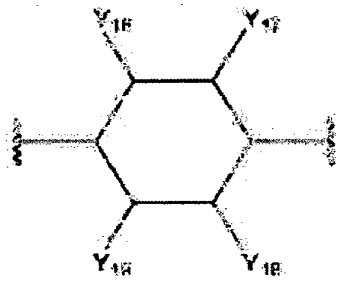


(v)

wherein each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl.

In one embodiment each Y_{15} is methyl, and each Y_9 is a bond.

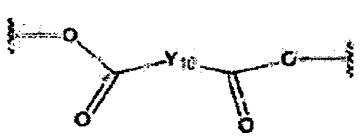
In a further embodiment Y_{10} has the following formula:



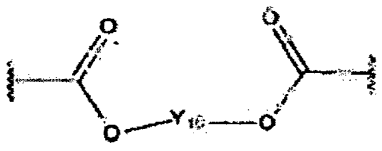
(vi)

wherein Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_6 alkyl or alkenyl. A preferred alkenyl group is vinyl. Optionally Y_{18} is H or vinyl, and Y_{16}, Y_{17} and Y_{19} are each H. In one embodiment each of Y_{16} to Y_{19} is H. In another embodiment Y_{18} is vinyl, and Y_{16}, Y_{17} and Y_{19} are each H.

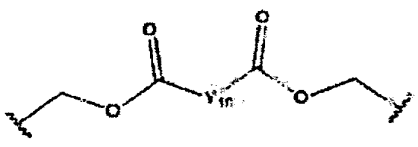
In preferable embodiments for compound (i), L has one of the following structures:



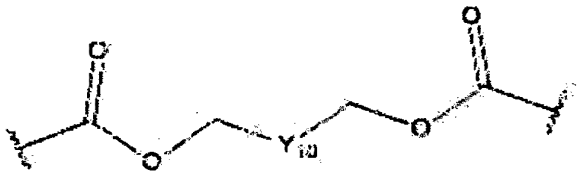
(vii)



(viii)



(ix)



(x)

In another embodiment for compound (i) L has one of the following structures:



(xi)



(xii)

For L according structure (vii), Y_{10} is preferably an alkylene chain or a cycloalkylene, such as those shown in structures iv) and vi) above. The alkylene chain may be a straight chain alkylene chain. When Y_{10} is a cycloalkylene, cyclohexylene is preferred, most preferably 1,4 cyclohexylene.

For L according to structure (viii), Y_{10} is preferably structure (iv), i.e. an alkylene or fluoroalkylene chain.

For L according to structure (ix), Y_{10} is preferably cycloalkylene, such as the cyclohexylene according to structure (vi).

For L according to structure (x), Y_{10} is preferably structure (iv) wherein each Y_{12} and Y_{13} is F, i.e. a perfluoroalkylene chain.

For L according to structure (xi) or structure (xii) Y_{10} is preferably alkylene or cycloalkylene. Optionally the alkylene or cycloalkylene may be substituted with one or more vinyl groups or alkenyl ether groups, preferably one or more vinyl ether groups.

When each Y_9 is a bond, each Y_{10} may be any of structures (iv), (v) and (vi). Preferably Y_{10} is a straight chain alkylene such that the crosslinking reagent is a diene, such as a heptadiene, octadiene, or nonadiene, most preferably 1,7-octadiene.

When each Y_9 is O, each Y_{10} is preferably a branched or straight chain C_1- C_8 alkylene, preferably a straight chain alkylene, most preferably a C_4 straight chain alkylene, i.e the crosslinking reagent is 1,4-butanediol divinyl ether

It will be understood that each Y_9 group can be combined with any other Y_9 group and Y_{10} group to form the crosslinking reagent.

The skilled person will be aware of possible substituents for each of the cyclic, branched or straight chain C_1-C_8 alkylene groups mentioned above. The alkylene groups may be substituted at one or more positions by a suitable chemical group. Halo substituents are preferred, with fluoro substituents most preferred. Each C_1-C_8 alkylene group may be a C_1-C_3, C_2-C_6, or C_6-C_8 alkylene group.

Particularly preferred embodiments of the crosslinker have alkyl chains for Y_{10} and vinyl ester or vinyl ether groups on either side.

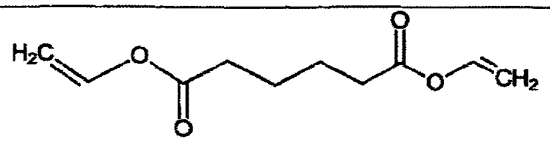
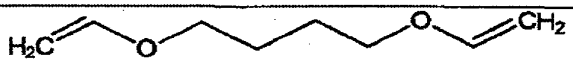
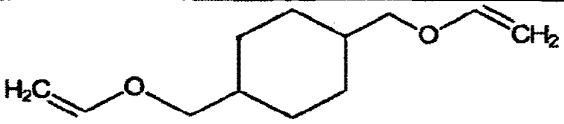
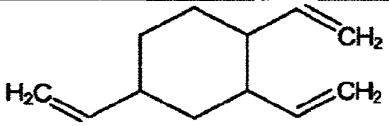
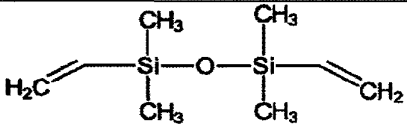
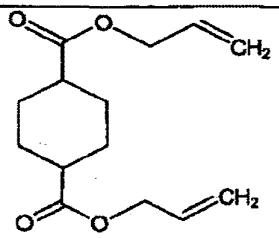
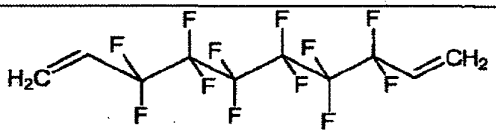
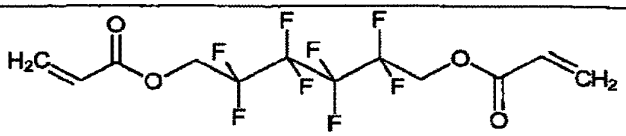
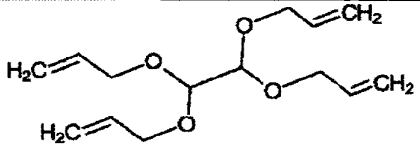
A particularly preferred cross-linking reagent is divinyl adipate. (a divinyl ester)

Another preferred cross-linking reagent is 1,4-butanediol divinyl ether (a divinyl ether)

For the most preferred embodiments the crosslinking reagent is selected from Divinyl Adipate (DVA), 1,4 Butanediol divinyl ether (BDVE), 1,4 Cyclohexanedimethanol divinyl ether (CDDE), 1,7 -Octadiene (17OD), 1,2,4 -Trivinylcyclohexane (TVCH), 1,3-Divinyltetramethyldisiloxane (DVTMDS), Diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-Divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

For the alkyne crosslinking reagents according to compound (ii), L is preferably selected from a branched or straight chain C_1-C_8 alkylene or an ether group. L may be a C_3, C_4, C_5, or C_6 alkylene,

preferably a straight chain alkylene.Chemical structures for the particularly preferred crosslinking reagents are set out below in Table 1:

Divinyl Adipate (DVA)	
1,4 Butanediol divinyl ether (BDVE)	
1,4 Cyclohexanedimethanol divinyl ether (CDDE)	
1,7 -Octadiene (17OD)	
1,2,4 -Trivinylcyclohexane (TVCH)	
1,3-Divinyltetramethyldisiloxane (DVTMDS)	
Diallyl 1,4-cyclohexanedicarboxylate (DCHD)	
1,6-Divinylperfluorohexane (DVPFH)	
1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA)	
GBDA	

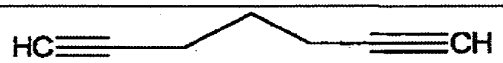
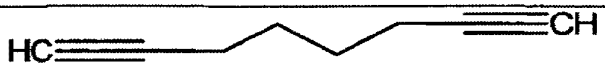
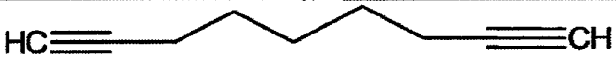
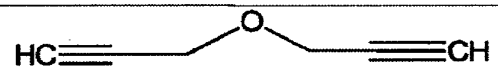
1,6-heptadiyne	
1,7-heptadiyne	
1,8-heptadiyne	
Propargyl ether	

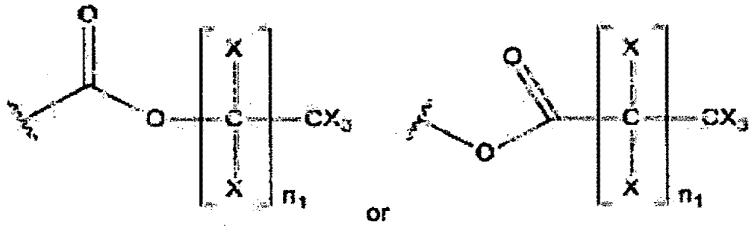
Table 1

Monomer Compound

The monomer compound has the following formula:

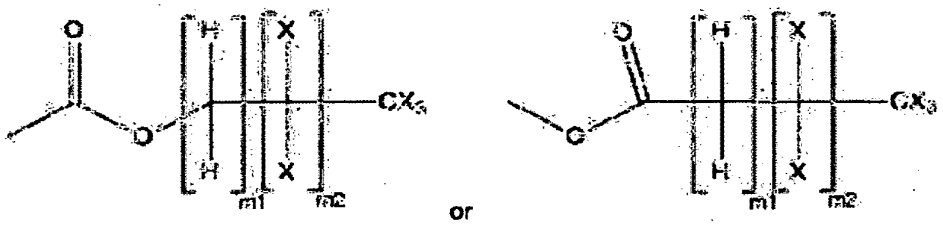


where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27. Preferably, n_1 is from 1 to 12. Optionally n_1 is from 4 to 12, optionally 6 to 8.

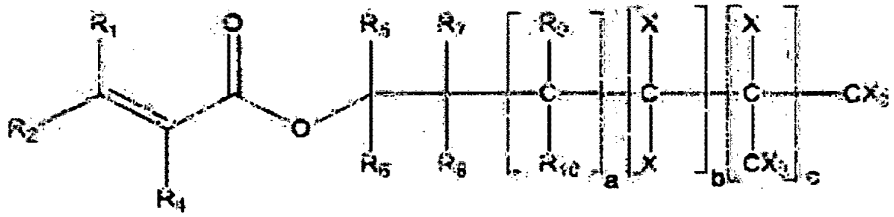
In a preferred embodiment R_3 is selected from:



where m_1 is an integer from 0 to 13 and each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and m2 is an integer from 2 to 14;

In a particularly preferred embodiment the monomer is a compound of formula I(a):

I(a)

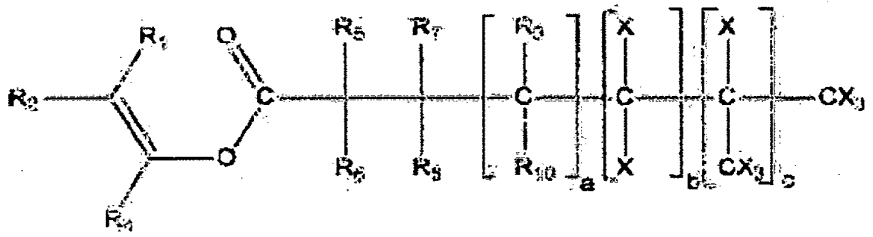


wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1;

or

the monomer is a compound of formula I(b):

I(b)



wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1.

The halogen may be chlorine or bromine, but is preferably fluorine for compliance with RoHS regulations (Restriction of Hazardous Substances).

a is from 0 to 10, preferably from 0 to 6, optionally 2 to 4, most preferably 0 or 1. b is from 2 to 14, optionally from 2 to 10, preferably 3 to 7.

Each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or a C_1-C_6 branched or straight chain alkyl group. The alkyl group may be substituted or unsubstituted, saturated or unsaturated. When the alkyl group is substituted, the location or type of the substituent is not especially limited provided the resultant polymer provides an appropriate liquid repellent and/or barrier layer. The skilled person would be aware of suitable substituents. If the alkyl group is substituted, a preferred substituent is halo, i.e. any of R_1, R_2, R_4, and R_5 to R_{10} may be haloalkyl, preferably fluoro alkyl. Other possible substituents may be hydroxyl or amine groups. If the alkyl group is unsaturated it may comprise one or more alkene or alkyne groups.

Each of R_1, R_2, R_4, and R_5 to R_{10} may be independently selected from hydrogen, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, neopentyl, n-hexyl, isohexyl, and 3-methylpentyl.

In a preferred embodiment each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or methyl.

In a preferred embodiment, a and c are each independently 0 or 1; and b is from 3 to 7.

In one preferred embodiment each X is H. In an alternative preferred embodiment each X is F.

Optionally R_1 and R_2 are both hydrogen.

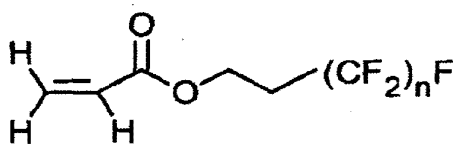
Optionally R_4 is hydrogen or methyl. Preferably R_1 and R_2 are both hydrogen and R_4 is hydrogen or methyl.

Optionally R_9 is hydrogen and R_{10} is branched or straight chain C_1-C_6 alkyl group. In a preferred embodiment R_{10} is methyl.

In one embodiment each of R_5 to R_8 is hydrogen.

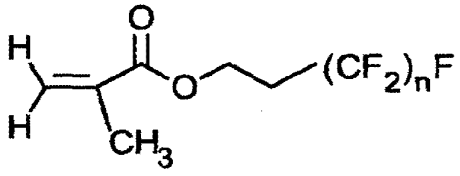
In one embodiment each of R_1, R_2, R_4, and R_5 to R_{10} is hydrogen, each X is H, a=0 and c=0.

In a particularly preferred embodiment the monomer compound has the following formula:



where n is from 2 to 10.

In another preferred embodiment the monomer compound has the following formula:

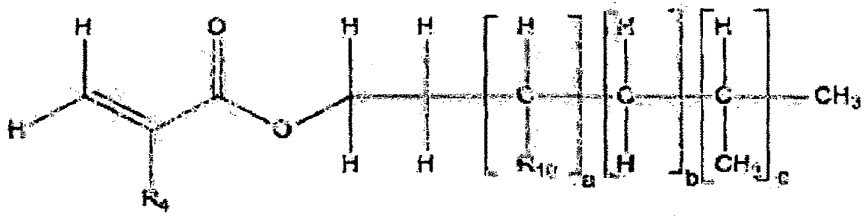


where n is from 2 to 10.

The monomer compound may be selected from 1H,1H,2H,2H-perfluorohexyl acrylate (PFAC4), 1H,1H,2H,2H-perfluorooctyl acrylate (PFAC6), 1H,1H,2H,2H-perfluorodecyl acrylate (PFAC8) and 1H,1H,2H,2H-perfluorododecyl acrylate (PFAC10).

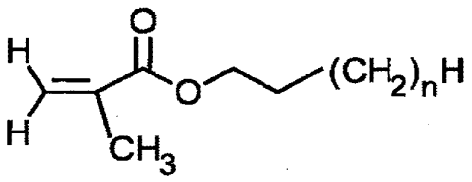
The monomer compound may be selected from 1H,1H,2H,2H-pefluorohexyl methacrylate (PFMAC4), 1H,1H,2H,2H-perfluorooctyl methacrylate (PFMAC6) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8).

The monomer compound of formula I(a) may have the following formula:



wherein a and c are each independently 0 or 1, b =3-7 and n is 4 to 10, where n=a+b+c+1.

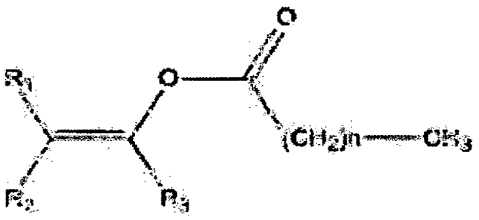
The monomer ccompound of formula I(a) may have the following formula:



where n is 2 to 12.

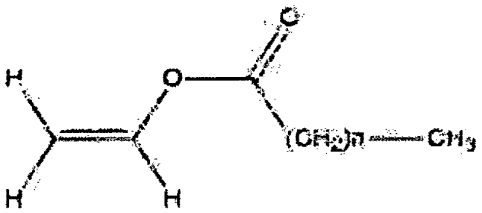
The monomer compound may be selected from ethyl hexyl acrylate, hexyl acrylate, decyl acrylate, lauryl dodecyl acrylate and iso decyl acrylate.

The monomer may have the following formula:



where n is from 4 to 14.

The monomer may have the following formula:

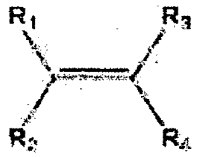


where n is from 4 to 14.

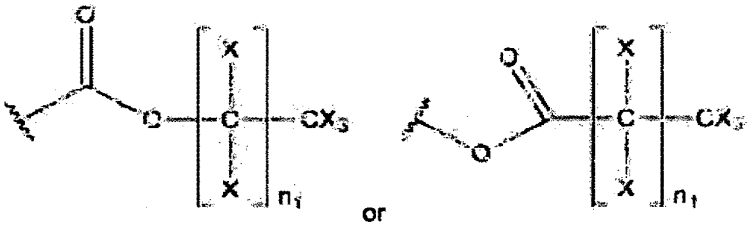
In an additional aspect, the present invention provides a method for treating an electronic device or component thereof comprising:

exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow a protective cross-linked polymeric coating to form on a surface of the electronic or electrical device or component thereof;

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_8 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



or

where each X is independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds and has a boiling point of less than 500 °C at standard pressure.

The monomer compound and the crosslinking reagent utilised in the method are described in further detail above.

Typically the electronic or electrical device or component thereof is placed in a plasma deposition chamber, a glow discharge is ignited within said chamber, and a voltage applied as a pulsed field. .

Preferably the applied voltage is at a power of from 30 to 800W. Optionally the voltage is pulsed in a sequence in which the ratio of the time on/time off is in the range of from 0.001 to 1, optionally 0.002 to 0.5. For example, time on may be 10-500 µs, preferably 35-45 µs, or 30-40 µs, such as about 36 µs and time off may be from 0.1 to 30 ms, preferably 0.1 to 20 ms, optionally from 5 to 15 ms, for example 6ms. Time on may be 35 µs, 40 µs, 45 µs. Time off may be 0.1, 1, 2, 3, 6, 8, 10, 15, 20, 25 or 30 ms.

The term pulsed may mean that the plasma cycles between a state of no (or substantially no) plasma emission (off-state) and a state where a particular amount of plasma is emitted (on-state). Alternatively, pulsed may mean that there is continuous emission of plasma but that the amount of plasma cycles between an upper limit (on-state) and lower limit (off-state).

In a further embodiment, the invention resides in a method of forming a coating on an electronic or electrical device or component thereof as defined above, the method comprising: exposing said substrate in a chamber to a plasma comprising a monomer compound, preferably a continuous plasma, for a sufficient period of time to allow a protective polymeric coating to form on the substrate,

wherein during exposure of the substrate the continuous plasma has a power density of at least 2W/litre, preferably 20W/litre.

Optionally the voltage is applied as a pulsed field for a period of from 30 seconds to 90 minutes. Optionally the voltage is applied as a pulsed field for from 5 to 60 minutes. Optionally in a preliminary step, a continuous power plasma is applied to the electronic or electrical device or component thereof. The preliminary step may be conducted in the presence of an inert gas.

Before the crosslinker and/or the monomer compound enter the deposition chamber each may be in the form of a gas, liquid or a solid (for example a powder) at room temperature. However, it is the preferred that the crosslinking reagent and the monomer compound are both liquid at room temperature, and most preferably that the monomer and crosslinker liquids are miscible.

The monomer compound and/or the crosslinker will suitably be in a gaseous state in the plasma. The plasma may simply comprise a vapour of the monomer compound and the crosslinker. Such a vapour may be formed in-situ, with the compounds being introduced into the chamber in liquid form. The monomer may also be combined with a carrier gas, in particular, an inert gas such as helium or argon.

In preferred embodiments, the monomer and/or the crosslinker may be delivered into the chamber by way of an aerosol device such as a nebuliser or the like, as described for example in WO2003/097245 and WO03/101621, the content of which is incorporated herein by reference. In such an arrangement a carrier gas may not be required, which advantageously assists in achieving high flow rates.

In one embodiment the monomer compound and/or the crosslinking reagent are in gaseous form and are fed into the plasma at a rate of from 10-5000 mg/minute depending on chamber volume, whilst the pulsed voltage is applied.

Optionally the plasma is created with an average power of from 0.001 to 40W/litre.

The crosslinker may be miscible with the monomer and so introduced together or separately into the plasma chamber. Or the crosslinker may be immiscible with the monomer and introduced separately into the plasma chamber. In this context, the term "miscible" means that the crosslinker is soluble in the monomer, and when mixed they form a solution of uniform composition. The term "immiscible" is used to mean that the crosslinker is only partly soluble or insoluble in the monomer, and so either forms an emulsion or separates out into two layers.

The crosslinking reagent is preferably present in an amount of from 10 to 60 (v/v) %, optionally 20 to 40 (v/v) %, optionally 25 to 30 (v/v)% , optionally 30 to 50 (v/v)% of the total volume of monomer compound and crosslinking reagent, depending on the specific crosslinker. The skilled person would understand that the amount will vary to some extent depending on whether the coating is required to

be liquid repellent or provide a barrier to mass and electron transport. The skilled person would understand that the (v/v) percentages are those which give a stable crosslinked polymer coating and the highest water contact angle.

Electronic or electrical device or component thereof

Although the invention is of benefit in the context of a wide variety of substrates, the substrate may, in all aspects of the invention, advantageously be an electronic substrate.

In some embodiments of the invention, the electronic substrate may comprise an electronic or electrical device, i.e. any piece of electrical or electronic equipment. Non-limiting examples of electrical and electronic devices include communications devices such as mobile phones, smartphones and pagers, radios, and sound and audio systems such as loudspeakers, microphones, ringers or buzzers, hearing aids, personal audio equipment such as personal CD, tape cassette or MP3 players, televisions, DVD players including portable DVD players, video recorders, digi and other set-top boxes such as Sky, computers and related components such as laptop, notebook, tablet, phablet or palmtop computers, personal digital assistants (PDAs), keyboards, or instrumentation, games consoles in particular hand-held playstations and the like, data storage devices, outdoor lighting systems or radio antenna and other forms of communication equipment.

In preferred embodiments of the invention, the substrate may comprise or consist of an electronic component, e.g. a printed circuit board (PCB), a printed circuit board array (PCBA), a transistor, resistor, or semi-conductor chip. The electronic component may thus be an internal component of an electronic device, e.g. a mobile phone. The coatings of the invention are particularly valuable in preventing electrochemical migration in such components.

In all aspects of the invention, the precise conditions under which the protective polymeric coating is formed in an effective manner will vary depending upon factors such as, without limitation, the nature of the monomer compound, the crosslinking reagent, the substrate, as well as the desired properties of the coating. These conditions can be determined using routine methods or, preferably, using the techniques and preferred features of the invention described herein, which work in particular synergy with the invention.

The present invention will now be further described with reference to the following non-limiting examples and the accompanying illustrative drawings, of which:

Figure 1 illustrates shows the effect of increasing the power to monomer flow ratio for CW plasmas in a 3 litre chamber in a prior art process.

Figure 2 shows the same effect for pulsed plasma conditions.

Figure 3 shows a tapping mode image over 10x10 μm^2 field of view of a specimen example (thickness d=1230 nm) prepared according to Example 1 (left hand side) and a contour line plot showing the data used for calculation of RMS roughness (right hand side). The ΔZ value indicated on the plot has been taken over an area of the graph that represents the majority of the coating. Peaks that lie above the ΔZ range indicate large particles and troughs that fall below the ΔZ range show voids or pinholes in the coating. The width of the peaks also gives an indication of the particle size.

Figure 4 illustrates the effect of adding the divinyl adipate crosslinker to perfluorooctyl acrylate on water contact angle from a process on a 125 Litre chamber.

Figure 5 shows the effect of adding crosslinkers in accordance with the invention on the electrical resistance per nm of the coatings.

Figure 6 shows a tapping mode image of a 90 nm thick coating, prepared as described in Example 3, over 2x2μm^2 field of view (top left), a representative contour line indicating height variation (z-axis) of the coating (top right) and a phase image indicating full substrate coverage (bottom left) ;RMS roughness of the coating is 1.65 nm and $\Delta z/d$ =0.05

Example 1

Example of plasma polymerising PFAC6 with no crosslinker in a 3 litre chamber

PFAC6 was polymerised in a 3 litre glass chamber using a continuous plasma process. In the experimental matrix, the continuous plasma was produced using RF power levels of 50, 100 and 200 Watts. The process pressure was run at 30, 60 and 90 mTorr and the monomer flow rate run at 50, 100 and 200 microlitres of liquid per minute. The duration of the process was either 10 or 40 minutes. The coated substrate was silicon wafer and whether the coating was tacky or not was determined by wiping the substrate with a finger and determining by eye if the coating had smeared. The results in Figure 1 indicate that for lower CW powers, the coating could easily be smeared (i.e. tacky), but by increasing the power to flow ratio, the coating became resistant to smearing (i.e. non-tacky) and this is expected to be due to additional crosslinking caused by more monomer fragmentation. The water contact angle was also seen to decline with increasing power to flow ratio, and this too is indicative of more power increasing the level of monomer fragmentation.

The same 3 litre chamber was used to also look at the effect of power to flow ratios with pulsed plasma polymerisation. In these experiments, the peak power was either 250 or 500 W. The RF power feed was pulsed with an on time of 35 microseconds and off times of 5.5 and 1 millisecond. Process pressure was either 20, 35, 60 or 80 mTorr. The monomer flow was either 50 or 200 microlitres of liquid per minute. Figure 2 shows that low power to flow conditions can generate coatings that can be smeared (tacky) and only by increasing the power could the smear be reduced. This too had a concomitant decline in water contact angle.

The results from Figures 1 and 2 show that plasma processing PFAC6 on its own could only lead to smear –free coatings when the powers were high enough to decrease the other desirable property of the water contact angle This illustrates the need to add a crosslinker to prevent the coating smearing and maintain the water contact angle.

Example 2

Examples of Perfluoro Alkyl Acrylate co-polymerisation with Crosslinker to show improvements in electrical resistance

Perfluorooctyl acrylate monomer was mixed with a single crosslinker from the following list:

VINYL ESTERS: Divinyl adipate (DVA)

VINYL ETHERS: 1,4-Butanediol divinyl ether (BDVE); 1,4 Cyclohexanedimethanol divinyl ether (CDDE)

DI- or TRI- VINYLS: 1,7-Octadiene (1,7-OD); 1,2,4-Trivinylcyclohexane (TVCH);

DI VINYL with alkyl fluoro group: 1,6-divinylperfluorohexane (DVPFH)

DI VINYL with silicon group: 1,3-Divinyl tetramethyldisiloxane (DVTMDS)

DI VINYL with cyclic ring and carboxylate groups: Diallyl 1,4-cyclohexanedicarboxylate (DCHC)

DI ACRYLATE: 1H1H,6H,6H-perfluorohexanediol diacrylate (PFHDA)

The crosslinker was mixed with the PFAC6 as a percentage by volume for the following percentages: 20, 40 , 60 , 80, and 100%.

Plasma initiated polymerisation reactions were carried out in a 3 litre glass plasma chamber. The substrates were test circuit boards. The PFAC6/crosslinker mixture was introduced at a rate of 0.04 – 0.06 ul/min and the process pressure was 40 mTorr. The process plasma consisted of a 1 minute continuous plasma (CW) step of 50W followed by 10 - 20 minute pulsed plasma (PW) step of 50W and RF power being delivered by a pulse sequence with a duty cycle of 6.9%. The coated circuit boards were immersed in tap water and an 8V potential was applied for 13 minutes. The final current readings, together with coating thickness measurements, were used to calculate the electrical resistance per nm of coating. Figure 5 below shows the effect of adding a range of crosslinkers on the electrical resistance per nm of the barrier coatings. Figure 5 clearly shows the improvement in resistance that can be gained by adding the crosslinker to the PFAC6 monomer. Furthermore, all of the crosslinkers tested gave non-smear/non-tacky coatings with concentration levels of 20% and above, with the exceptions of DVTMDS, DCHD, PFHDA and DVPFH which were non-smear at levels of 40% and above.

Example 3

Example of crosslinker concentration on water repellent coating.

Water repellent coatings were prepared in a 125 litre volume chamber using PFAC6 with different levels of divinyl adipate (DVA) and using helium as a carrier gas. The deposition process consisted of a 3 minute CW step with 300W power and a pulsed step with 150W power and an RF pulse duty cycle of 0.018%. Silicon wafer was used as the test substrates and the contact angle of the coated wafer was determined by applying a 3ul drop of deionised wafer onto the coated wafer and measuring the contact angle using a VCA Optima (AST products) with image analysis software. The variation of contact angle with (v/v)% DVA crosslinker is shown in Figure 4. It was also noted that for the 10 (v/v) % DVA concentration, the water drop left a mark on the coated wafer where it's circumference had been. This indicated that a higher level of crosslinker was required to give a more stable coating. This observation, in combination with the results in figure 4, suggest an optimum range of 20 – 40 (v/v) % DVA crosslinker, though this is likely to vary, typically within the range of from 10-60 (v/v) % for different monomers and crosslinkers and different chamber sizes.

Pulsed plasma polymerisation of perfluoro alkyl acrylate in the presence of divinyl adipate (DVA) was carried out in a 125 litre chamber. Figure 4 shows the effect of adding different liquid volume percentages of DVA crosslinker to perfluorooctyl acrylate on water contact angle on a silicon wafer substrate.

Example 4

Example of AFM measurement of monomer/crosslinker co-polymer coating

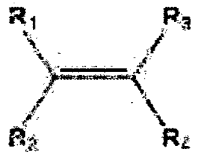
A barrier-style coating was prepared in a 22 litre volume chamber using PFAC6 with 10% DVA. The deposition process consisted of a 1 minute CW step with a CW power to flow ratio of 3.9 (W/microliter/min), and a pulsed step with a PW power/monomer flow ratio of 0.28 (W/microlitres/min). Figure 6 shows the representative topographical and phase contrast images were obtained from all the samples. High spatial resolution images show mainly the structures of areas between the raised features. The RMS roughness of the coating is 1.65 nm and the $\Delta z/d = 0.05$. As the $\Delta z/d$ value is < 0.15, then this indicates that the physical layer is substantially pinhole free.

Claims:

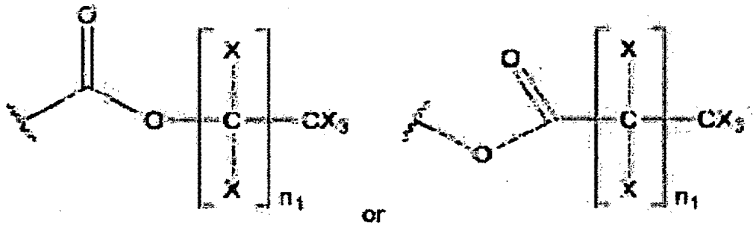
1. An electronic or electrical device or component thereof comprising a protective cross-linked polymeric coating on a surface of the electronic or electrical device or component thereof;

wherein the protective cross-linked polymeric coating is obtainable by exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



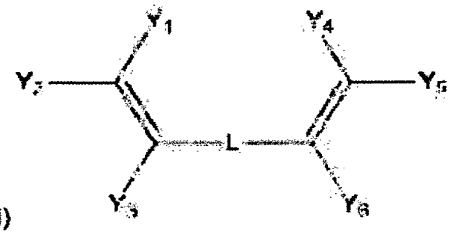
or

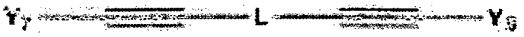
where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point of less than 500 °C at standard pressure.

2. An electronic or electrical device or component thereof according to claim 1, wherein the protective cross-linked polymeric coating is a physical barrier to mass and electron transport.

3. An electronic or electrical device or component thereof according to claim 1 or claim 2, wherein the protective cross-linked polymeric coating forms a liquid repellent surface defined by a static water contact angle (WCA) of at least 90°.

4. An electronic or electrical device or component thereof according to any preceding claim, wherein the crosslinking reagent has one of the following structures:

(i) 

(ii) 

where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_6 alkyl or aryl; and L is a linker moiety.

5. An electronic or electrical device or component thereof according to claim 4, wherein for compound (i) L has the following formula:

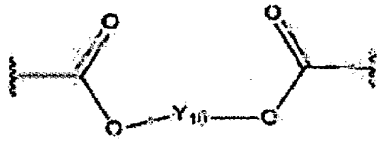


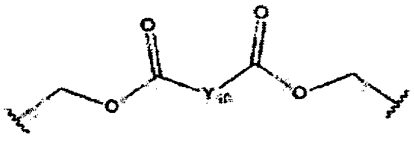
each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and

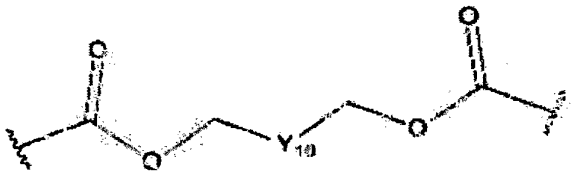
Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane group.

6. An electronic or electrical device or component thereof according to claim 5, wherein for compound (i) L has one of the following structures:



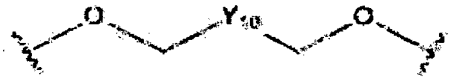




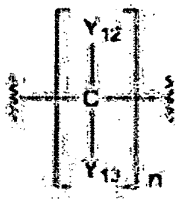


7. An electronic or electrical device or component thereof according to claim 5, wherein for compound (i) L has one of the following structures:





8. An electronic or electrical device or component thereof according to any of claims 5 to 7, wherein Y_{10} has the following formula:



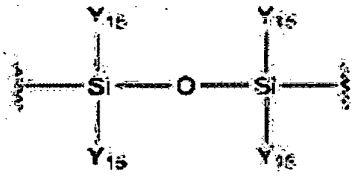
wherein each Y_{12} and Y_{13} is independently selected from H, halo, optionally substituted cyclic, branched or straight chain alkyl, or $-OY_{14}$, where Y_{14} is selected from optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl, and n is an integer from 1 to 10.

9. An electronic or electrical device or component thereof according to claim 8, wherein each Y_{12} is H and each Y_{13} is H.

10. An electronic or electrical device or component thereof according to claim 8, wherein each Y_{12} is fluoro and each Y_{13} is fluoro.

11. An electronic or electrical device or component thereof according to any of claims 8 to 10, wherein n is from 4 to 6.

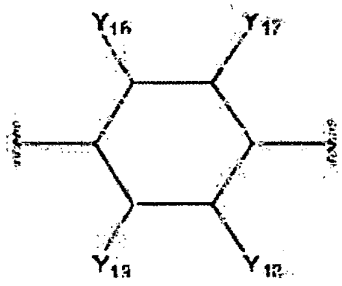
12. An electronic or electrical device or component thereof according to any of claims 5 to 7, wherein Y_{10} has the following formula:



Wherein each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl.

13. An electronic or electrical device or component thereof according to claim 12, wherein each Y_{15} is methyl, and each Y_9 is a bond.

14. An electronic or electrical device or component thereof according to any of claims 5 to 7, wherein Y_{10} has the following formula:



wherein Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl.

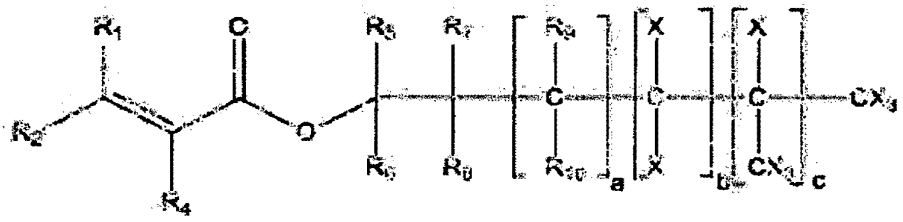
15. An electronic or electrical device or component thereof according to claim 14, wherein Y_{18} is H or vinylene, and Y_{16}, Y_{17} and Y_{19} are each H.

16. An electronic or electrical device or component thereof according to any preceding claim wherein the crosslinking reagent is selected from Divinyl Adipate (DVA), 1,4 Butanediol divinyl ether (BDVE), 1,4 Cyclohexanedimethanol divinyl ether (CDDE), 1,7 -Octadiene (17OD), 1,2,4 - Trivinylcyclohexane (TVCH), 1,3-Divinyltetramethyldisiloxane (DVTMDS), Diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-Divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

17. An electronic or electrical device or component thereof according to claim 4, wherein for compound (ii), L is selected from a branched or straight chain C_1-C_8 alkylene or an ether group.

18. An electronic or electrical device or component thereof according to any preceding claim wherein the monomer is a compound of formula I(a):

I(a)

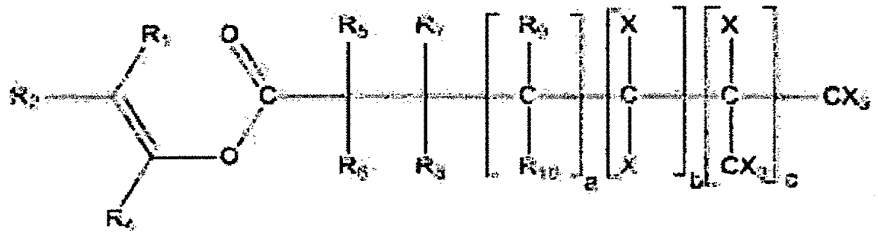


wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1;

; or

wherein the monomer is a compound of formula I(b):

I(b)



wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1.

19. An electronic or electrical device or component thereof according to claim 18, wherein the halogen is fluorine.

20. An electronic or electrical device or component thereof according to claim 18 or claim 19, wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, neopentyl, n-hexyl, isohexyl, and 3-methylpentyl.

21. An electronic or electrical device or component thereof according to claim 20, wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or methyl.

22. An electronic or electrical device or component thereof according to any of claims 18 to 20, wherein a and c are each independently 0 or 1; and b is from 3 to 7.

23. An electronic or electrical device or component thereof according to any preceding claim wherein each X is H.

24. An electronic or electrical device or component thereof according to any of claims 1 to 22, wherein each X is F.

25. An electronic or electrical device or component thereof according to any of claims 18 to 24, wherein R_1 and R_2 are both hydrogen.

26. An electronic or electrical device or component thereof according to any of claims 18 to 25, wherein R_4 is hydrogen or methyl.

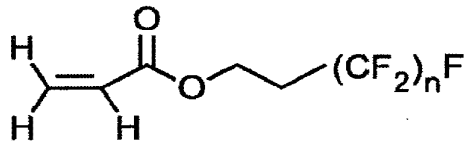
27. An electronic or electrical device or component thereof according to any of claims 18 to 26, wherein R_9 is hydrogen and R_{10} is branched or straight chain C_1-C_6 alkyl group.

28. An electronic or electrical device or component thereof according to claim 27, wherein R_{10} is methyl.

29. An electronic or electrical device or component thereof according to any of claims 18 to 28, wherein each of R_5 to R_8 is hydrogen.

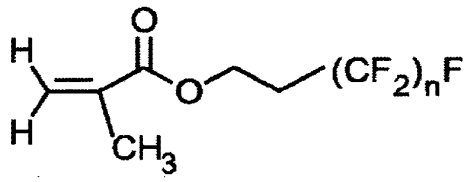
30. An electronic or electrical device or component thereof according to any of claims 18 to 29 wherein each of each of R_1, R_2, R_4, and R_5 to R_{10} is hydrogen, each X is H, a=0 and c=0.

31. An electronic or electrical device or component thereof according to any of claims 24 to 30, wherein the compound of formula I(a) has the following formula:



where n is from 2 to 10.

32. An electronic or electrical device or component thereof according to any of claims 24 to 30, wherein the compound of formula I(a) has the following formula:

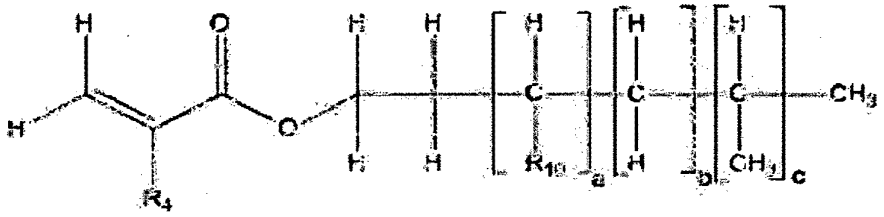


where n is from 2 to 10.

33. An electronic or electrical device or component thereof according to claim 31, wherein the compound of formula I(a) is selected from 1H,1H,2H,2H-perfluorohexyl acrylate (PFAC4), 1H,1H,2H,2H-perfluorooctyl acrylate (PFAC6), 1H,1H,2H,2H-perfluorodecyl acrylate (PFAC8) and 1H,1H,2H,2H-perfluorododecyl acrylate (PFAC10).

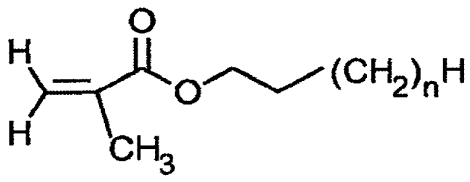
34. An electronic or electrical device or component thereof according to claim 32, wherein the compound of formula I(a) is selected from 1H,1H,2H,2H-pefluorohexyl methacrylate (PFMAC4), 1H,1H,2H,2H-perfluorooctyl methacrylate (PFMAC6) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8).

35. An electronic or electrical device or component thereof according to any of claims 18 to 23, wherein the compound of formula I(a) has the following formula:



wherein a and c are each independently 0 or 1, b =3-7 and n is 4 to 10, where n=a+b+c+1.

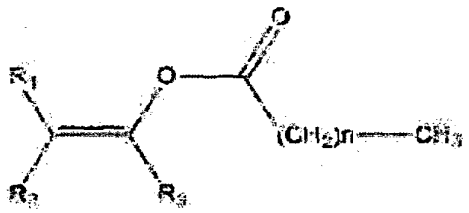
36. An electronic or electrical device or component thereof according to any of claims 18 to 23, wherein the compound of formula I(a) has the following formula:



where n is 2 to 12.

37. An electronic or electrical device or component thereof according to claim 35 or claim 36, wherein the compound of formula I(a) is selected from ethyl hexyl acrylate, hexyl acrylate, decyl acrylate, lauryl dodecyl acrylate and iso decyl acrylate.

38. An electronic or electrical device or component thereof according to any of claims 18 to 23, wherein the monomer is a compound of formula I(b) and has the following formula:



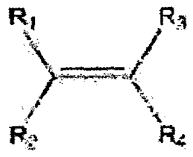
where n is from 4 to 14, optionally where R_1, R_2 and R_3 are each H.

39. An electronic or electrical device or component thereof according to any of the preceding claims, wherein the electronic or electrical device or component thereof is selected from mobile phones, smartphones, pagers, radios, sound and audio systems such as loudspeakers, microphones, ringers and/or buzzers, hearing aids, personal audio equipment such as personal CD, tape cassette or MP3 players, televisions, DVD players including portable DVD players, video recorders, digi and other set-top boxes, computers and related components such as laptop, notebook, tablet, phablet or palmtop computers, personal digital assistants (PDAs), keyboards, or instrumentation, games consoles, data storage devices, outdoor lighting systems, radio antennae and other forms of communication equipment, and printed circuit boards.

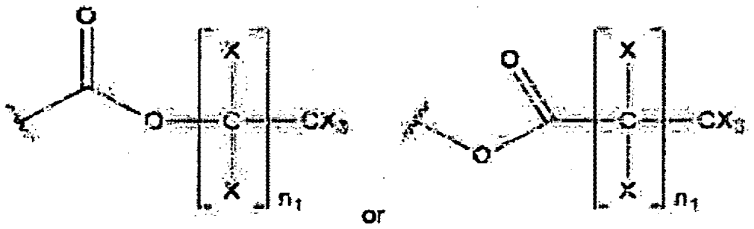
40. A method for treating an electronic or electrical device or component thereof comprising:

exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow a protective cross-linked polymeric coating to form on a surface of the electronic or electrical device or component thereof;

wherein the monomer compound has the following formula:

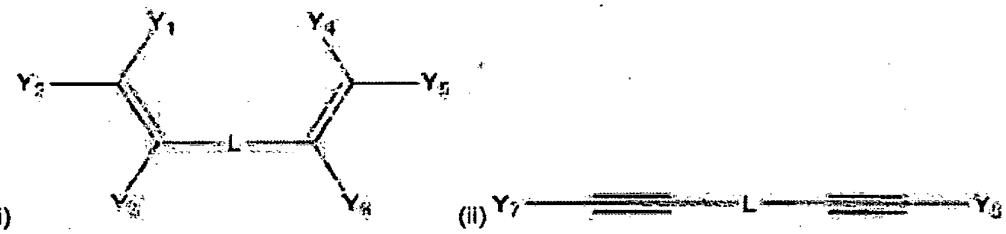


where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



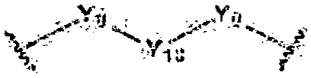
where each X is independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point at standard pressure of less than 500°C.

41. A method according to claim 40, wherein the crosslinking reagent has one of the following structures:



where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_6 alkyl or aryl; and L is a linker moiety.

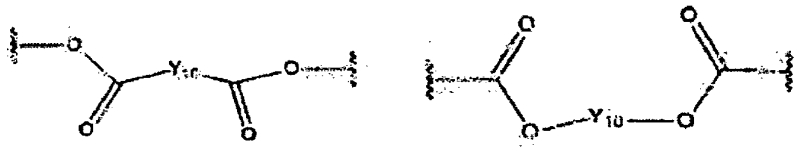
42. A method according to claim 41, wherein for compound (i) L has the following formula:

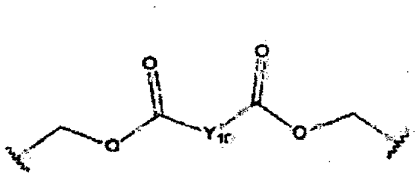


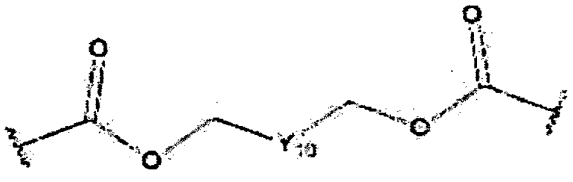
each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and

Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane group.

43. A method according to claim 42, wherein for compound (i) L has one of the following structures:





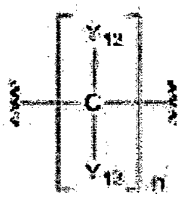


44. A method according to claim 42, wherein for compound (i) L has one of the following structures:





45. An method according to any of claims 42 to 44, wherein Y_{10} has the following formula:



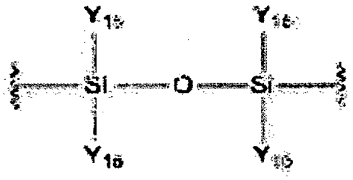
wherein each Y_{12} and Y_{13} is independently selected from H, halo, optionally substituted cyclic, branched or straight chain alkyl, or $-OY_{14}$, where Y_{14} is selected from optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl, and n is an integer from 1 to 10.

46. A method according to claim 45, wherein each Y_{12} is H and each Y_{13} is H.

47. A method according to claim 45, wherein each Y_{12} is fluoro and each Y_{13} is fluoro.

48. A method according to any of claims 45 to 47, wherein n is from 4 to 6.

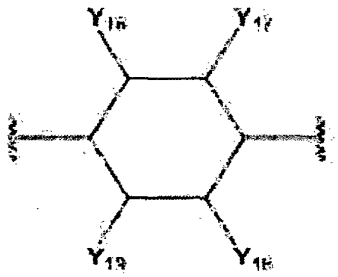
49. A method according to any of claims 42 to 44, wherein Y_{10} has the following formula:



Wherein each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl.

50. A method according to claim 49, wherein each Y_{15} is methyl, and each Y_9 is a bond.

51. A method according to any of claims 42 to 44, wherein Y_{10} has the following formula:



wherein Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl.

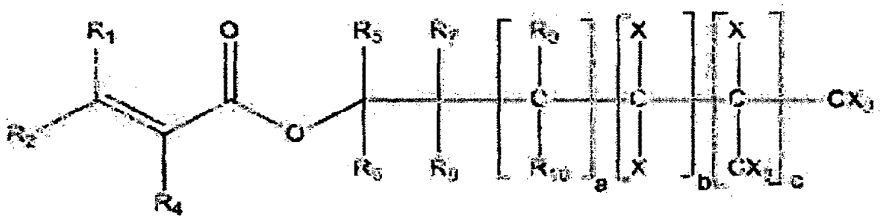
52. An method according to claim 51, wherein Y_{18} is vinylene or H, and Y_{16}, Y_{17} and Y_{19} are each H.

53. A method according to any of claims 40 to 52, wherein the crosslinking reagent is selected from Divinyl Adipate (DVA), 1,4 Butanediol divinyl ether (BDVE), 1,4 Cyclohexanedimethanol divinyl ether (CDDE), 1,7 -Octadiene (17OD), 1,2,4 -Trivinylcyclohexane (TVCH), 1,3-Divinyltetramethyldisiloxane (DVTMDS), Diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-Divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-Perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

54. A method according to claim 41, wherein for compound (ii), L is selected from a branched or straight chain C_1-C_8 alkylene or an ether group.

55. A method according to any of claims 40 to 54 wherein the monomer is a compound of formula I(a):

I(a)

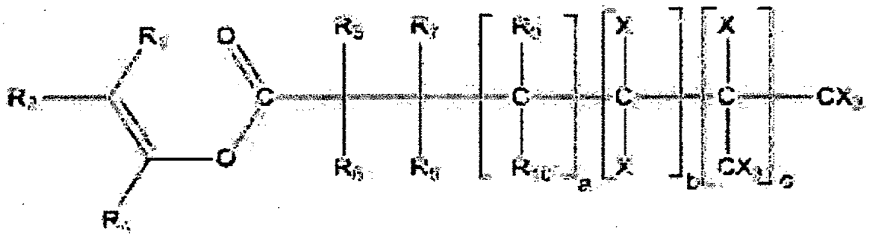


wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1;

; or

wherein the monomer is a compound of formula I(b):

I(b)



wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or an optionally substituted C_1-C_6 branched or straight chain alkyl group; each X is independently selected from hydrogen or halogen; a is from 0-10; b is from 2 to 14; and c is 0 or 1.

56. A method according to claim 55, wherein the halogen is fluorine.

57. A method according to claim 55 or claim 56, wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, neopentyl, n-hexyl, isohexyl, and 3-methylpentyl.

58. A method according to claim 57, wherein each of R_1, R_2, R_4, and R_5 to R_{10} is independently selected from hydrogen or methyl.

59. A method according to any of claims 55 to 58, wherein a and c are each independently 0 or 1; and b is from 3 to 7.

60. A method according to any preceding claim wherein each X is H.

61. A method according to any of claims 41 to 59, wherein each X is F.

62. A method according to any of claims 41 to 61, wherein R_1 and R_2 are both hydrogen.

63. A method according to any of claims 41 to 62, wherein R_4 is hydrogen or methyl.

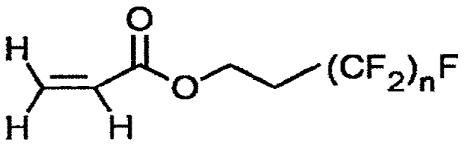
64. A method according to any of claims 41 to 63, wherein R_9 is hydrogen and R_{10} is branched or straight chain C_1-C_6 alkyl group.

65. A method according to claim 64, wherein R_{10} is methyl.

66. A method to any of claims 41 to 65, wherein each of R_5 to R_8 is hydrogen.

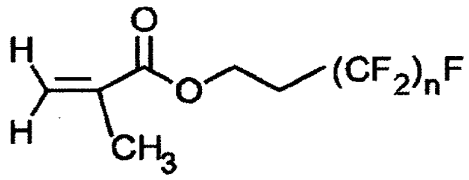
67. A method according to any of claims 41 to 66 wherein each of each of R_1, R_2, R_4, and R_5 to R_{10} is hydrogen, each X is H, a=0 and c=0.

68. A method according to any of claims 61 to 67, wherein the compound of formula I(a) has the following formula:



where n is from 2 to 10.

69. A method according to any of claims 61 to 67, wherein the compound of formula I(a) has the following formula:

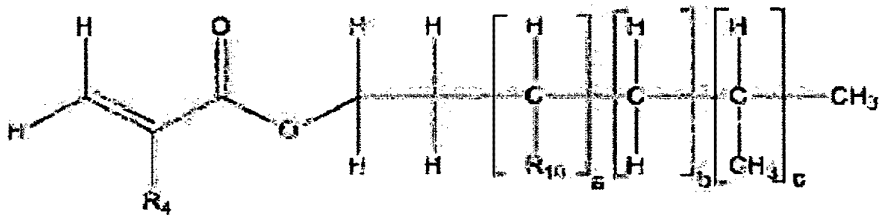


where n is from 2 to 10.

70. A method according to claim 68, wherein the compound of formula I(a) is selected from 1H,1H,2H,2H-perfluorohexyl acrylate (PFAC4), 1H,1H,2H,2H-perfluorooctyl acrylate (PFAC6), 1H,1H,2H,2H-perfluorodecyl acrylate (PFAC8) and 1H,1H,2H,2H-perfluorododecyl acrylate (PFAC10).

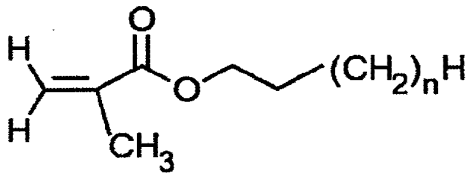
71. A method according to claim 69, wherein the compound of formula I(a) is selected from 1H,1H,2H,2H-pefluorohexyl methacrylate (PFMAC4), 1H,1H,2H,2H-perfluorooctyl methacrylate (PFMAC6) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8).

72. A method according to any of claims 41 to 61, wherein the compound of formula I(a) has the following formula:



wherein a and c are each independently 0 or 1, b =3-7 and n is 4 to 10, where n=a+b+c+1.

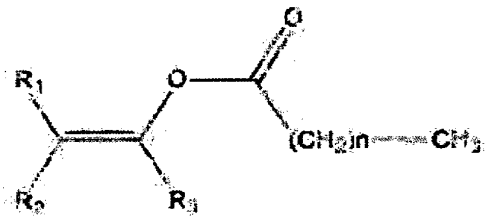
73. A method according to any of claims 41 to 61, wherein the compound of formula I(a) has the following formula:



where n is 2 to 12.

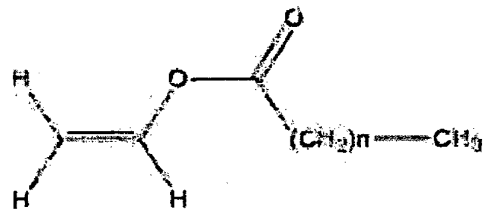
74. A method according to claim 72 or claim 73, wherein the compound of formula I(a) is selected from ethyl hexyl acrylate, hexyl acrylate, decyl acrylate, lauryl dodecyl acrylate and iso decyl acrylate.

75. A method according to any of claims 41 to 60, wherein the monomer is a compound of formula I(b) and has the following formula:



where n is from 4 to 14.

76. A method according to claim 75 wherein the monomer is a compound of formula I(b) and has the following formula:



where n is from 4 to 14.

77. A method according to any of claims 40 to 76 wherein the electronic or electrical device or component thereof is placed in a plasma deposition chamber, a glow discharge is ignited within said chamber, and a voltage applied as a pulsed field.

78. A method according to claim 77 wherein applied voltage is at a power of from 40 to 500W.

79. A method according to claim 77 or claim 78 wherein the voltage is pulsed in a sequence in which the ratio of the time on : time off is in the range of from 1:500 to 1:1500.

80. A method according to any of claims 77 to 79 wherein the voltage is pulsed in a sequence where power is on for 20-50μs, and off for from 1000μs to 30000μs.

81. A method according to any of claims 77 to 80 wherein the voltage is applied as a pulsed field for a period of from 30 seconds to 90 minutes.

82. A method according to claim 81 wherein the voltage is applied as a pulsed field for from 5 to 60 minutes.

83. A method according to any one of claims 77 to 82, wherein in a preliminary step, a continuous power plasma is applied to the electronic or electrical device or component thereof.

84. A method according to claim 83, wherein the preliminary step is conducted in the presence of an inert gas.

85. A method according to any one of claims 77 to 84, wherein the monomer compound and/or the crosslinking reagent in gaseous form is fed into the plasma at a rate of from 80-300 mg/minute, whilst the pulsed voltage is applied.

86. A method according to any one of claims 77 to 85, wherein the plasma is created with a voltage at an average power of from 0.001 to 500w/m^3.

87. A method according to any of claims 40 to 86, wherein the monomer compound is miscible with the crosslinking reagent.

88. A method according to any of claims 40 to 86, wherein the monomer compound is immiscible with the crosslinking reagent.

89. A method according to claim 87, wherein the step of exposing the electronic or electrical device or component thereof to a plasma occurs in a plasma chamber; and the monomer compound and crosslinking reagent are mixed prior to entering the chamber.

90. A method according to claim 87 or claim 88 wherein the step of exposing the electronic or electrical device or component thereof to a plasma occurs in a plasma chamber; and the monomer compound and crosslinking reagent are introduced separately into the chamber.

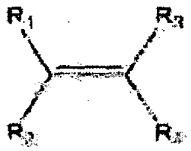
91. A method according to any of claims 40 to 90, wherein the crosslinking reagent is present in an amount of from 10 to 60 (v/v) % of the total volume of monomer compound and crosslinking reagent.

Coatings

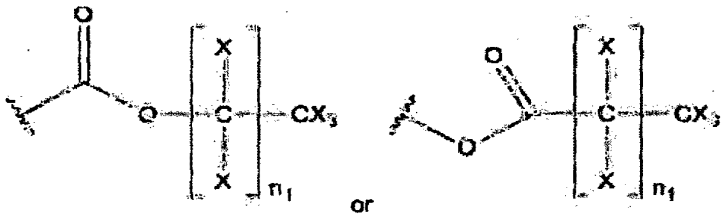
Abstract

The present invention provides an electronic or electrical device or component thereof comprising a cross-linked polymeric coating on a surface of the electronic or electrical device or component thereof; wherein the cross-linked polymeric coating is obtainable by exposing the electronic or electrical device or component thereof to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the cross-linked polymeric coating on a surface thereof,

wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:



where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; and n_1 is an integer from 1 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more linker moieties and has a boiling point at standard pressure of less than 500°C.

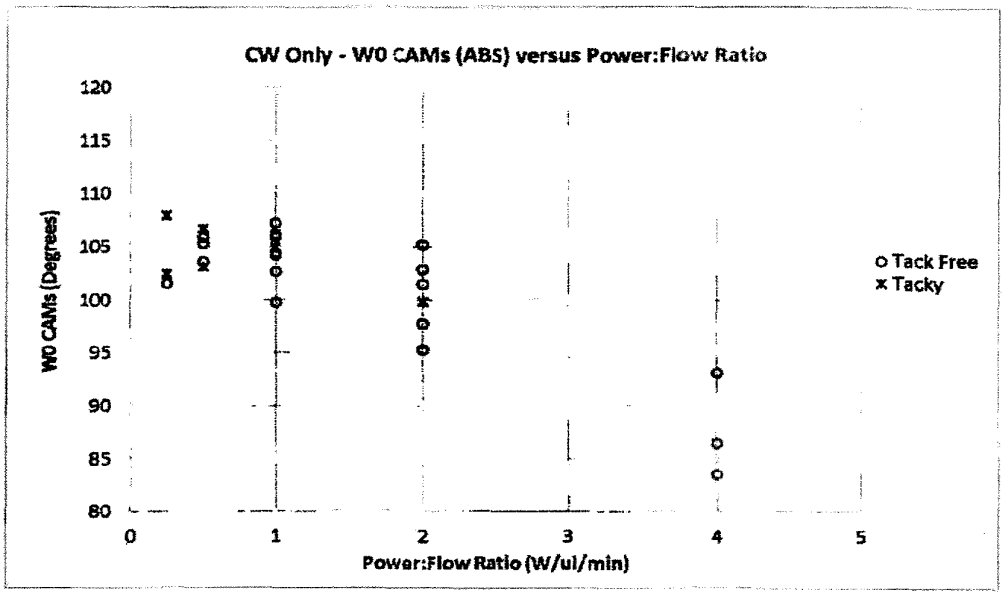

CW Only - W0 CAMs (ABS) versus Power:Flow Ratio
W0 CAMs (Degrees)
120
115
110
105
100
95
90
85
80
0
1
2
3
4
5
Power:Flow Ratio (W/ul/min)
o Tack Free
x Tacky

Figure 1

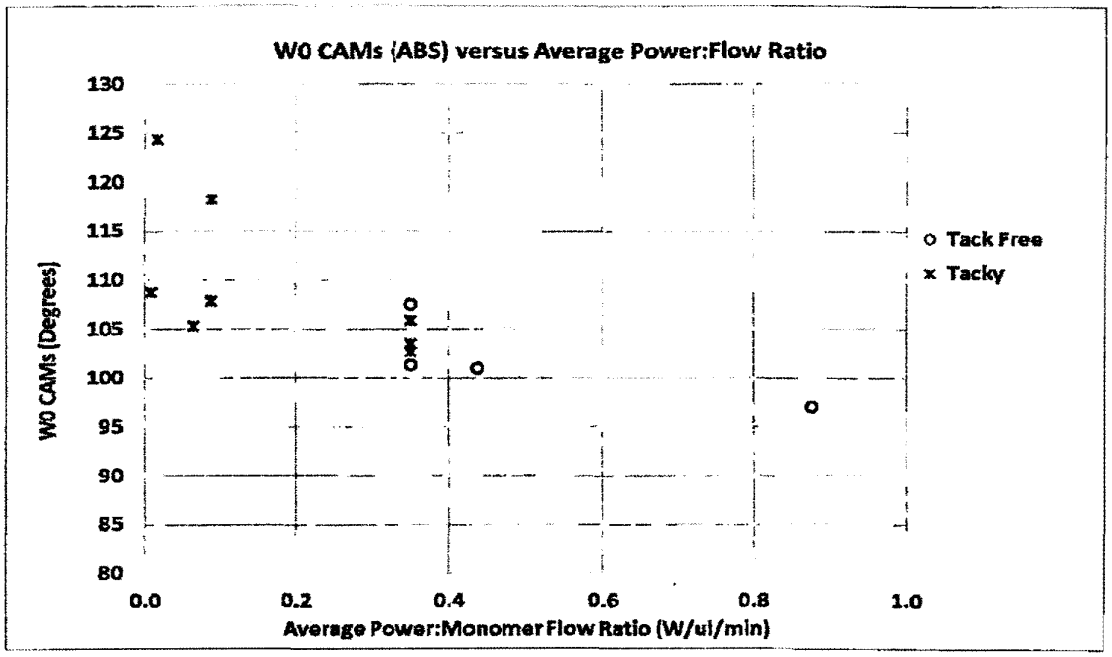

W0 CAMs (ABS) versus Average Power:Flow Ratio
W0 CAMs (Degrees)
130
125
120
115
110
105
100
95
90
85
80
0.0
0.2
0.4
0.6
0.8
1.0
Average Power:Monomer Flow Ratio (W/ul/min)
Tack Free
Tacky

Figure 2

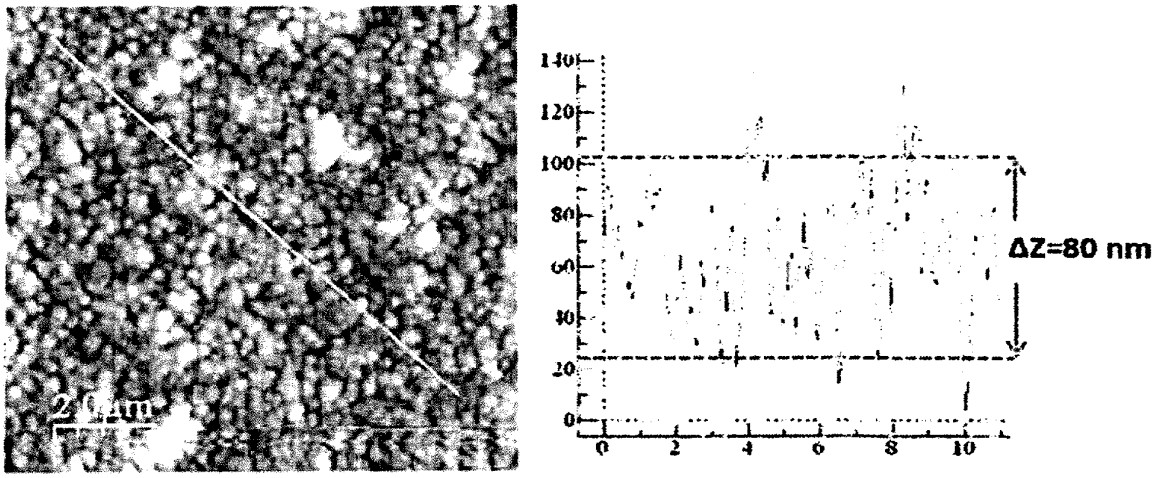


Figure 3

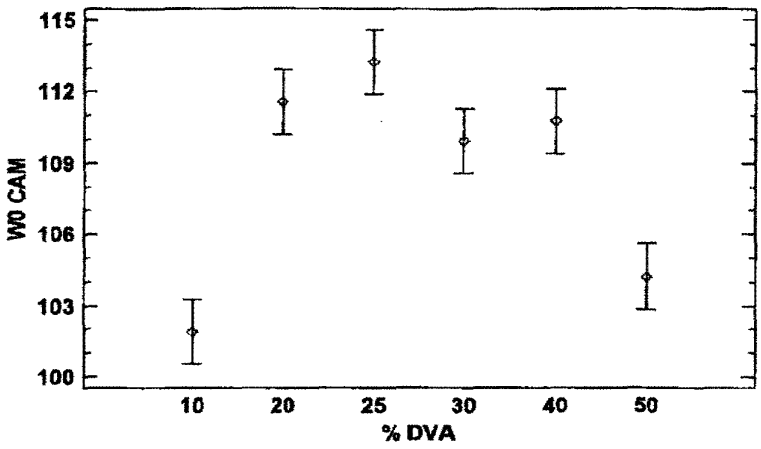


Figure 4

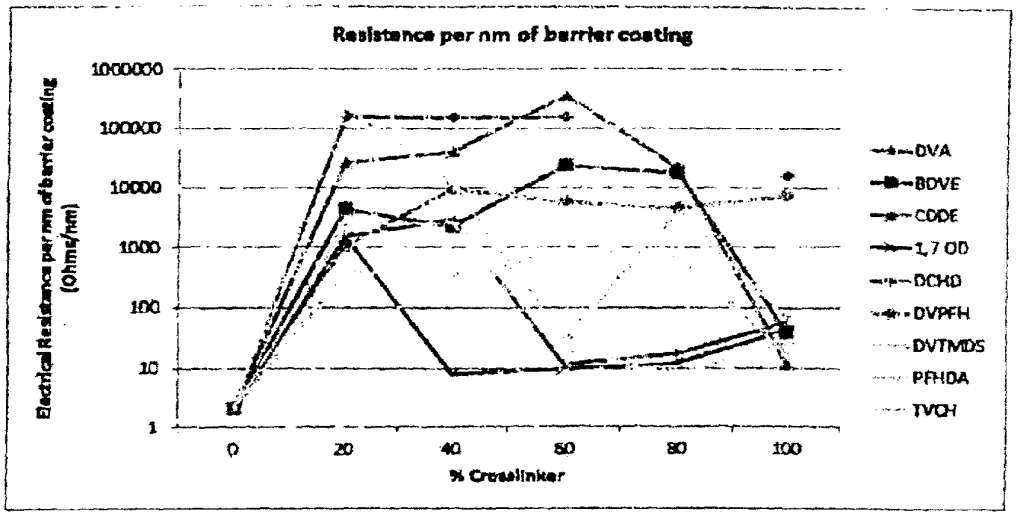
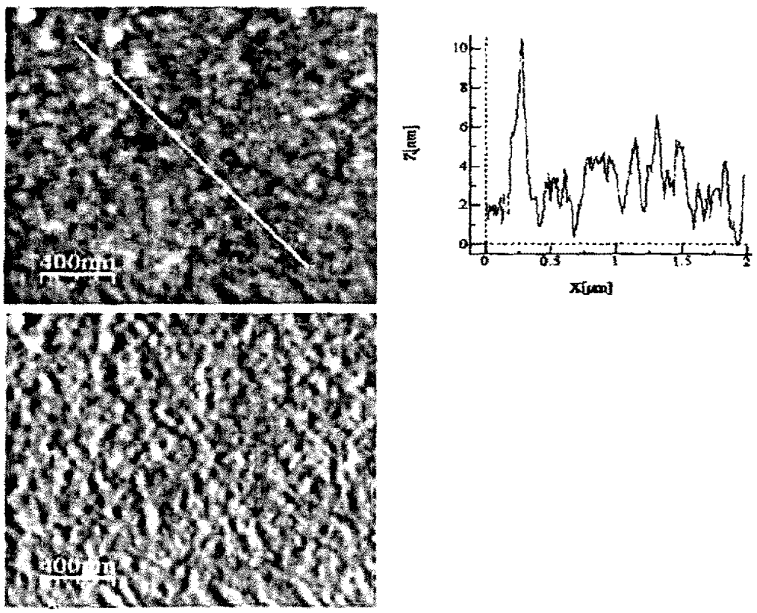

Resistance per nm of barrier coating
Electrical Resistance per nm of barrier coating (Ohms/nm)
1000000
100000
10000
1000
100
10
1
0
20
40
60
80
100
% Crosslinker
DVA
BDVE
CODE
1,7 OD
DCHD
DVPFH
DVTMDS
PFHDA
TVCH

Figure 5

Figure 6



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2

CONFIRMATION NO. 6664

33072
KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

PUBLICATION NOTICE

OC000000113296939

Title:COATINGS

Publication No.US-2019-0375961-A1
Publication Date:12/12/2019

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/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

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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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

33072 7590 09/18/2020

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

EXAMINER	
BUIE-HATCHER, NICOLE M	

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
09/18/2020	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):

docketing@kaganbinder.com

Office Action Summary	Application No. 16/547,728	Applicant(s) COULSON et al.	
	Examiner NICOLE M BUIE-HATCHER	Art Unit 1767	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 _____.

☐ 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) 1-20 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) 1-6,8-9 and 16-20 is/are rejected.

8) ☑ Claim(s) 6-7 and 10-16 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 08/22/2019 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 20190822.

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

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

Claim Status

Claims 1-20 are pending.

Drawings

The drawings are objected to because view numbers must be preceded by the abbreviation "FIG.". See MPEP § 608.02 (V). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not

accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 6-7 are objected to because of the following informalities: both claims 6 and 7 do not end with a period. Appropriate correction is required.

Claim 16 is objected to because of the following informalities: on line 4, it is expected that "1,3-vivinyltetramethyldisiloxane" should be "1,3-divinyltetramethyldisoloxane" (P10/L22 of the original specification). Appropriate correction is required.

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.

Claim 20 is 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 applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, **claim 20** recites the broad recitation "audio systems", and the

claim also recites loudspeakers, microphones, ringers and/or buzzers which is the narrower statement of the range/limitation. . The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Regarding claim 20, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d). The broad limitation is “personal audio equipment”. The narrow limitation is “personal CD, tape cassette or MP3 players”.

Regarding claim 20, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d). The broad limitation is “related components”. The narrow limitation is “a laptop, notebook, tablet, phablet or palmtop computers”.

For the purpose of this Office Action, the broader limitations will be treated on the merits.

Regarding claim 20, the plural form of the device or component is used. It is unknown whether one or more types of these devices or components are required.

Claim Rejections - 35 USC § 103

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.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

Claims 1-6, 8-9, and 16-20 are rejected under 35 U.S.C. 103 as being unpatentable over Huebsch et al. (US 2015/0125695 A1) in view of Kurihara et al. (WO 2010/101091 A1, See machine translation for citation), Padiyath et al. (US 2007/0020451 A1) and Coulson (US 2010/0203347 A1).

Regarding claims 1, 3-6, 8-9, 16-17, and 20, Huebsch et al. discloses formulations comprising at least one compound of Formula A and at least one compound of Formula B may be applied by plasma deposition [0058-0059, 0063]. In addition to at least one compound of Formula A and at least one compound of Formula B include diluent and/or crosslinking monomers. The diluent monomers include (meth)acrylate esters of aromatic alcohols [0055].

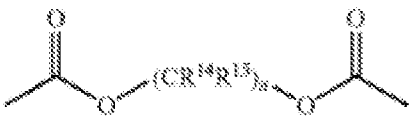
The substrates include polyester, polypropylene, polyethylene, polycarbonate, or polyurethane films [0064].

However, Huebsch et al. does not disclose the (meth)acrylate esters of aromatic alcohols meets the limitations of the formula of the monomer compound of the instant claims. Kurihara et al. teaches benzyl (meth) acrylate (P4/L147-P5/L165). Kurihara et al. is concerned with coating compositions comprising a copolymer of (meth)acrylic acid derivative containing a perfluoroalkyl group (P1/L10-14). Huebsch et al. and Kurihara et al. are analogous art concerned with similar technical difficulty, namely coatings containing copolymers of fluoro (meth)acrylates. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention substitute the (meth)acrylate esters of aromatic alcohols per the teachings of Huebsch et al. with the benzyl (meth)acrylates per the teachings of Kurihara et al., and the motivation to do so would have been as Kurihara et al. suggests balance of water repellency and oil repellency of the treated substrate (P4/L147-P5/L165).

However, Huebsch et al. does not disclose an electronic or electrical device or electronic or electrical component. Padiyath et al. teaches substrates such as flexible plastic materials, including thermoplastic films, such as polyesters, polycarbonates, polypropylenes, high or low density polyethylenes, or polyurethanes [0027]. The substrates are for use in electronic devices, such as OLEDs , organic transistors, or liquid crystal displays [0023,0027] Padiyath et al. is concerned with barrier films [0001]. The polymer layers may be applied by vapor deposition of (meth)acrylate monomers [0052]. Huebsch et al. and Padiyath et al. are analogous art concerned with the same field of endeavor, namely barrier coatings applied by plasma on similar substrates. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention apply the treated substrate per the teachings of Huebsch et al. in an

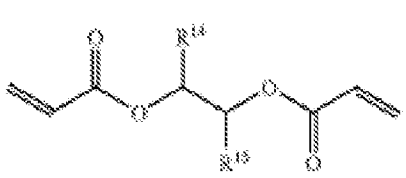
electronic device as per the teachings of Padiyath et al., and the motivation to do so would have been as Padiyath et al. suggests . The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See MPEP § 2144.07.

However, Huebsch et al. does not disclose the crosslinking reagent of the instant claims. Coulson teaches a polymeric coating formed by exposing an item to plasma comprising one or more organic monomeric compounds, at least one of which comprises two carbon-carbon double bonds (crosslinking reagents) [0029]. The crosslinking reagents include where Z is perfluoroalkyl group or optionally substituted alkyl groups, wherein the ester group is not required [0030-0031]. Z is a group of sub-formula (VI) [0032]:



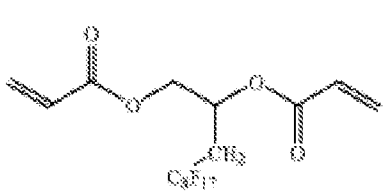
(VI)

wherein n is an integer from 1 to 10, each R14 and R15 is independently selected from hydrogen, alkyl or haloalkyl (When R^{14} and R^{15} hare hydrogen and n is 4 , the structure is divinyl adipate). The compounds also include the following compound:



A

wherein each R^{14} and R^{15} is independently selected from hydrogen, alkyl or haloalkyl [0032, 0035]. One of the crosslinking reagents is of the following formula:



Since the crosslinking reagent meets the claimed limitations of the formula as recited in claim 4, it would be expected that the crosslinking reagent has a boiling point of less than 500°C, absent objective evidence to the contrary. The comonomers may include fluoro (meth)acrylates [0028]. Huebsch et al. and Coulson are analogous art concerned with the same field of endeavor, namely plasma formed coatings. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to substitute the crosslinking monomers per the teachings of Huebsch et al. with the two carbon-carbon double bonds per the teachings of Coulson, and the motivation to do so would have been as Coulson (US '347 suggests such polymeric layers are useful on the surface [0029]. The coatings have a high degree of liquid-proofing protection [0011]. Since the coating has a high degree of liquid-proofing protection, it would be expected that the protective cross-linked polymer coating form a liquid repellent surface defined by a static water contact angle (WCA) of at 90° or may be adjusted to achieve this static water contact angle. Due to two carbon-carbon double bounds, crosslinking would result, and the resulting coating is tougher and less flexible. In regards to the length of the carbon chain in the alkyl group for Y^{10}, an obviousness rejection based on similarity in chemical structure and function entails the motivation of one skilled in the art to make a claimed compound in the expectation that compounds similar in structure will have similar properties. *In re Payne*, 606 F. 2d 303, 313, 203 USPQ 245, 254 (CCPA 979). See *In re Papesch*, 315.2d 381, 137 USPQ 43 (CCPA 1963) and *In re Dillon*, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1991). See MPEP 2144.09.

Regarding claim 2, Huebsch et al. does not disclose the protective cross-linked polymeric coating is a physical barrier to mass and electron transport. The Office realizes that all of the claimed effects or physical properties are not positively stated by the reference(s). However, the reference(s) teaches all of the claimed ingredients, claimed amounts, and substantially similar process of making. Therefore, the claimed effects and physical properties, i.e. the protective cross-linked polymeric coating is a physical barrier to mass and electron transport would implicitly be achieved by a composition with all the claimed ingredients, claimed amounts, and substantially similar process of making. See MPEP § 2112.01. If it is the applicant's position that this would not be the case: (1) evidence would need to be provided to support the applicant's position; and (2) it would be the Office's position that the application contains inadequate disclosure that there is no teaching as to how to obtain the claimed properties with only the claimed ingredients, claimed amounts, and substantially similar process of making.

Regarding claims 18-19, since n1 may be 0, X is optional. The claimed limitations are met.

Allowable Subject Matter

Claims 7 and 10-15 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.

The following is a statement of reasons for the indication of allowable subject matter: the closest prior art of record, Huebsch et al. (US 2015/0125695 A1) nor Coulson (US '347) teach or suggest for compound (i) L has one of the structures as recited in claim 7. Huebsch et al. nor

Coulson (US '347) teach or suggest Y_{12} is fluoro and each Y_{13} is fluoro. Huebsch et al. nor Coulson (US '347) Y_{10} has the formula as instantly claimed in claim 14.

Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lee (US 5,925,420) teaches amorphously crosslinked aromatic polymeric low κ materials.

Dunbar et al. (US 2006/0068519 A1) teaches a method of making an electronic device.

Badyal (WO 00/05000 A1) teaches a method of coating a surface with a polymer layer by exposing the surface to a pulsed plasma comprising a monomeric saturated organic compound.

Benard et al. (GB 2477410 A) teaches a conventional polymer is grafted to a plasma polymer layer provided at a substrate surface Abstract). Aromatic methacrylate derivatives may be used as plasma polymer precursors (P4-5).

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE M. BUIE-HATCHER whose telephone number is (571)270-3879. The examiner can normally be reached on M-F, 8 am - 4:30 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571)272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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 https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICOLE M. BUIE-HATCHER/
Primary Examiner, Art Unit 1767

Notice of References Cited	Application/Control No. 16/547,728	Applicant(s)/Patent Under Reexamination COULSON et al.	
	Examiner NICOLE M BUIE-HATCHER	Art Unit 1767	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-5925420-A	07-1999	Lee; Chung	C08G61/02	427/226
*	B	US-20060068519-A1	03-2006	Dunbar; Timothy D.	H01L51/0545	438/82
*	C	US-20070020451-A1	01-2007	Padiyath; Raghunath	B05D7/58	428/336
*	D	US-20150125695-A1	05-2015	HUEBSCH; ERIC	C09D4/00	428/393
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	WO-0005000-A1	02-2000	WO	BREWER STUART ANSON	C23C16/515
	O	WO-2010101091-A1	09-2010	WO	Kurihara et al.	C09K3/18
	P	GB-2477410-A	08-2011	GB	RENAUX FABIAN	B05D3/142
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Machine translation of WO 2010/101091 A1, retrieved September 2020 (Year: 2020)
	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
	16/547,728	COULSON et al.
	Examiner	Art Unit
	NICOLE M BUIE-HATCHER	1767

CPC - Searched*		
Symbol	Date	Examiner
C08F (text)	09/11/2020	NMB
C09D (text)	09/11/2020	NMB
B05D(text)	09/11/2020	NMB
H05K (text)	09/11/2020	NMB
H01J (text)	09/11/2020	NMB
H01L (text)	09/11/2020	NMB
B05D1/62 (text)	09/11/2020	NMB
H01L21/02274 (text)	09/11/2020	NMB
C08F220/24 (text)	09/11/2020	NMB

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	Art Unit
	NICOLE M BUIE-HATCHER	1767

Search Notes		
Search Notes	**Date**	**Examiner**
Inventor name search, DAV and PE2E Search	09/10/2020	NMB
Reviewed appln 15/735130	09/10/2020	NMB
IPR2020-01198 Reviewed Inter Partes Review of US Patent No. 10,421,876	09/10/2020	NMB
Global Dossier	09/10/2020	NMB
Scifinder, see search history	09/10/2020	NMB
ip.com (PG Pub)	09/10/2020	NMB
PE2E Search, see search history	09/11/2020	NMB

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

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	52	("20040028931"|"20040046165"|"20090267489"|"20100021998"|"20100189914"|"20100203347"|"20120009231"|"20120051018"|"20120171386"|"20120321775"|"20140010969"|"20140322525"|"20140342103"|"20150291830"|"20160284518"|"20180171171"|"4822632"|"6613393"|"6764758"|"8852693"|"RE43651").PN.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 11:06 AM
L2	2	us-6551950-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:02 PM
L3	25665065	((electronic electrical) NEAR2 (device component)) (mobile ADJ phone) smartphone (smart ADJ phone) pager radio (sound NEAR2 system) (audio NEAR2 system) loudspeaker microphone ringer buzzer (hearing NEAR2 aid) (personal ADJ audio) cd (tape ADJ cassette) ("mp3" NEAR2 player) television tv dvd computer laptop tablet phablet palmtop pda keyboard console (circuit ADJ board)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:11 PM
L4	13036425	monomer polymer$3	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:11 PM
L5	2971888	plasma	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:11 PM
L6	4152431	crosslink$5 (cross NEAR2 link$5) curable cured vulcaniz$5	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:11 PM
L7	12	(L3 SAME L4 SAME L5	US-PGPUB; USPAT;	OR	ON	ON	2020/09/10

		SAME L6) AND (coulson-s$ evans-d$ siokou-s$ telford-c$).in.	USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB				02:12 PM
L8	3	(L3 SAME L4 SAME L5 SAME L6) AND ("p2i" ADJ ltd$2).as.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:13 PM
L9	195	(L3 SAME L4 SAME L5 SAME L6).ab.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:14 PM
L10	2560	(L3 SAME L4 SAME L5 SAME L6)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:24 PM
L11	1233	L10 AND (h05k$/$ c08f$/$ c09d$/$ b05d$/$ h01j$/$ h01l$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 02:25 PM
L13	302	L11 AND ((phenyl aryl aromatic) NEAR2 (ester acryl$4 methacryl$4))	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 03:12 PM
L14	394	L11 AND ((phenyl aryl aromatic benzyl) NEAR2 (ester acryl$4 methacryl$4))	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 03:16 PM
L15	2	us-5925420-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 03:42 PM
L16	2	us-20060068519-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 03:45 PM
L17	2	us-20120183752-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 03:54 PM
L18	1	us-re43651-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:27 PM
L19	0	wo-2000005000-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:29 PM
L20	0	wo-200005000-$.did.	US-PGPUB; USPAT;	OR	ON	ON	2020/09/10

			USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB				04:29 PM
L21	0	wo-20005000-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:29 PM
L22	3	wo-0005000-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:30 PM
L23	2	us-20130071561-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:38 PM
L24	1	ca-2334631-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:39 PM
L25	3	wo-02094906-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:41 PM
L26	2	us-8389070-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:44 PM
L27	70	((phenyl aryl aromatic benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) AND (h01l21/02274).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:46 PM
L28	3	wo-2015029577-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 04:47 PM
L29	70	(((phenyl aryl aromatic benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND (h01l21/02274).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 05:01 PM
L30	73	(((phenyl aryl aromatic benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND (b05d1/62).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 05:01 PM
L31	4659	(((phenyl aryl aromatic	US-PGPUB; USPAT;	OR	ON	ON	2020/09/10

		benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND (plasma NEAR2 (polymer$8 deposition))	USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB				05:17 PM
L32	437	L31 AND (c08f$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/10 05:17 PM
L33	5	wo-2007083122-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 09:50 AM
L34	18747	(plasma NEAR4 ($5polymer$8 resin elastomer$5 thermoplastic plastic)).ab.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 12:04 PM
L35	8967	(plasma NEAR4 ($5polymer$8 resin elastomer$5 thermoplastic plastic)).clm.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 12:05 PM
L36	324	(((phenyl aryl aromatic benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND (L34 L35)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 12:05 PM
L37	330	(((phenyl$6 aryl aromatic benzyl$6 naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND (L34 L35)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 12:23 PM
L38	330	(((phenyl$6 aryl aromatic benzyl$6 naphthyl) NEAR2 (vinyleser ester acryl$4 methacryl$4)) acrylbenzene) AND (L34 L35)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 12:27 PM
L39	476675	((phenyl$6 aryl aromatic benzyl$6 naphthyl) NEAR2 (vinyleser ester acryl$4 methacryl$4)) acrylbenzene	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:18 PM
L40	493	(plasma NEAR4 ($5polymer$8 resin elastomer$5 thermoplastic plastic))	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:18 PM

		SAME3 L39					
L41	282	L40 AND L3	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:18 PM
L42	70744	(sheet paper film) SAME L3 SAME L5	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:58 PM
L43	11502	((sheet paper film) SAME L3 SAME L5).ab.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:58 PM
L44	3156	L43 AND (c09d$/$ h01j$/$ b05d$/$ h01l$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:59 PM
L45	48	L44 AND (plasma NEAR2 polymer)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 01:59 PM
L46	87072	film SAME (polyester polypropylene polyethylene polycarbonate (cellulose NEAR2 triacetate) polyurethane) SAME L3	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 03:01 PM
L47	20828	L46 AND plasma	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 03:01 PM
L48	4307	L47 AND (c09d$/$ b05d$/$ h01j$/$ h01l$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 03:01 PM
L49	1542	L46 SAME plasma AND (c09d$/$ b05d$/$ h01j$/$ h01l$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 03:02 PM
L50	1225	L48 AND (hydrophobic oleophobic (water ADJ resist$4 repel$5))	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 03:04 PM
L51	83	(L3 SAME L4 SAME L5 SAME L6) AND (barrier NEAR2 (mass electron))	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 04:03 PM
L52	4597	L46 SAME (plasma	US-PGPUB; USPAT;	OR	ON	ON	2020/09/11

		pecvd)	USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB				04:38 PM
L53	2988015	plasma pecvd	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 04:38 PM
L54	2570	(L3 SAME L4 SAME L53 SAME L6)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 04:38 PM
L55	896	L54 AND (c09d$/$ b05d$/$ h01j$/$ h01l$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 04:39 PM
L56	4493	((((phenyl aryl aromatic benzyl naphthyl) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) SAME (coating coated)).ab.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:51 PM
L57	1235	L56 AND (c09d$/$ b05d$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:51 PM
L58	4743	((((phenyl$6 aryl aromatic benzyl$6 naphthyl$6) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) SAME (coating coated)).ab.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:56 PM
L59	1265	L58 AND (c09d$/$ b05d$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:56 PM
L60	1	L59 AND ((plasma NEAR polymerization) pecvd)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:59 PM
L61	1	L58 AND ((plasma NEAR2 polymerization) pecvd)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 05:59 PM
L62	2937	(((phenyl$6 aryl aromatic benzyl$6 naphthyl$6) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) AND ((plasma NEAR2	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 06:00 PM

		polymerization) pecvd)					
L63	520	L62 AND (c09d$/$ b05d$/$).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 06:00 PM
L64	1617	L58 AND (crosslink$6 (cross ADJ link$6) cured curable vulcaniz$6)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 06:57 PM
L65	2	L64 AND (c08f220/24).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 07:13 PM
L66	61	(((phenyl$6 aryl aromatic benzyl$6 naphthyl$6) NEAR2 (ester acryl$4 methacryl$4)) acrylbenzene) SAME (coating coated) AND (c08f220/24).cpc.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 07:14 PM
L67	4	wo-2010101091-$.did.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/09/11 07:16 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	1	"20190375961".pn.	US-PGPUB; USPAT	OR	ON	ON	2020/09/10 09:24 AM
N2	21	("20040028931"|"20040046165"|"20090267489"|"20100021998"|"20100189914"|"20100203347"|"20120009231"|"20120051018"|"20120171386"|"20120321775"|"20140010969"|"20140322525"|"20140342103"|"20150291830"|"20160284518"|"20180171171"|"4822632"|"6613393"|"6764758"|"8852693"|"RE43651").PN.	US-PGPUB; USPAT	OR	ON	ON	2020/09/10 11:06 AM

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Title: COATINGS

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APPLICANTS

P2i Ltd, Abingdon, UNITED KINGDOM

INVENTORS

Stephen Richard COULSON, Abingdon, UNITED KINGDOM

Delwyn EVANS, Abingdon, UNITED KINGDOM

Angeliki SIOKOU, Abingdon, UNITED KINGDOM

Clive TELFORD, Abingdon, UNITED KINGDOM

CONTINUING DATA

This application is a CON of 15735130 12/08/2017 PAT 10421876

15735130 is a 371 of PCT/GB2016/051688 06/08/2016

FOREIGN APPLICATIONS

EPO EP15386017.6 06/09/2015

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ADDRESS

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082
UNITED STATES

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Application Number	
Filing Date	
First Named Inventor	Stephen Richard COULSON
Art Unit	
Examiner Name	
Attorney Docket Number	GBL0007/US/2

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	First Named Inventor	Stephen Richard COULSON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	GBL0007/US/2

/N.M.B./	13	20140342103	A1	2014-11-20	Petersen et al.	
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/N.M.B./	15	20160284518	A1	2016-09-29	Legein et al.	
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First Named Inventor	Stephen Richard COULSON
Art Unit	
Examiner Name	
Attorney Docket Number	GBL0007/US/2

/N.M.B./	6	2711153	EP	A1	2014-03-26	The Goodyear Tire and Rubber Company		
/N.M.B./	7	9858117	WO	A1	1998-12-23	THE SECRETARY OF STATE FOR DEFENCE		
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(71) **Applicant** *(for all designated States except US)*: THE SECRETARY OF STATE FOR DEFENCE [GB/GB]; Defence Evaluation and Research Agency, Ively Road, Farnborough, Hampshire GU14 0LX (GB).

(72) **Inventors; and**
(75) **Inventors/Applicants** *(for US only)*: BADYAL, Jas, Pal, Singh [GB/GB]; University of Durham, Science Laboratories, South Road, Durham DH1 3LE (GB). COULSON, Stephen, Richard [GB/GB]; University of Durham, Science Laboratories, South Road, Durham DH1 3LE (GB). WILLIS, Colin, Robert [GB/GB]; CBDE, Porton Down, Salisbury, Wiltshire SP4 0JQ (GB). BREWER, Stuart, Anson [GB/GB]; CBDE, Porton Down, Salisbury, Wiltshire SP4 0JQ (GB).

(74) **Agent:** BOWDERY, A., O.; D/IPR, Formalities Section, Poplar 2, MOD Abbey Wood # 19, Bristol BS34 8JH (GB).

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(57) **Abstract**

A method of coating a surface with a polymer layer, which method comprises exposing said surface to a pulsed plasma comprising a monomeric saturated organic compound, said compound comprising an optionally substituted alkyl chain of at least 5 carbon atoms optionally interposed with a heteroatom, such as a halo substituted alkane; so as to form an oil or water repellent coating on said substrate. Substrates such as fabrics obtained by this process are also claimed.

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Surface Coatings

The present invention relates to the coating of surfaces, in particular to the production of oil- and water- repellent surfaces, as well as to coated articles obtained thereby.

Oil- and water- repellent treatments for a wide variety of surfaces are in widespread use. For example, it may be desirable to impart such properties to solid surfaces, such as metal, glass, ceramics, paper, polymers etc. in order to improve preservation properties, or to prevent or inhibit soiling.

A particular substrate which requires such coatings are fabrics, in particular for outdoor clothing applications, sportswear, leisurewear and in military applications. Their treatments generally require the incorporation of a fluoropolymer into or more particularly, fixed onto the surface of the clothing fabric. The degree of oil and water repellency is a function of the number and length of fluorocarbon groups or moieties that can be fitted into the available space. The greater the concentration of such moieties, the greater the repellency of the finish.

In addition however, the polymeric compounds must be able to form durable bonds with the substrate. Oil- and water-repellent textile treatments are generally based on fluoropolymers that are applied to fabric in the form of an aqueous emulsion. The fabric remains breathable and permeable to air since the treatment simply coats the fibres with a very thin, liquid-repellent film. In order to make these finishes durable, they are sometimes co-applied with cross-linking resins that bind the fluoropolymer to fibres. Whilst good levels of durability towards laundering and dry-

cleaning can be achieved in this way, the cross-linking resins can seriously damage cellulosic fibres and reduce the mechanical strength of the material. Chemical methods for producing oil- and water-repellent textiles are disclosed for example in WO 97/13024 and British patent No 1,102,903 or M. Lewin et al., 'Handbood of Fibre Science and Technology' Marcel and Dekker Inc., New York, (1984) Vol 2, Part B Chapter 2.

Plasma deposition techniques have been quite widely used for the deposition of polymeric coatings onto a range of surfaces. This technique is recognised as being a clean, dry technique that generates little waste compared to conventional wet chemical methods. Using this method, plasmas are generated from small organic molecules, which are subjected to an ionising electrical field under low pressure conditions. When this is done in the presence of a substrate, the ions, radicals and excited molecules of the compound in the plasma polymerise in the gas phase and react with a growing polymer film on the substrate. Conventional polymer synthesis tends to produce structures containing repeat units which bear a strong resemblance to the monomer species, whereas a polymer network generated using a plasma can be extremely complex.

The success or otherwise of plasma polymerisation depends upon a number of factors, including the nature of the organic compound. Reactive oxygen containing compounds such as maleic anhydride, has previously been subjected to plasma polymerisation (Chem. Mater. Vol. 8, 1, 1996).

US Patent No 5,328,576 describes the treatment of fabric or paper surfaces to impart liquid repellent properties by

subjecting the surfaces to a pre-treatment with an oxygen plasma, followed by plasma polymerisation of methane.

However, plasma polymerisation of the desirable oil and water repellent fluorocarbons have proved more difficult to achieve. It has been reported that cyclic fluorocarbons undergo plasma polymerisation more readily than their acyclic counterparts (H. Yasuda et al., J. Polym. Sci., Polym. Chem. Ed. 1977, 15, 2411). The plasma polymerization of trifluoromethyl-substituted perfluorocyclohexane monomers has been reported (A. M. Hynes et al., Macromolecules, 1996, 29, 18-21).

A process in which textiles are subjected to plasma discharge in the presence of an inert gas and subsequently exposed to an F-containing acrylic monomer is described in SU-1158-634. A similar process for the deposition of a fluroalkyl acrylate resists on a solid substrate is described in European Patent Application No. 0049884.

Japanese application no. 02011606 describes the plasma polymerisation of compounds including fluorosubstituted acrylates. In that process, a mixture of the fluorosubstituted acrylate compounds and an inert gas are subjected to a glow discharge.

Copending International Patent application based upon British Patent Application Nos. 9712338.4 and 9720078.6 describes a method method for producing polymer and particular halopolymer coatings which are water and/or oil repellent on surfaces by the plasma deposition of monomer compounds which include carbon-carbon double bonds. The applicants have found that the method can be extended to the deposition of other compounds. In particular monomers which

are unsaturated in that they contain no carbon-carbon double bonds may be employed in the process and similar advantageous results achieved.

According to the present invention there is provided a method of coating a surface with a polymer layer, which method comprises exposing said surface to a pulsed plasma comprising a monomeric saturated organic compound, said compound comprising an optionally substituted alkyl chain of at least 5 carbon atoms optionally interposed with a heteroatom; so as to form an oil or water repellent coating on said substrate.

The term "saturated" as used herein means that the monomer does not contain multiple bonds (i.e. double or triple bonds) between two carbon atoms which are not part of an aromatic ring. The term "heteroatom" includes oxygen, sulphur, silicon or nitrogen atoms. Where the alkyl chain is interposed by a nitrogen atom, it will be substituted so as to form a secondary or tertiary amine. Similarly, silicons will be substituted appropriately, for example with two alkoxy groups.

Other terms used herein include "halo" or "halogen" which refer to fluorine, chlorine, bromine and iodine. Particularly preferred halo groups are fluoro. The term "aryl" refers to aromatic cyclic groups such as phenyl or napthyl, in particular phenyl. The term "alkyl" refers to straight or branched chains of carbon atoms, suitably of up to 50 carbon atoms in length. Derivatives of alkyl groups, such as would be understood by "alkoxy" include such groups. The term "heterocyclyl" includes aromatic and non aromatic rings or ring systems, suitably containing up to 12 atoms, up to three of which may be heteroatoms.

The monomeric compound used in the process of the invention may comprise one or more optionally substituted alkyl chains, either as part of a branched alkane or as part of a more complex structure including rings and other functional groups. These may be present either in the monomer used as a starting material, or may be created in the monomer on application of the plasma, for example by the ring opening of an optionally substituted cycloalkyl monomer.

Suitable optional substituents for the monomeric compounds of the invention include halo, cyano, nitro, oxo, epoxide, optionally substituted cycloalkyl, optionally substituted aryl, optionally substituted aralkyl, optionally substituted heterocyclyl, $C(O)_nR^1$, OR^1, $S(O)_mR^1$, NR^2R^3, $C(O)NR^2R^3$, $OC(O)NR^2R^3$, $=NOR^2$, $-NR^2C(O)_nR^2$, $-NR^1CONR^2R^3$, $-C=NOR^1$, $-N=CR^2R^3$, $S(O)_mNR^2R^3$ or $-NR^2S(O)_mR^1$ where R^1, R^2 and R^3 are independently selected from hydrogen or alkyl, aralkyl, cycloalkyl, aryl or heterocyclyl, any of which may be optionally substituted, or R^2 and R^3 together form an optionally substituted ring which optionally contains further heteroatoms such as sulphur, oxygen and nitrogen, n is an integer of 1 or 2, m is 0 or an integer of 1-3.

Suitable optional substituents for aryl, aralkyl and cycloalkyl and heterocyclyl groups R^1, R^2 and R^3 include halo, perhaloalkyl, mercapto, hydroxy, alkoxy, oxo, heteroaryloxy, alkenyloxy, alkynyloxy, alkoxyalkoxy, aryloxy (where the aryl group may be substituted by halo, nitro, or hydroxy), cyano, nitro, amino, mono- or di-alkyl amino, alkylamido or oximino.

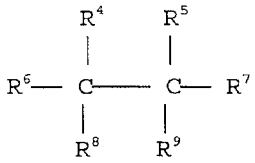
Suitable alkyl chains, which may be straight or branched, have from 5 to 50 carbon atoms, more suitably from 6 to 20

carbon atoms, and preferably from 8 to 15 carbon atoms, provided at least 5 carbon atoms form a straight chain.

Monomeric compounds where the chains comprise unsubstituted alkyl groups are suitable for producing coatings which are water repellent. By substituting at least some of the hydrogen atoms in these chains with at least some halogen atoms, oil repellency may also be conferred by the coating.

Thus in a preferred aspect, the monomeric compounds include haloalkyl moieties or comprise haloalkyls. Therefore, preferably the plasma used in the method of the invention will comprise a monomeric saturated haloalkyl containing organic compound.

Particularly suitable monomeric organic compounds are those of formula (I)



where R^4, R^5, R^6, R^7 and R^8 are independently selected from hydrogen, halogen, alkyl, haloalkyl or aryl optionally substituted by halo; and R^9 is a group $X\text{-}R^{10}$ where R^{10} is an alkyl or haloalkyl group and X is a bond; a group of formula $-C(O)O(CH_2)_xY-$ where x is an integer of from 1 to 10 and Y is a bond or a sulphonamide group; or a group $-(O)_pR^{11}(O)_s(CH_2)_t-$ where R^{11} is aryl optionally substituted by halo, p is 0 or 1, s is 0 or 1 and t is 0 or an integer of from 1 to 10, provided that where s is 1, t is other than 0.

Suitable haloalkyl groups for R^4, R^5, R^6, R^6, and R^8 are fluoroalkyl groups. The alkyl chains may be straight or branched and may include cyclic moieties and have, for example from 1 to 6 carbon atoms.

For R^{10}, the alkyl chains suitably comprise 1 or more carbon atoms, suitably from 1-20 carbon atoms and preferably from 6 to 12 carbon atoms.

Preferably R^{10} is a haloalkyl, and more preferably a perhaloalkyl group, particularly a perfluoroalkyl group of formula C_zF_{2z+1} where z is an integer of 1 or more, suitably from 1-20, and preferably from 6-12 such as 8 or 10.

Where X is a group $-C(O)O(CH_2)_yY-$, y is an integer which provides a suitable spacer group. In particular, y is from 1 to 5, preferably about 2.

Suitable sulphonamide groups for Y include those of formula $-N(R^{11})SO_2^-$ where R^{11} is hydrogen, alkyl or haloalkyl such as C_{1-4}alkyl, in particular methyl or ethyl.

The monomeric compounds used in the method of the invention preferably comprises an C_{6-25}alkane optionally substituted by halogen, in particular a perhaloalkane, and especially a perfluoroalkane.

Compounds of formula (I) are either known compounds or they can be prepared from known compounds using conventional methods.

Suitable plasmas for use in the method of the invention include non-equilibrium plasmas such as those generated by alternating current (AC)(e.g. radiofrequencies (Rf),

microwaves) or direct current (DC). They may operate at atmospheric or sub-atmospheric pressures as are known in the art.

The plasma may comprise the monomeric compound alone, in the absence of other gases or in mixture with for example an inert gas. Plasmas consisting of monomeric compound alone may be achieved as illustrated hereinafter, by first evacuating the reactor vessel as far as possible, and then purging the reactor vessel with the organic compound for a period sufficient to ensure that the vessel is substantially free of other gases.

The surface coated in accordance with the invention may be of any solid substrate, such as fabric, metal, glass, ceramics, paper or polymers. In particular, the surface comprises a fabric substrate such as a cellulosic fabric, to which oil- and/or water-repellency is to be applied. Alternatively, the fabric may be a synthetic fabric such as an acrylic/nylon fabric.

The fabric may be untreated or it may have been subjected to earlier treatments. For example, it has been found that treatment in accordance with the invention can enhance the water repellency and confer a good oil-repellent finish onto fabric which already has a silicone finish which is water repellent only.

Precise conditions under which the plasma polymerization takes place in an effective manner will vary depending upon factors such as the nature of the polymer, the substrate etc. and will be determined using routine methods and/or the techniques illustrated hereinafter. In general however, polymerisation is suitably effected using vapours of

compounds of formula (I) at pressures of from 0.01 to 10 mbar, suitably at about 0.2mbar.

A glow discharge is then ignited by applying a high frequency voltage, for example at 13.56MHz.

The applied fields are suitably of average power of up to 50W. Suitable pulsed fields are those which are applied in a sequence which yields very low average powers, for example of less than 10W and preferably of less than 1W. Examples of such sequences are those in which the power is on for 20μs and off for from 10000μs to 20000μs.

The fields are suitably applied for a period sufficient to give the desired coating. In general, this will be from 30 seconds to 3 hours, preferably from 2 to 30 minutes, depending upon the nature of the monomer compound used and the substrate etc.

Plasma polymerisation in accordance with the invention particularly at low average powers has been found to result in the deposition of highly fluorinated coatings which exhibit super-hydrophobicity.

In a preferred embodiment, the pulses are applied at a variable rate, with relatively long pulses applied, for example of from 1 to 10 secs on initially, reducing down to short pulses for example of from 100μs to 1μs on and 10μs to 1000μs off, later in the process. It is believed that such a regime leads to improved coatings because the initial long pulse leads to greater fragmentation of the monomer, leading to a more disorganised and therefore strongly bonding layer directly adjacent the substrate. Shorter late pulses means that the upper layers deposited retain a more organised

structure and so contain a greater number of long chains, which are responsible for the oil and water repellency on the surface.

Suitably the compound of formula (I) includes a perfluoroalkylated tail or moiety, in which case, the coating obtained by the process of the invention may have oleophobic as well as hydrophobic surface properties.

Thus the invention further provides a hydrophobic or oleophobic substrate which comprises a substrate comprising a coating of a alkyl polymer and particularly a haloalkyl polymer which has been applied by the method described above. In particular, the substrates are fabrics but they may be solid materials such as biomedical devices.

In a further aspect the invention provides the use of an optionally substituted alkane or optionally substituted cycloalkane having at least 5 carbon atoms and particularly a perhaloalkane in the production of water and/or oil repellent coatings by pulsed plasma deposition methods.

The invention will now be particularly described by way of example with reference to the accompanying diagrammatic drawings in which:

Figure 1 shows a diagram of the apparatus used to effect plasma deposition; and

Figure 2 is a graph showing the characteristics of pulsed wave plasma polymerisation of perfluorododecane.

Example 1

Plasma Polymerisation of perfluorododecane

Rerfluorododecane ($C_{12}F_{26}$) was placed into a monomer tube (I) (Fig. 1). A series of plasma polymerisation experiments were carried out in an inductively coupled cylindrical plasma reactor vessel (2) of 5cm diameter, 470cm^3 volume, base pressure of $7x10^{-3}$mbar, and with a leak rate of better than $2x10^{-3}$ cm^3min^{-1}. The reactor vessel (2) was connected by way of a "viton" O-ring (3), a gas inlet (4) and a needle valve (5) to the monomer tube (1).

A thermocouple pressure gauge (6) was connected by way of a Young's tap (7) to the reactor vessel (2). A further Young's tap (8) connected with an air supply and a third (9) lead to an E2M2 two stage Edwards rotary pump (not shown) by way of a liquid nitrogen cold trap (10). All connections were grease free.

An L-C matching unit (11) and a power meter (12) was used to couple the output of a 13.56 Mhz R.F. generator (13), which was connected to a power supply (14), to copper coils (15) surrounding the reactor vessel (2). This arrangement ensured that the standing wave ratio (SWR) of the transmitted power to partially ionised gas in the reactor was [illegible] generator (16) was used to trigger the R.F power supply, and a cathode ray oscilloscope (17) was used to monitor the pulse width and amplitude. The average power <P> delivered to the system during pulsing is given by the following formula:

$$\langle P \rangle = P_{cw}\{T_{on}/(T_{on} + T_{off})\}$$

where $T_{on}/(T_{on} + T_{off})$ is defined as the duty cycle and P_{cw} is the average continuous wave power.

In order to carry out polymerization/deposition reactions the reactor vessel (2) was cleaned by soaking overnight in a chloros bleach bath, then scrubbing with detergent and finally rinsing with isopropyl alcohol followed by oven drying. The reactor vessel (2) was then incorporated into the assembly as shown in Figure 1 and further cleaned with a 50W air plasma for 30 minutes. Next the reactor (2) vessel was vented to air and the substrate to be coated (19), in this case a glass slide, was placed in the centre of the chamber defined by the reactor vessel (2) on a glass plate (18). The chamber was then evacuated back down to base pressure (7.0×10^{-3}mbar).

Perfluoroalkane vapour was then introduced into the reaction chamber at a constant pressure of ~0.2mbar and allowed to purge the plasma reactor, followed by ignition of the glow discharge. Typically 2-15 minutes deposition time was found to be sufficient to give complete coverage of the substrate. After this, the R.F generator was switched off and the perfluoroalkane vapour allowed to continue to pass over the substrate for a further 5 minutes before evacuating the reactor back down to base pressure, and finally venting up to atmospheric pressure.

The experiments were carried out with average powers in the range of from 0.3 to 50W. The XPS spectrum of the product of a pulsed wave plasma polymer deposition onto a glass slide was taken.

Figure 2 shows the C (1s) XPS spectrum for a 5 minute pulsed plasma polymerisation experiment where:- P_{cw} = 70W

T_{on} = 20μs

T_{off} = 20000μs <P> = 0.07W

The chemical composition of the deposited coating for pulsed plasma deposition is given in Table 2 below.

Table 2

	Experimental	Theoretical
F:C ratio	1.86	2.17
%$\underline{C}F_2$ group	47.9	83.3
%$\underline{C}F_3$ group	18.5	16.7

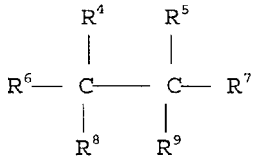
Claims

1. A method of coating a surface with a polymer layer, which method comprises exposing said surface to a pulsed plasma comprising a monomeric saturated organic compound, said compound comprising an optionally substituted alkyl chain of at least 5 carbon atoms optionally interposed with a heteroatom; so as to form an oil or water repellent coating on said substrate.

2. A method according to claim 1 wherein the alkyl chains are substituted by halogen.

3. A method according to claim 2 wherein the alkyl chains are perhalogenated.

4. A method according to claim 1 wherein the monomeric organic compound is a compound of formula (I)



where R^4, R^5, R^6, R^7 and R^8 are independently selected from hydrogen, halogen, alkyl, haloalkyl or aryl optionally substituted by halo; and R^9 is a group $X\text{-}R^{10}$ where R^{10} is an alkyl or haloalkyl group and X is a bond; a group of formula $-C(O)O(CH_2)_xY-$ where x is an integer of from 1 to 10 and Y is a bond or a sulphonamide group; or a group $-(O)_pR^{11}(O)_s(CH_2)_t-$ where R^{11} is aryl optionally substituted by

halo, p is 0 or 1, s is 0 or 1 and t is 0 or an integer of from 1 to 10, provided that where s is 1, t is other than 0.

5. A method according to claim 4 wherein the compound of formula (I) comprises a C_{6-25}alkane optionally substituted by halogen.

6. A method according to claim 5 wherein the C_{6-25} alkane is a C_{6-25} perfluoroalkane.

7. A method according to any one of the preceding claims wherein the substrate is a fabric, metal, glass, ceramics, paper or polymer material.

8. A method according to claim 7 wherein the substrate is a cellulosic fabric.

9. A method according to claim 7 wherein the substrate is a synthetic fabric.

10. A method according to any one of the preceding claims wherein the monomeric organic compound is in the form of a vapour at a pressure of from 0.01 to 10 mbar.

11. A method according to any one of the preceding claims wherein the plasma is created by applying an alternating frequency voltage.

12. A method according to any one of the preceding claims wherein the average power of the electrical field applied is up to 50W.

13. A method according to any one of the preceding claims wherein the pulsed fields are applied in a sequence which yields an average power of less than 10W.

14. A method according to claim 13 wherein the average power is less than 1W.

15. A method according to claim 13 or claim 14 wherein the pulses are applied in a sequence in the power is on for 20μs and off for from 10000μs to 20000μs.

16. A method according to any one of the preceding claims wherein the pulses are applied at a variable rate.

17. A method according to claim 16 wherein the length of the pulses decreases during the treatment.

18. A hydrophobic or oleophobic substrate which comprises a substrate comprising a coating of an alkyl polymer obtained by a method according to any one of the preceding claims.

19. The use of an optionally substituted alkane or optionally substituted cycloalkane having at least 5 carbon atoms in the production of water and/or oil repellent coatings by pulsed plasma deposition methods.

20. The use of claim 19 wherein the alkane or cycloalkane is perhalogenated.

21. A method for producing an water and/or oil repellent coating on a substrate, substantially as hereinbefore described with reference to the Example.

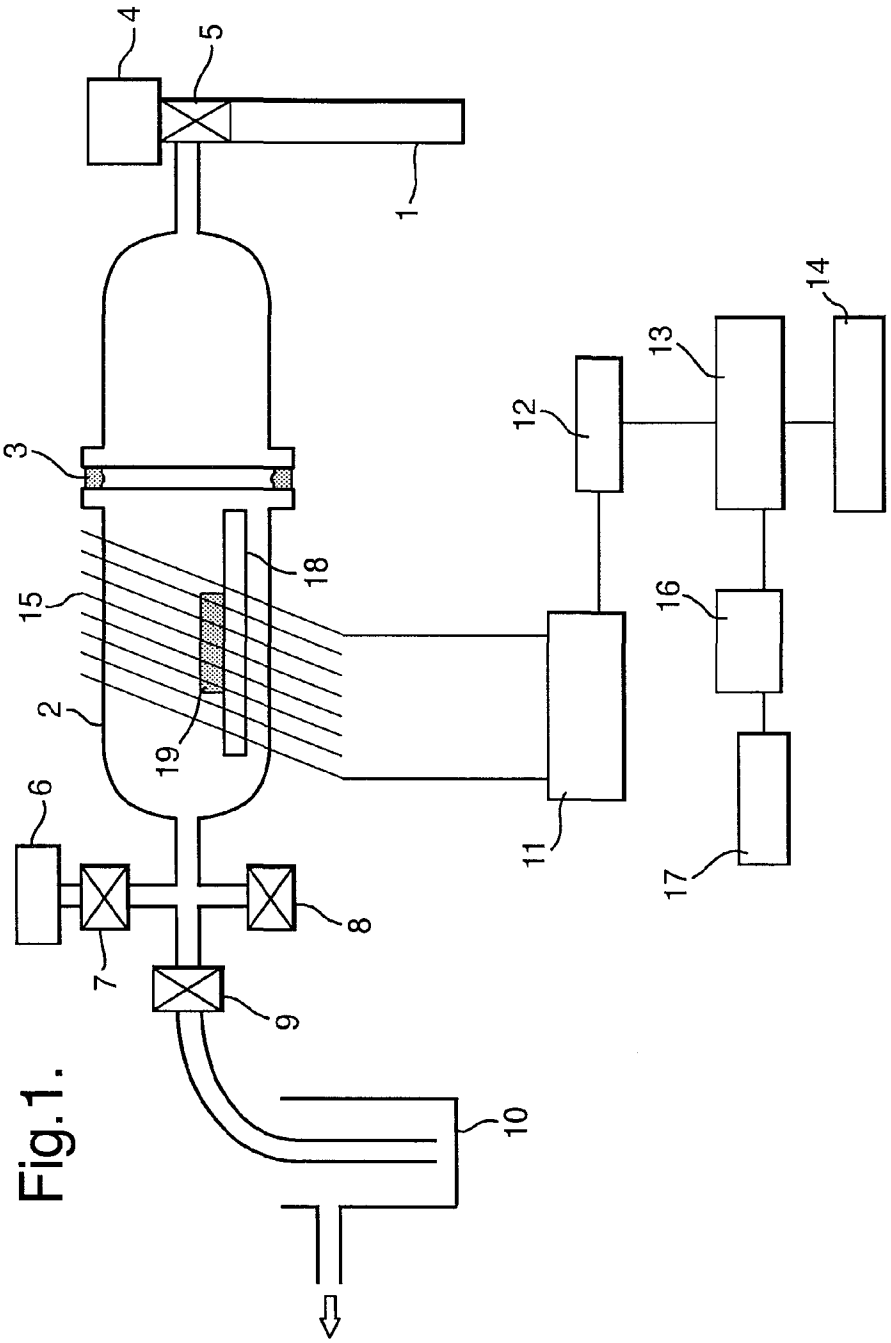
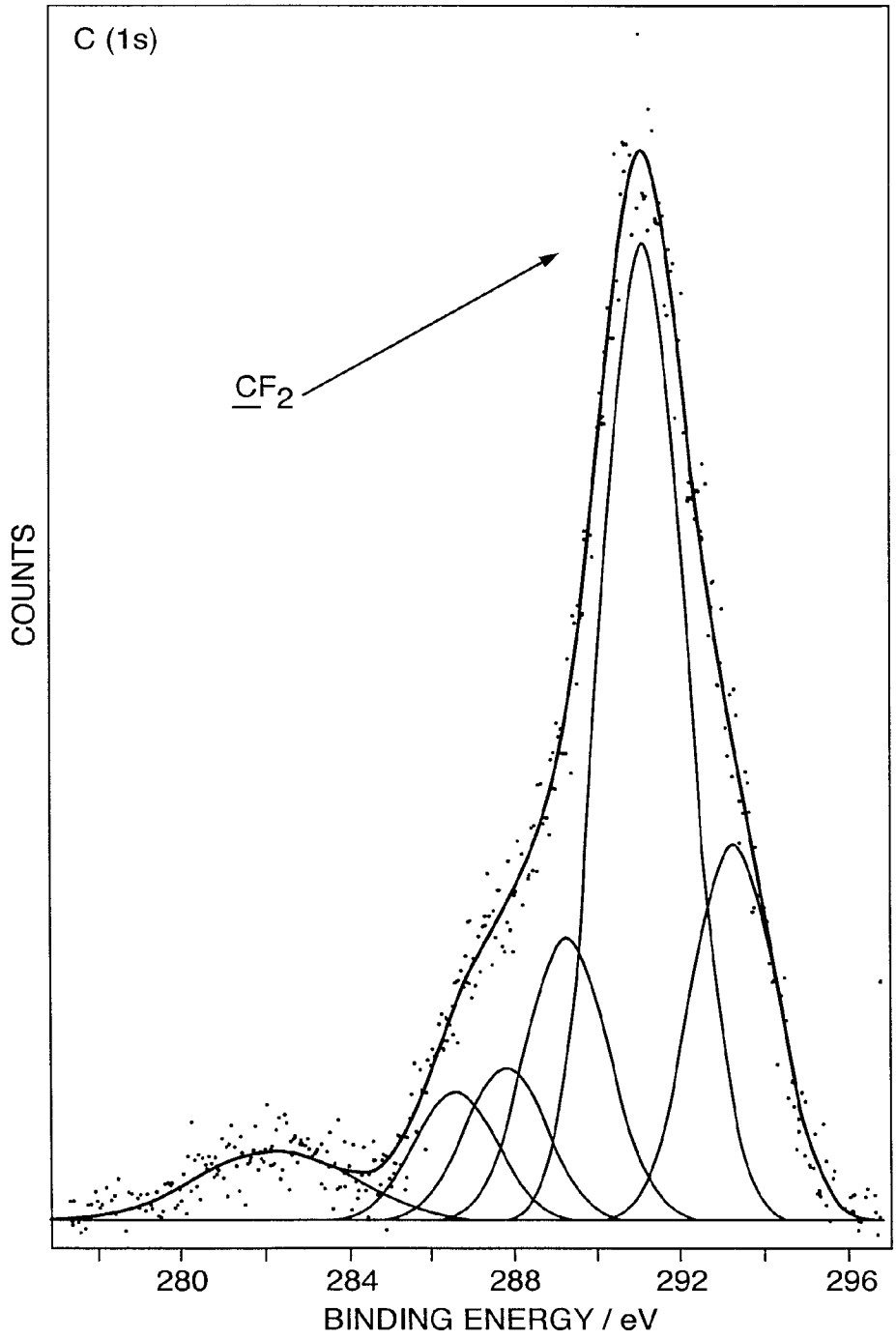


Fig.1.

Fig.2.



INTERNATIONAL SEARCH REPORT

Interr ›nal Application No
PCT/GB 99/02121

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05D7/24 C23C16/50 D06M10/10 D06M10/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05D C23C D06M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 99 32235 A (BTG INT LTD ;BADYAL JAS PAL SINGH (GB); HUTTON SIMON JAMES (GB)) 1 July 1999 (1999-07-01) page 10; claims	1-7, 10-13, 18-21
X	US 4 693 799 A (YANAGIHARA KENJI ET AL) 15 September 1987 (1987-09-15)	1-7,10, 11,16, 18-21
Y	the whole document	8,9
X	WO 92 10310 A (ELF AQUITAINE) 25 June 1992 (1992-06-25) page 4, line 6 - line 21; claims	1,4,5, 10,11

-/--

[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 November 1999	25/11/1999

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 318 806 A (MONTGOMERY DAVID B ET AL) 7 June 1994 (1994-06-07) column 6, line 20 - line 23; claims; table 2	1,4,7, 10,11
X	US 5 002 794 A (RATNER BUDDY D ET AL) 26 March 1991 (1991-03-26) column 2, line 57 - line 68; claims; examples	1,4,7, 10-12
Y	US 3 674 667 A (MANION JEAN P ET AL) 4 July 1972 (1972-07-04) column 6, line 36 - line 54; examples	8,9
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1

INTERNATIONAL SEARCH REPORT

information on patent family members

Intern· nal Application No
PCT/GB 99/02121

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9932235 A	01-07-1999	AU 1770099 A	12-07-1999
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Session Began September 10, 2020 at 03:22 PM

Task Began September 10, 2020 03:23 PM

Explore references by patent: (ID 1)

Patent Number: us20190375961
Answer Type: *References*
Result Count: *2*

Detailed display

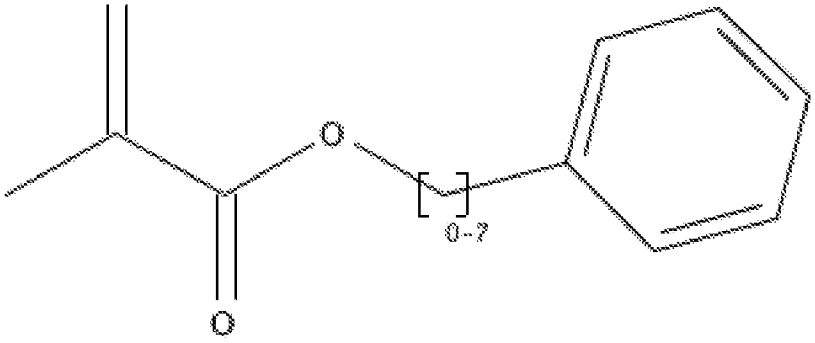
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Type: hydrophobic coating for protection of an electronic or electric device

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From ID: 0
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Result Count: *17*

Task Began September 10, 2020 03:25 PM

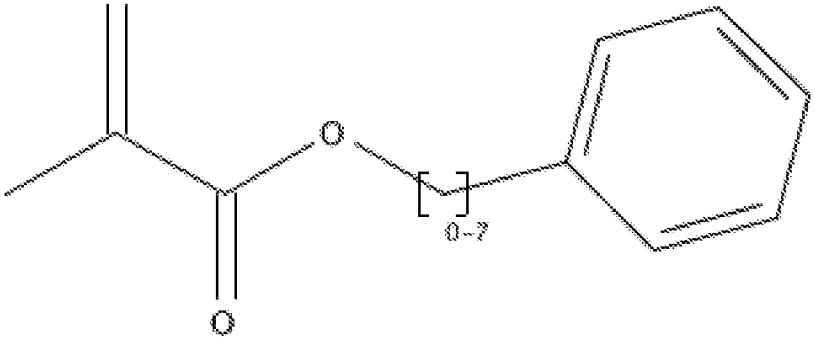
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Refine Answer set by structure (ID 4)

Structure: substructure
From ID: 3



Limiters:

Polymers
Answer Type: *Substances*
Result Count: *61224*

Task Began September 10, 2020 03:30 PM

Explore references by research topic: plasma polymerization of phenyl acrylate

Research Topic: plasma polymerization of phenyl acrylate
Result Count: 2

Task Began September 10, 2020 03:30 PM

Explore references by research topic: plasma polymerization of benzyl acrylate

Research Topic: plasma polymerization of benzyl acrylate
Result Count: 3

Candidates Selected (ID 5)

4 references were found containing the two concepts "plasma polymerization" and "benzyl acrylate".

Answer Type: *References*
Result Count: *4*

Prepared 2 reference answers from Answer set 5 for printing in PDF form

Task Began September 10, 2020 03:32 PM

Explore references by research topic: plasma polymerization of aromatic monomers

Research Topic: plasma polymerization of aromatic monomers
Result Count: 4

Candidates Selected (ID 6)

20 references were found containing the two concepts "plasma polymerization" and "aromatic monomers" closely associated with one another.

49 references were found where the two concepts "plasma polymerization" and "aromatic monomers" were present anywhere in the reference.

Answer Type: *References*
Result Count: *49*

Prepared 4 reference answers from Answer set 6 for printing in PDF form

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Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

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	1	2716638	A	1955-08-30	Cohen et al.	
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	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
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	1	9964662	WO	A1	1999-12-16	Badyal et al.		
	2	2012168440	WO	A1	2012-12-13	Taesler		
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	1	Petition for Inter Partes Review for US Patent Application No. 10,421,876, mailed July 17, 2020, (90 pages).	
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	4	Declaration of Dr. Karen Gleason, Exhibit 1002, Case IPR2020-01198, filed July 17, 2020, (117 pages).	
	5	Curriculum Vitae for Karen K. Gleason, Exhibit 1003, Case IPR2020-01198, filed July 17, 2020, (34 pages).	
	6	Francesch et al., "Fabrication of Bioactive Surfaces by Plasma Polymerization Techniques Using a Novel Acrylate-Derived Monomer", Plasma Processes and Polymers, Vol. 2, Isse. 8, pages 605-611, 2005, (7 pages).	

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	Attorney Docket Number	GBL0007/US/2

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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 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:	16547728
Filing Date:	22-Aug-2019
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt

EFS ID:	40795225
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	08-OCT-2020
Filing Date:	22-AUG-2019
Time Stamp:	15:14:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E202008F15064525
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	Transmittal Letter	GBL0007US2_Transmittal_for_SIDS.pdf	86359 cd24a5f543af24968368ebe991958d9ab023d9b6	no	1
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	GBL0007US2_SIDS.pdf	1062051 262a2b206bf68f0ae53a3985d0745e05a58db560	no	7
Warnings:					
Information:					
3	Non Patent Literature	NPL1_IPR_Petition.pdf	712765 e625951bc4c78baae4673aef8906eded30ee2e89	no	90
Warnings:					
Information:					
4	Non Patent Literature	NPL2_Yao_et_al.pdf	2099619 29959b0bdfaa54f76a943166e729f30b3091331c	no	15
Warnings:					
Information:					
5	Non Patent Literature	NPL3_Sartomer_Comp_Material_Safety_Data_Sheet.pdf	73591 75d49e53ce89db3ae34295ee0e3ba302cf0c77bc	no	7
Warnings:					
Information:					
6	Non Patent Literature	NPL4_Declaration_for_Gleason.pdf	771231 11eb285fe76ba0d3573c23f6662354e2a83b1d4f	no	117
Warnings:					
Information:					

7	Non Patent Literature	NPL5_Curriculum_for_Gleason.pdf	353950 ab0a3a7439491561f8b765e4313fd405e9218bdc	no	34
Warnings:					
Information:					
8	Non Patent Literature	NPL6_Francesch_et_al.pdf	188230 4836e9798b2d1b9dcf1709be380b9cfaa0203091	no	7
Warnings:					
Information:					
9	Non Patent Literature	NPL10_Yague_et_al_.pdf	715945 9229f42856ff3e5ec9e0bebd86fde7f1d9325d62	no	7
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Information:					
10	Non Patent Literature	NPL12_Kurosawa_et_al.pdf	290097 0188fa0e2de8ef8ead583fcd747ff9b94497d566	no	8
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Information:					
12	Non Patent Literature	NPL14_Joback_et_al.pdf	438481 531abfbfdd1521872d5dad5739317534db1c3156	no	12
Warnings:					
Information:					
13	Non Patent Literature	NPL15_Chemspider.pdf	2700026 18ce8dd65dcbeda461ebf7450006173c755159fa	no	14
Warnings:					
Information:					

14	Non Patent Literature	NPL16_Declaration_for_Rampersad.pdf	5941153 9d30b65bf663cb3295bff8d1f919013433a18a28	no	7
Warnings:					
Information:					
15	Foreign Reference	WO9964662A1.pdf	590532 bd341715a0257b3007513dc0d3265c2656c65eff	no	19
Warnings:					
Information:					
16	Foreign Reference	WO2012168440A1.pdf	1293993 47efac7a4f9cb2f6985ce0cda5d9012425633352b	no	35
Warnings:					
Information:					
17	Foreign Reference	WO2014026967A2.pdf	1477796 9287483bbbe2f9bc120809851993b8e64b46288a	no	46
Warnings:					
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18	Non Patent Literature	NPL7_Declaration_for_Dr_Gomez.pdf	333970 31cee93373db3452ca669aceb72b4f22e94c6901	no	3
Warnings:					
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19	Non Patent Literature	NPL8_Coulson_et_al.pdf	11439532 90b68af580bbcd6081f85b13a837875c5f52cdbc	no	8
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Information:					
20	Non Patent Literature	NPL9_Tarducci_et_al.pdf	5038181 84277c3817fe90b3502c2536562ddb61d12e4145	no	4
Warnings:					
Information:					

21	Non Patent Literature	NPL11_Yasuda_.pdf	9229297 f0d6881da0972caf5ef73c870d283d25eeaadac8	no	58
Warnings:					
Information:					
22	Fee Worksheet (SB06)	fee-info.pdf	30384 8d737ef5c78237360 5f71723d2aa5c1ed8cc4251	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	45075122		

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.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): COULSON et al.	**Examiner: NICOLE M. BUIE-HATCHER**
Serial No.: 16/547,728	**Group Art Unit: 1767**
Filing Date: August 22, 2019	**Confirmation No.: 6664**
For: COATINGS	**Docket No.: GBL0007/US/2**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I CERTIFY THAT ON **OCTOBER 8, 2020,** THIS CORRESPONDENCE IS BEING ELECTRONICALLY TRANSMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA THE OFFICE'S EFS-WEB

/Bethany Lichtscheidl/
BETHANY L. LICHTSCHEIDL

INFORMATION DISCLOSURE STATEMENT

The document listed on the enclosed Form PTO-1449 are presented pursuant to Applicants' duty of disclosure under 37 C.F.R. 1.56.

Applicant notes that the present application is a Continuation of application Serial No. 15/735,130 filed December 8, 2017, which issued into U.S. Pat. No. 10,421,876 and is now involved in an Inter Partes Review having trial numbers IPR2020-01198 and filing date of July 17, 2020. The petition and exhibits of which are cited on the enclosed Form PTO-1449. The Form PTO-1449 includes references listed in the Exhibit List of the petition that are not already of record.

Respectfully Submitted,

Dated: _October 8, 2020

By: _/Paul J. Parins/
Paul J. Parins, Reg. No. 54,358
Customer No. 33072
Phone: 651-275-9831
Facsimile: 651-351-2954

#129467

SCORE Placeholder Sheet for IFW Content

Application Number: 16547728 Document Date: 12/15/2020

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):

- USPTO employees may access SCORE content via DAV or via the SCORE web page.
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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/547,728	Filing Date 08/22/2019	☐ 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	12/15/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 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.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PARTHENIA D MERRILL/
*** 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.

Claim Amendments

Please amend claims 1, 11, 13, 15-17, and 20; cancel claims 4-10, 12, and 14; add new claims 21-23 as follows:

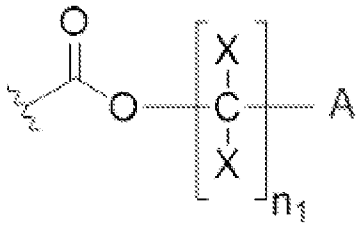
1. (Currently Amended) An electronic or electrical device or electronic or electrical component thereof comprising a protective cross-linked polymeric coating on a surface of the device or component;

wherein the protective cross-linked polymeric coating is obtained by exposing the device or component to a plasma comprising a monomer compound and a crosslinking reagent for a period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,

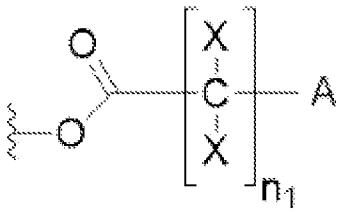
wherein the monomer compound has the following formula:



where R_1, R_2 and R_4 are each independently selected from hydrogen, optionally substituted branched or straight chain C_1-C_6 alkyl or halo alkyl or aryl optionally substituted by halo, and R_3 is selected from:

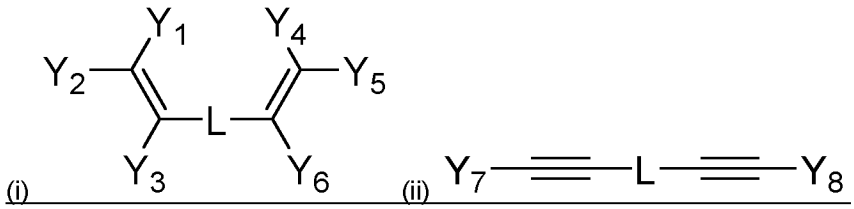


or



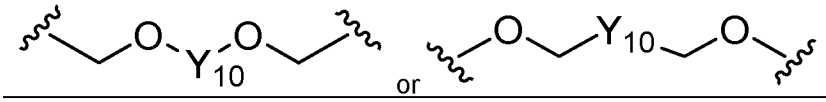
where each X is independently selected from hydrogen, a halogen, optionally substituted branched or straight chain C_1-C_6 alkyl, halo alkyl or aryl optionally substituted by halo; where A is aryl optionally substituted by halo; and n_1 is an integer from 0 to 27; and wherein the crosslinking reagent comprises two or more unsaturated bonds attached by means of one or more

linker moieties and has a boiling point of less than 500 °C at standard pressure[[.]], the crosslinking reagent having one of the following structures:



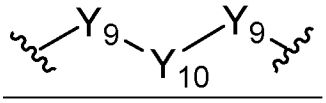
where Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 and Y_8 are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C_1-C_6 alkyl or aryl; and L is a linker moiety;

wherein for compound (i) L is of formula A having one of the following structures:

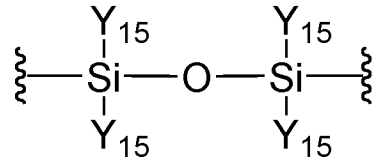


and Y_{10} is selected from optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene and a siloxane group;

or wherein for compound (i) L is of formula B having the following formula:

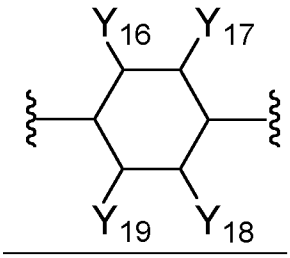


where each Y_9 is independently selected from, a bond, -O-, -O-C(O)-, –C(O)-O-, -Y_{11}-O-C(O)-, -C(O)-O-Y_{11}-, -OY_{11}-, and –Y_{11}O-, where Y_{11} is an optionally substituted cyclic, branched or straight chain C_1-C_8 alkylene; and wherein Y_{10} has the following formula:



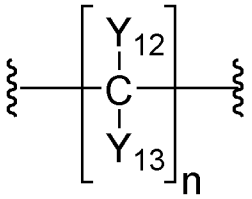
and each Y_{15} is independently selected from optionally substituted branched or straight chain C_1-C_6 alkyl;

or wherein Y_{10} has the following formula:



and Y_{16} to Y_{19} are each independently selected from H and optionally substituted branched or straight chain C_1-C_8 alkyl or alkenyl

or wherein Y_{10} has the following formula:



and each Y_{12} is fluoro and each Y_{13} is fluoro .

2. (Original) A device or component according to claim 1, wherein the protective cross-linked polymeric coating is a physical barrier to mass and electron transport.

3. (Original) A device or component according to claim 1, wherein the protective cross-linked polymeric coating forms a liquid repellent surface defined by a static water contact angle (WCA) of at least 90°.

4. (Cancelled)

5. (Cancelled)

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

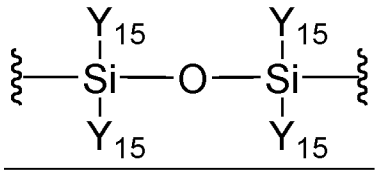
9. (Cancelled)

10. (Cancelled)

11. (Currently Amended) A device or component according to claim ~~10~~ 1, wherein n is from 4 to 6.

12. (Cancelled)

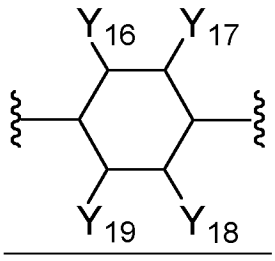
13. (Currently Amended) A device or component according to claim ~~12~~ 1, wherein Y_{10} has the following formula:



and each Y_{15} is methyl, and each Y_9 is a bond.

14. (Cancelled)

15. (Currently Amended) A device or component according to claim ~~14~~ 1, wherein Y_{10} has the following formula:



and wherein Y_{18} is H or vinylene, and Y_{16}, Y_{17} and Y_{19} are each H.

16. (Currently Amended) A device or component according to claim 1 wherein the crosslinking reagent is selected from ~~divinyl adipate (DVA),~~ 1,4-butanediol divinyl ether (BDVE), 1,4-cyclohexanedimethanol divinyl ether (CDDE), ~~1,7-octadiene (17OD),~~ 1,2,4-trivinylcyclohexane (TVCH), 1,3-vivinyltetramethyldisiloxane (DVTMDS), diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).

17. (Currently Amended) A device or component according to claim [[4]] 1, wherein for compound (ii), L is selected from a branched or straight chain C_1-C_8 alkylene or an ether group.

18. (Original) A device or component according to claim 1 wherein each X is H.

19. (Original) A device or component according to claim 1, wherein each X is F.

20. (Currently Amended) A device or component according to claim 1, wherein the device or component is selected from a mobile phone[[s]], smartphone[[s]], pager[[s]], radio[[s]], sound and audio system[[s]] ~~such as loudspeakers, microphones, ringers and/or buzzers~~, hearing aid[[s]], personal audio equipment ~~such as personal CD, tape cassette or MP3 players~~, television[[s]], DVD player[[s]] including portable a DVD player[[s]], video recorder[[s]], digi ~~and~~ or other set-top box~~es~~, computer[[s]] ~~and~~ or related component[[s]] ~~such as laptop, notebook, tablet, phablet or palmtop computers~~, personal digital assistant[[s]] (PDA[[s]]), keyboard[[s]], ~~or~~ instrument~~ation~~, games console[[s]], data storage device[[s]], outdoor lighting system[[s]], radio antennae ~~and~~ or other form[[s]] of communication equipment, ~~and~~ or printed circuit board[[s]].

21. (New) A device or component according to claim 20, wherein the sound and audio system is a loudspeaker, microphone, ringer and/or buzzer.

22. (New) A device or component according to claim 20, wherein the personal audio equipment is a personal CD, tape cassette or MP3 player.

23. (New) A device or component according to claim 20, wherein the computer or related component is a laptop, notebook, tablet, phablet or palmtop computer.

Drawing Amendments

Please replace each of original figures 1-7 with each of the respective, enclosed replacement sheets, which shall replace each of original figures 1-7.

Each of figures 1-7 are amended to replace "Figure," which precedes each of the view numbers, with "Fig." as requested in the Office Action.

Remarks

Claims 1-20 are pending. With this Response, claims 1, 11, 13, 15-17, and 20 are amended; claims 4-10, 12, and 14 are cancelled; and new claims 21-23 are added. Upon entry of the current amendments, claims 1, 2, 3, 11, 13, 15-23 are pending for consideration.

Applicant respectfully requests reconsideration and further examination of the application in view of the amendments above and remarks below.

Excess Claim Fees for New Claims 21-23

Because of claims previously paid for and subsequently canceled, no excess claim fees are due for adding new claims 21-23.

Support for Amendments

The present amendments are fully supported by the application as originally filed and do not introduce new matter.

Claim 1 has been amended to incorporate the subject matter of previous claims 4, 5, 7, 8, 10, 12 and 14.

Claims 4 to 19 have been amended or canceled as required to bring them in accordance with the language now in claim 1. Specifically, in claim 16 the crosslinker entries that are understood to lie outside the scope of amended claim 1 have been deleted.

The typographical error pointed out by the examiner in the name of DVTMDS in claim 16 has been corrected.

Claim 20 has been amended by moving the "such as" features into new claims 21-23.

Claim 20 has also been amended by converting the plural form of each device or component into the singular form.

Allowable Subject Matter

Applicant gratefully acknowledges the indication in the Office Action that claim 7 and 10-15 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

With this reply, claim 1 is amended to include the subject matter of claims 4, 5, 7, 8, 10, 12 and 14. Accordingly, claim 1 and its dependent claims are considered allowable.

Drawing Objections

According to the Office Action, the drawings are objected to because each of the view numbers must be preceded by the abbreviation "Fig."

With this reply, each of figures 1-7 are amended to replace "Figure" with "Fig." as requested in the Office Action.

Accordingly, it is respectfully requested the outstanding drawing objections be withdrawn.

Claim Objections

Claims 6-7 are objected to because of the following informalities: both claims 6 and 7 do not end with a period. Appropriate correction is required.

Each of claims 6 and 7 are canceled thereby rendering this rejection moot.

Claim 16 is objected to because of the following informalities: on line 4, it is expected that "1,3-vivinyltetramethyldisiloxane" should be "1,3-divinyltetramethyldisoloxane" (Pl O/L22 of the original specification).

Claim 16 is amended to correct the typographical error pointed out in the Office Action, thereby rendering this objection moot.

Accordingly, it is respectfully requested that the claim objections be withdrawn.

Rejection Under 35 U.S.C. §112

Claim 20 is rejected under 35 U.S.C. 112(b) as being indefinite.

In the interest of compact prosecution, claim 20 is amended to address the issues identified in the Office Action, thereby rendering this rejection moot. Claim 20 has been amended by moving the "such as" features into new claims 21-23, and has also been amended by converting the plural form of each device or component into the singular form.

Accordingly, it is respectfully requested that the rejection of claim 20 under 35 U.S.C. 112(b) as being indefinite, be withdrawn.

Rejection Under 35 U.S.C. §103

Claims 1-6, 8-9, and 16-20 are rejected under 35 U.S.C. 103 as being unpatentable over Huebsch et al. (US 2015/0125695 Al) in view of Kurihara et al. (WO 2010/101091 Al), Padiyath et al. (US 2007/0020451 Al) and Coulson (US 2010/0203347 Al).

As discussed above, claim 1 is amended to include the subject matter of claims 4, 5, 7, 8, 10, 12 and 14 and is therefore allowable, thereby rendering this rejection moot.

Accordingly, it is respectfully requested that the rejection of claims 1-6, 8-9, and 16-20, under 35 U.S.C. 103 as being unpatentable over Huebsch et al. (US 2015/0125695 Al) in view of Kurihara et al. (WO 2010/101091 Al) Padiyath et al. (US 2007/0020451 Al) and Coulson (US 2010/0203347 Al) be withdrawn.

Conclusion

In view of the above amendments and remarks, it is respectfully submitted that all of the pending claims are in condition for allowance. Approval of the application and allowance of the claims are earnestly solicited. In the event that a phone conference between the Examiner and the Applicants' undersigned attorney would help resolve any issues in the application, the Examiner is invited to contact said attorney at (651) 275-9831.

Respectfully Submitted,

Dated: December 15, 2020

By: /Paul J. Parins/
Paul J. Parins, Reg. No. 54,358
Customer No. 33072
Phone: 651-275-9831
Facsimile: 651-351-2954

#130588

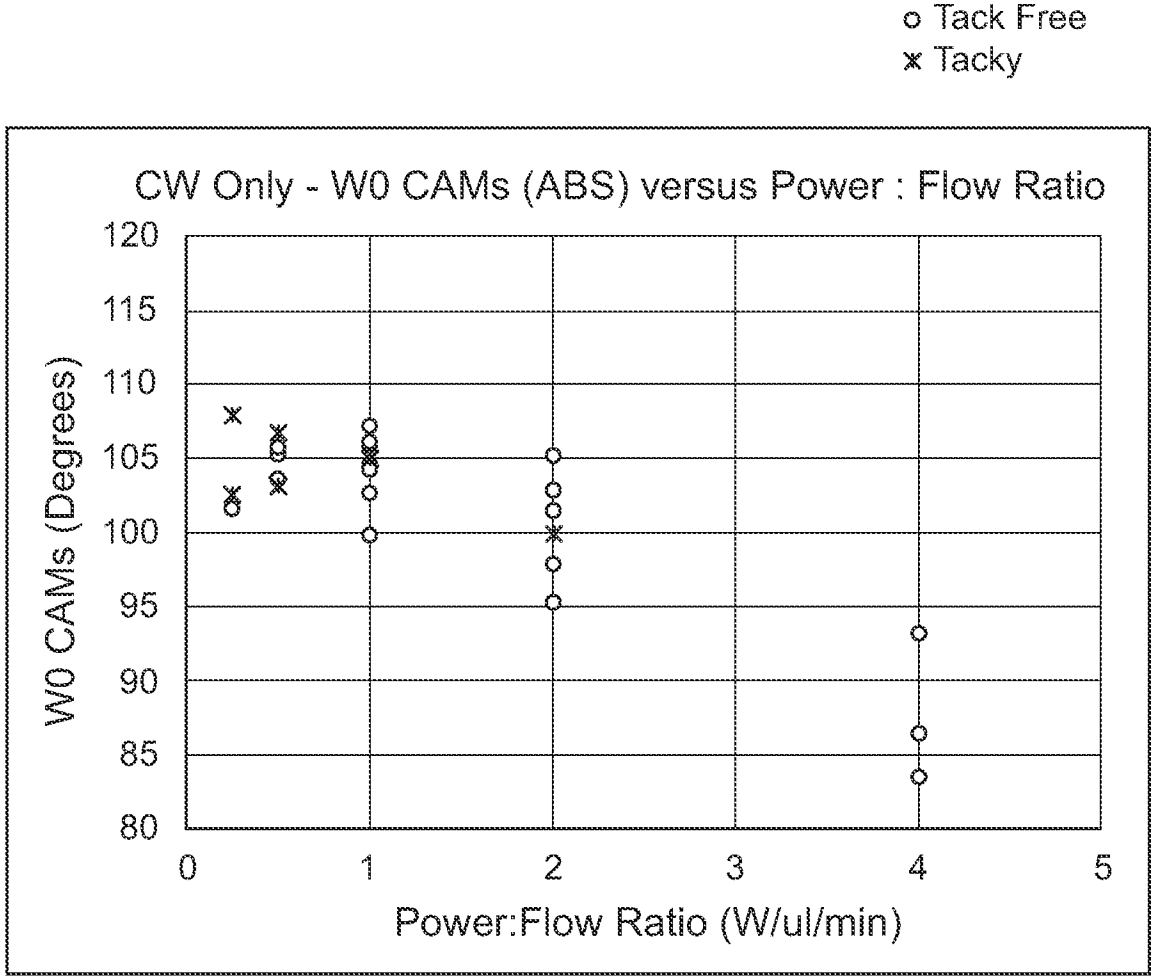

Tack Free
Tacky
CW Only - W0 CAMs (ABS) versus Power : Flow Ratio
W0 CAMs (Degrees)
120
115
110
105
100
95
90
85
80
0
1
2
3
4
5
Power:Flow Ratio (W/ul/min)

Fig. 1

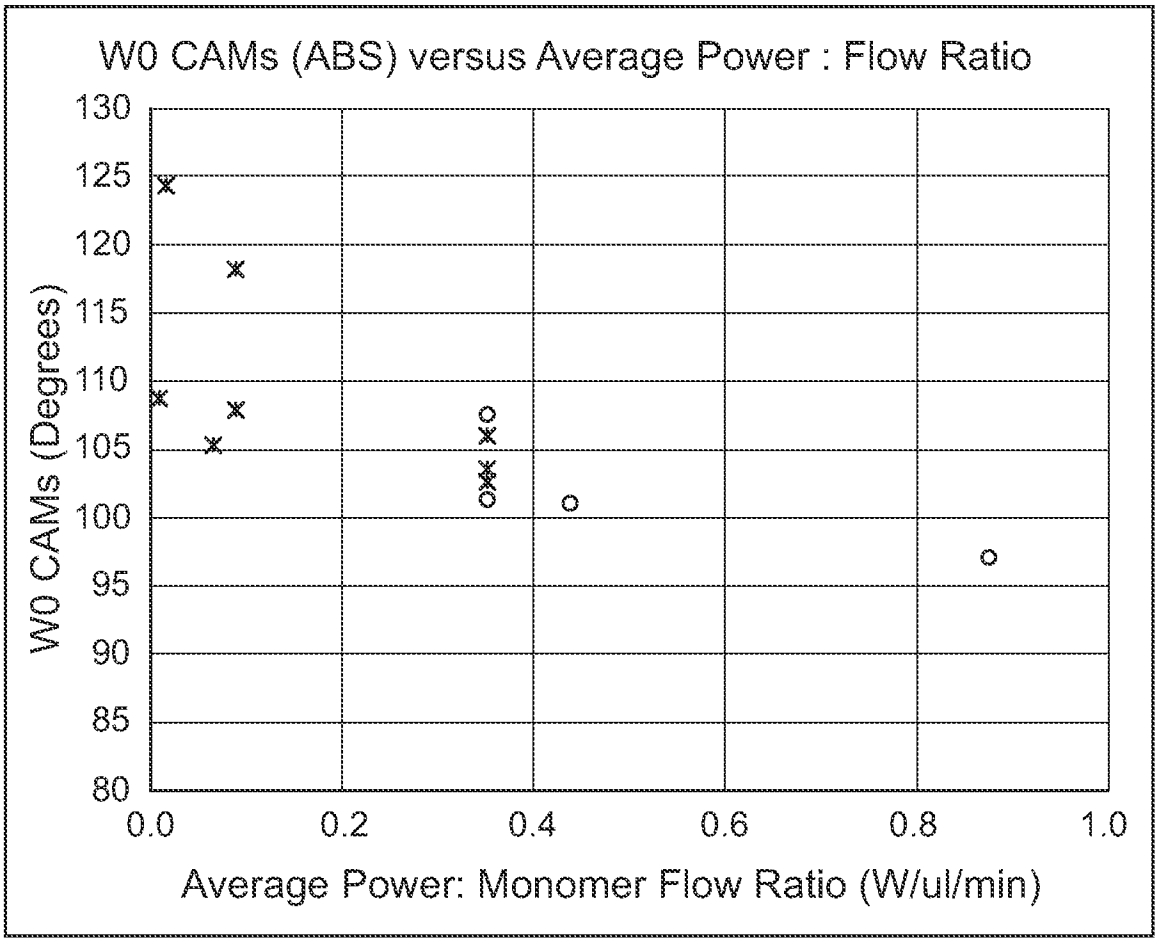

o Tack Free
x Tacky
W0 CAMs (ABS) versus Average Power : Flow Ratio
W0 CAMs (Degrees)
130
125
120
115
110
105
100
95
90
85
80
0.0
0.2
0.4
0.6
0.8
1.0
Average Power: Monomer Flow Ratio (W/ul/min)

Fig. 2

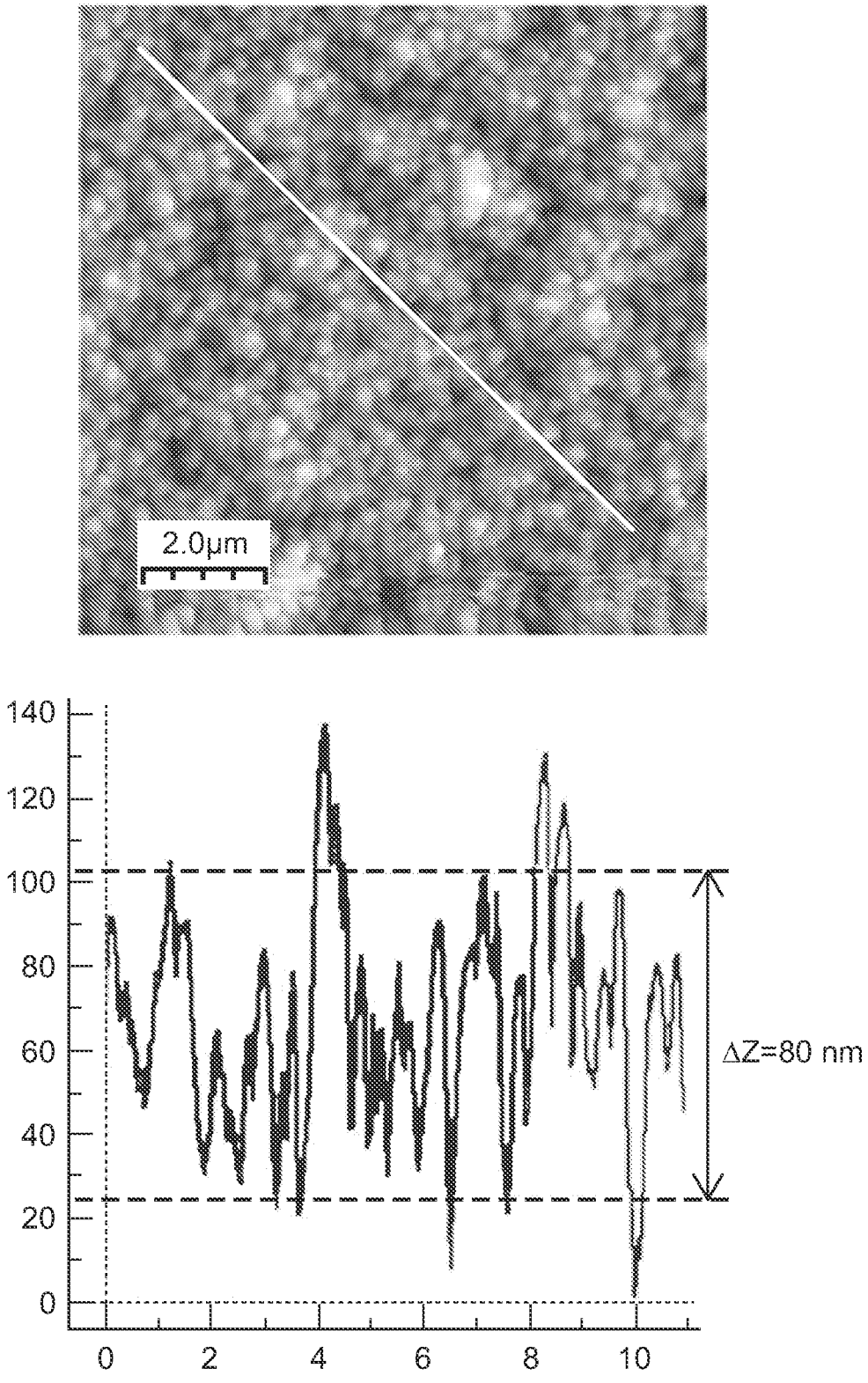


Fig. 3

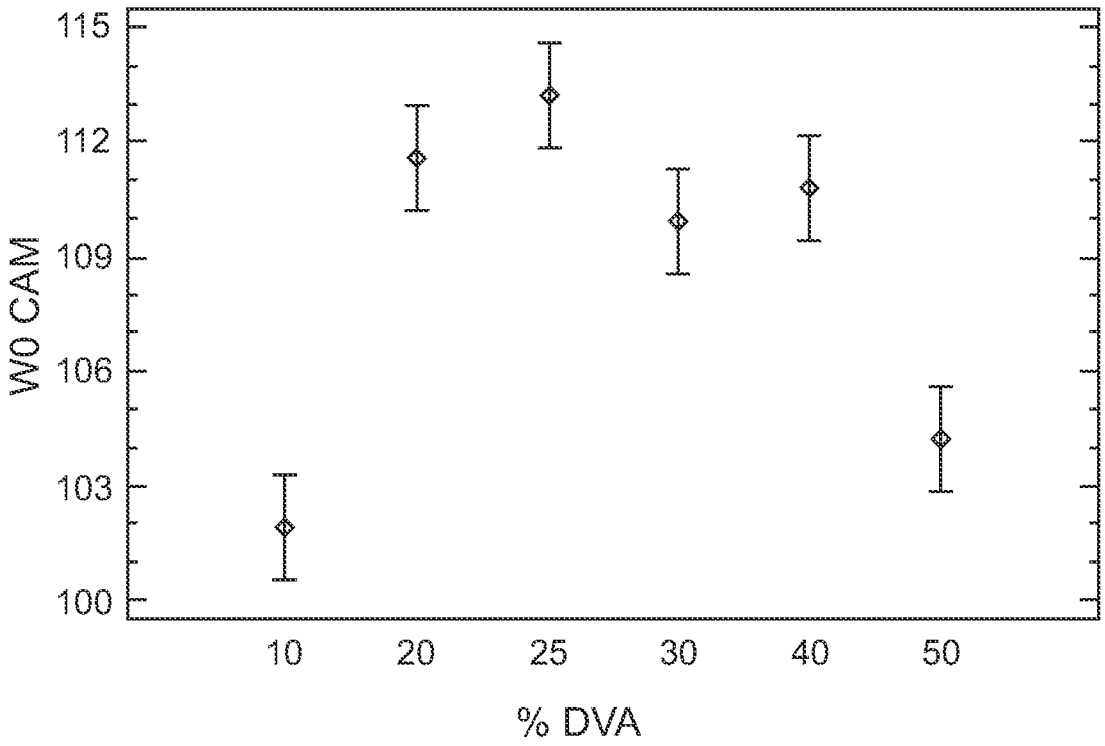


Fig. 4

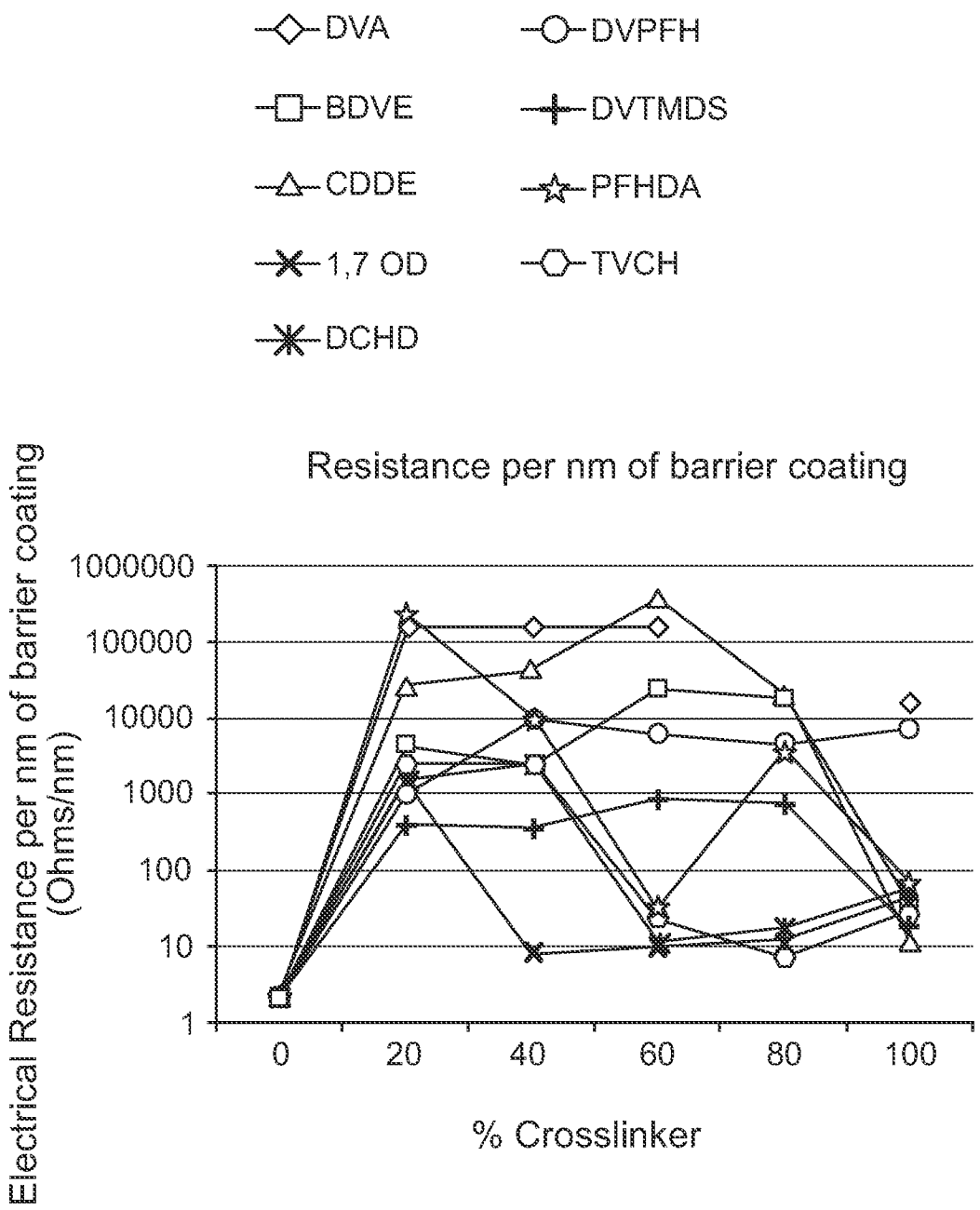

DVA
DVPFH
BDVE
DVTMDS
CDDE
PFHDA
1,7 OD
TVCH
DCHD
Resistance per nm of barrier coating
Electrical Resistance per nm of barrier coating (Ohms/nm)
1000000
100000
10000
1000
100
10
1
0
20
40
60
80
100
% Crosslinker

Fig. 5

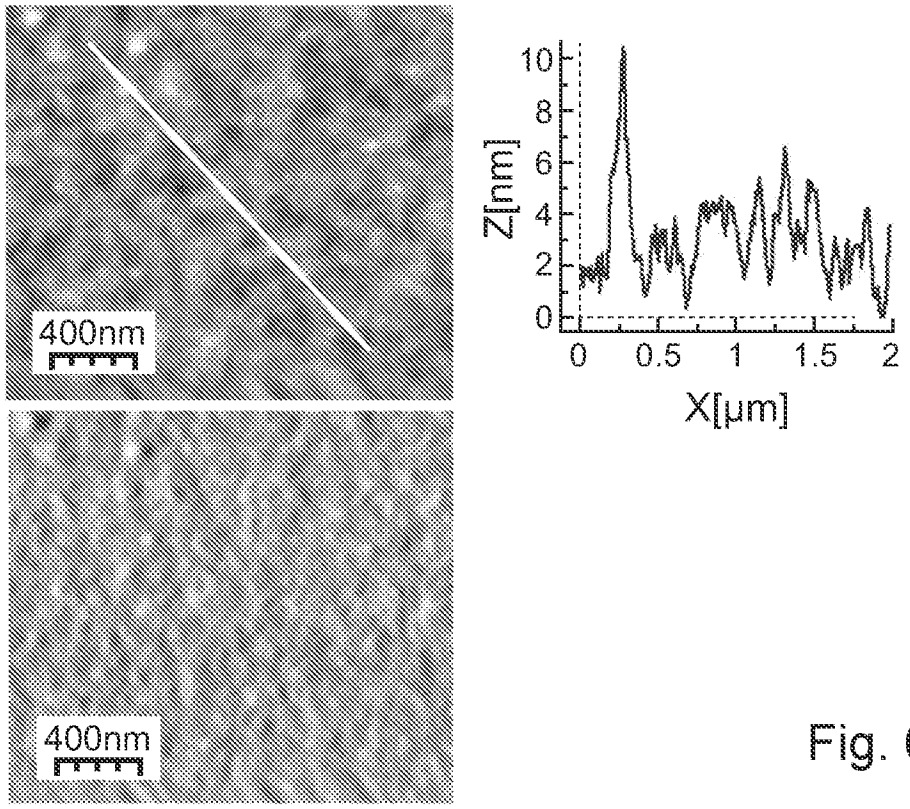

400nm
400nm
Z[nm]
X[µm]
0
2
4
6
8
10
0
0.5
1
1.5
2

Fig. 6

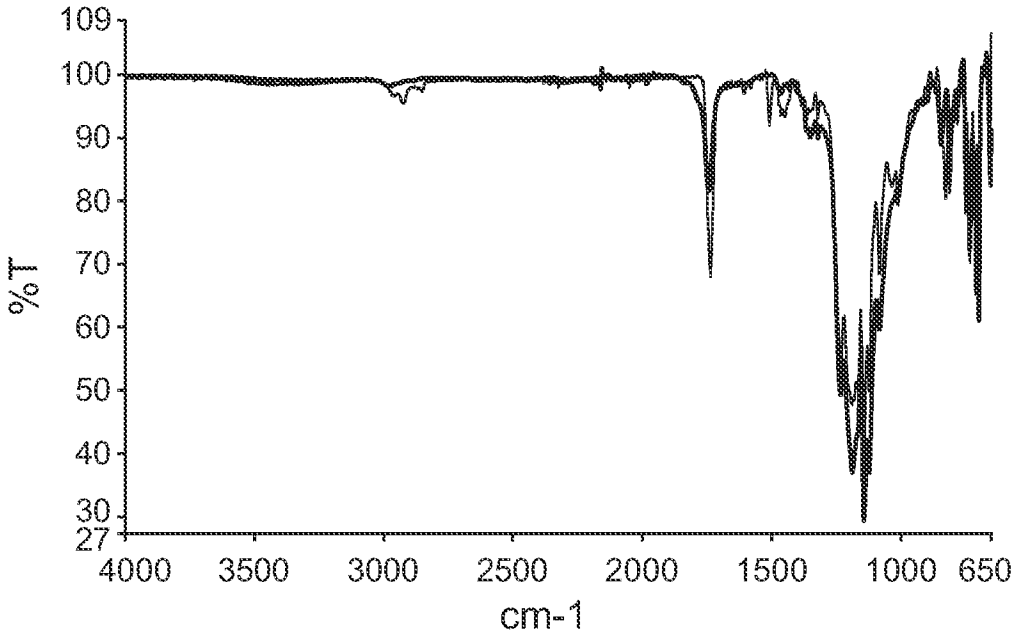

%T
cm-1
109
100
90
80
70
60
50
40
30
27
4000
3500
3000
2500
2000
1500
1000
650
Name
Description
PFAC6
Sample 350 By Administrator Date Thursday, February 13 2014
PFAC6-DVA(10%)
Sample 389 By PEService Date Tuesday, July 14 2015

Fig. 7

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: COULSON et al.	**Examiner: NICOLE M. BUIE-HATCHER**
Serial No. 16/547,728	**Group Art Unit: 1767**
International Filing Date: August 22, 2019	**Confirmation No. 6664**
International App. No. PCT/GB2016/051688	**Docket No. GBL0007/US/2**
For: COATINGS	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I CERTIFY THAT ON **DECEMBER 15, 2020** THIS CORRESPONDENCE IS BEING ELECTRONICALLY TRANSMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA THE OFFICE'S EFS-WEB.

/Bethany Lichtscheidl/
BETHANY L. LICHTSCHEIDL

INFORMATION DISCLOSURE STATEMENT

The document listed on the enclosed Form PTO-1449 are presented pursuant to Applicants' duty of disclosure under 37 C.F.R. 1.56.

As mentioned in the Information Disclosure Statement filed on October 8, 2020, the present application is a Continuation of application Serial No. 15/735,130 filed December 8, 2017, which issued into U.S. Pat. No. 10,421,876 and is now involved in an Inter Partes Review having trial numbers IPR2020-01198 and filing date of July 17, 2020.

Also, the Padiyath et al. (US 2007/0020451 Al) reference is relied on in the 103 rejection in the outstanding Office Action in connection with the above-identified patent application. The Padiyath et al. (US 2007/0020451 Al) reference is asserted prior art in the above-mentioned Inter Partes Review having trial number IPR2020-01198, additional documents of which are cited on the enclosed Form PTO-1449.

Respectfully Submitted,

Dated: December 15, 2020

By: /Paul J. Parins/
Paul J. Parins, Reg. No. 54,358
Customer No. 33072
Phone: 651-275-9831
Facsimile: 651-351-2954

#130624

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: COULSON et al.	**Examiner: NICOLE M. BUIE-HATCHER**
Serial No. 16/547,728	**Group Art Unit: 1767**
International Filing Date: August 22, 2019	**Confirmation No. 6664**
International App. No. PCT/GB2016/051688	**Docket No. GBL0007/US/2**
For: COATINGS	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

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/Bethany Lichtscheidl/
BETHANY L. LICHTSCHEIDL

AMENDMENT AND RESPONSE

Dear Examiner BUIE-HATCHER:

This communication is responsive to the non-final Office Action issued on September 18, 2020, in connection with the above-identified patent application, and is concurrently filed with a Supplemental Information Disclosure Statement.

The three-month shortened-statutory period for response is set to expire on December 18, 2020. It is respectfully submitted that this response is timely filed within the shortened statutory period. However, if any extension period is required in order for this paper to be timely filed, then Applicant hereby requests an extension for such additional time period and authorizes the appropriate fees therefore to be charged to the Kagan Binder Deposit Account No. 50-1775 and to notify us of the same.

It is believed that no other fee(s) are required in filing this Response. However, if any other fee(s) are required please charge all of the appropriate fee(s) to the Kagan Binder Deposit Account No. 50-1775 and notify us of the same.

Specification Amendments

Please delete the paragraph on page 1, lines 19 and 20, that begins with "Monosaturated monomers" and ends with "(see co-pending application)."

Please add the following paragraph (section heading) on page 20 immediately prior to the paragraph on line 28 beginning with "The present invention will now ….":

Brief Description of Drawings

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20190335592	A1	2019-10-31	Coulson et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16547728
	Filing Date	2019-08-22
	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

	1	Guimond et al., "Influence of gas phase and surface reactions on plasma polymerization", Surface & Coatings Technology, Vol. 205, Supplement 2, Pages 447-450, 2011, (4 pages).
	2	Yasuda, "Plasma Polymerization", Academic Press, Inc., Orlando, Florida, 1985, (22 pages).
	3	Declaration of Gregory N. Parsons, PH.D., Exhibit 2001, Case IPR2020-01198, filed October 30, 2020, (109 pages).
	4	Patent Owner's Preliminary Response, Case IPR2020-01198, filed October 30, 2020, (70 pages).
	5	Patent Owner's SUR-Reply to Petitioner's Reply to Preliminary Response, Case IPR2020-01198, filed December 8, 2020, (9 pages).
	6	Petitioner's Reply to Patent Owner's Preliminary Response, Case IPR2020-01198, filed December 1, 2020, (8 pages).

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16547728
	Filing Date	2019-08-22
	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul J. Parins/	Date (YYYY-MM-DD)	2020-12-15
Name/Print	Paul J. Parins	Registration Number	54,358

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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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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.

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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 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:	16547728
Filing Date:	22-Aug-2019
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt

EFS ID:	41391429
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	15-DEC-2020
Filing Date:	22-AUG-2019
Time Stamp:	15:07:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E2020BEF08101017
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		GBL0007US2_Response_to_Non-Final_Office_Action.pdf	169637 32caabf5bb2db185a60b3623c05d447998a9a022	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	2
	Claims	3	7
	Amendment/Req. Reconsideration-After Non-Final Reject	8	8
	Applicant Arguments/Remarks Made in an Amendment	9	11

Warnings:					
Information:					
2	Drawings-only black and white line drawings	GBL0007US2_Replacement_Drawings.pdf	178903 82065bf49d4d016f11ea4aff11066382a7ef92d6	no	6
Warnings:					
Information:					
3	Transmittal Letter	GBL0007US2_Transmittal_for_SIDS.pdf	87796 a859e98f2001b38751a35f6bc80af1d308979d68	no	1
Warnings:					
Information:					
4	Information Disclosure Statement (IDS) Form (SB08)	GBL0007US2_SIDS.pdf	1057061 87ef37e561cf9ea12a6b0c32df70006bba30c285	no	4
Warnings:					
Information:					

5	Non Patent Literature	NPL1_Guimond_et_al.pdf	373107 e7bd44f6b85b896b5ba5aa934c2042c15a090ea6	no	4
Warnings:					
Information:					
6	Non Patent Literature	NPL2_Yasuda_.pdf	11070030 3412afeb4c8a782d16e7975793124 5bd798b5194	no	22
Warnings:					
Information:					
7	Non Patent Literature	NPL3_Parsons_Declaration.pdf	790359 2df304a798f44b9b8a5594847a7e9b9163fa2056	no	109
Warnings:					
Information:					
8	Non Patent Literature	NPL4_Preliminary_Response.pdf	488244 988b13c6d5bcd233eba55c80440d01e8b24c3f68	no	70
Warnings:					
Information:					
9	Non Patent Literature	NPL5_Patent_Owner_SUR-Reply_to_Petitioners_Reply_to_Preliminary_Response.pdf	174768 72d17321122776 40fa9c296bc1398d648bc141c0	no	9
Warnings:					
Information:					
10	Non Patent Literature	NPL6_Petitioners_Reply_to_Patent_Owners_Preliminary_Response.pdf	147553 5577fde325582fe3695f728dc529e4e19e45a6a3	no	8
Warnings:					
Information:					
11	Fee Worksheet (SB06)	fee-info.pdf	30383 8a13fe4357dcab5ea4c5ea458354ca6eb63e2d62	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	14567841	

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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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www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

33072 7590 12/30/2020

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

EXAMINER
BUIE-HATCHER, NICOLE M

ART UNIT	PAPER NUMBER
1767	

DATE MAILED: 12/30/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

TITLE OF INVENTION: COATINGS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/30/2021

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.

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)

33072 7590 12/30/2020

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

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.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

TITLE OF INVENTION: COATINGS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/30/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
BUIE-HATCHER, NICOLE M	1767	526-245000

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
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.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

33072 7590 12/30/2020

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

EXAMINER	
BUIE-HATCHER, NICOLE M	
ART UNIT	PAPER NUMBER
1767	

DATE MAILED: 12/30/2020

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. 16/547,728	Applicant(s) COULSON et al.	
	Examiner NICOLE M BUIE-HATCHER	Art Unit 1767	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 response filed 12/15/2020.
   ☐ 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 1-3,11,13 and 15-23 . 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 20201008 / 20201215.
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 _____.

/NICOLE M. BUIE-HATCHER/
Primary Examiner, Art Unit 1767

Notice of Pre-AIA or AIA Status

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

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Paul J. Parins (Reg. No. 54,328) on 12/21/2020.

The application has been amended as follows:

In claim 1, last line, after the second "fluoro", add ", and n is an integer from 1 to 10". Also make sure the period is right after the number "10".

In claim 16, line 4, replace "1,3-vivinyltetramethyldisiloxane" with "1,3-divinyltetramethyldisiloxane".

Reasons for Allowance

The following is an examiner's statement of reasons for allowance:

A) The previous objection to the drawing is withdrawn in light of Applicant's amendment.

B) The previous objections to claims 6-7 and 16 are withdrawn in light of Applicant's amendment.

C) The previous rejections of claim 20 under 35 USC 112(b) and claims 1-6, 8-9, and 16-20 under 35 USC 103 as being unpatentable over Huebsch et al. (US 2015/0125695 A1) in view Kurihara et al. (WO 2010/101091 A1), Padiyath et al. (US 2007/002045 A1) and Coulson (US 2010/0203347) are withdrawn in light of Applicant's amendment.

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."

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE M. BUIE-HATCHER whose telephone number is (571)270-3879. The examiner can normally be reached on M-F, 8 am - 4:30 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571)272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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 https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICOLE M. BUIE-HATCHER/
Primary Examiner, Art Unit 1767

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	Art Unit
	NICOLE M BUIE-HATCHER	1767

CPC - Searched*		
Symbol	**Date**	**Examiner**
C08F (text)	09/11/2020	NMB
C09D (text)	09/11/2020	NMB
B05D(text)	09/11/2020	NMB
H05K (text)	09/11/2020	NMB
H01J (text)	09/11/2020	NMB
H01L (text)	09/11/2020	NMB
B05D1/62 (text)	09/11/2020	NMB
H01L21/02274 (text)	09/11/2020	NMB
C08F220/24 (text)	09/11/2020	NMB
Updated above CPC search	12/18/2020	NMB

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	Art Unit
	NICOLE M BUIE-HATCHER	1767

Search Notes		
Search Notes	**Date**	**Examiner**
Inventor name search, DAV and PE2E Search	09/10/2020	NMB
Reviewed appln 15/735130	09/10/2020	NMB
IPR2020-01198 Reviewed Inter Partes Review of US Patent No. 10,421,876	09/10/2020	NMB
Global Dossier	09/10/2020	NMB
Scifinder, see search history	09/10/2020	NMB
ip.com (PG Pub)	09/10/2020	NMB
PE2E Search, see search history	09/11/2020	NMB
Updated inventor name search, DAV and PE2E Search	12/18/2020	NMB
PE2E Search, see search history	12/18/2020	NMB

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
C08F		12/18/2020	NMB
C09D		12/18/2020	NMB
B05D		12/18/2020	NMB
H05K		12/18/2020	NMB
H01J		12/18/2020	NMB

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	**Art Unit**
	NICOLE M BUIE-HATCHER	1767

CPC						
Symbol					**Type**	**Version**
C09D	/	133	/	16	F	2013-01-01
C09D	/	5	/	00	I	2013-01-01
B05D	/	1	/	62	I	2013-01-01
B05D	/	5	/	08	I	2013-01-01
B05D	/	5	/	083	I	2013-01-01
H01J	/	37	/	32082	I	2013-01-01
H01J	/	37	/	32467	I	2013-01-01
H01J	/	2237	/	332	A	2013-01-01
H01J	/	2237	/	3382	A	2013-01-01
H01L	/	21	/	02118	A	2013-01-01
H01L	/	21	/	02274	A	2013-01-01
H01L	/	21	/	56	A	2013-01-01
H01L	/	23	/	293	A	2013-01-01
H01L	/	23	/	564	A	2013-01-01
H05K	/	3	/	285	A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/NICOLE M. BUIE-HATCHER/ Primary Examiner, Art Unit 1767	21 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	none

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	Art Unit
	NICOLE M BUIE-HATCHER	1767

INTERNATIONAL CLASSIFICATION				
CLAIMED				
C09D133/16	/	133	/	16
C09D5/00	/	5	/	00
B05D1/00	/	1	/	00
B05D5/08	/	5	/	08

NON-CLAIMED				
H01L21/02	/	21	/	02
H01L21/56	/	21	/	56
H01L23/29	/	23	/	29
H01L23/00	/	23	/	00
H05K3/28	/	3	/	28
H01J37/32	/	37	/	32

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner)	(Date)	Total Claims Allowed: 14	
/NICOLE M. BUIE-HATCHER/ Primary Examiner, Art Unit 1767 (Primary Examiner)	21 December 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure none

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/547,728	COULSON et al.
	Examiner	**Art Unit**
	NICOLE M BUIE-HATCHER	1767

☐ 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	-	10	10	19										
2	2	4	11	11	20										
3	3	-	12	12	21										
-	4	5	13	13	22										
-	5	-	14	14	23										
-	6	6	15												
-	7	7	16												
-	8	8	17												
-	9	9	18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/NICOLE M. BUIE-HATCHER/ Primary Examiner, Art Unit 1767	21 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	none

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L68	14	(L3 SAME L4 SAME L5 SAME L6) AND (coulson-s$ evans-d$ siokou-s$ telford-c$).in.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/12/18 10:20 AM
L69	3	(L3 SAME L4 SAME L5 SAME L6) AND ("p2i" ADJ ltd$2).as.	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/12/18 10:21 AM
L70	16	(L3 SAME L4 SAME L5 SAME L6) AND ("p2i" ADJ ltd$2)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/12/18 10:21 AM
L71	15	("10421876" OR "20050034667" OR "20050141738" OR "20060122301" OR "20110148979" OR "20130136936" OR "20130176700" OR "2716638" OR "3816564" OR "4562091" OR "5804669" OR "6207238" OR "6214423" OR "6551950" OR "7439315").pn.	US-PGPUB; USPAT	OR	ON	ON	2020/12/18 10:24 AM
L72	1	("20190335592").pn.	US-PGPUB; USPAT	OR	ON	ON	2020/12/18 10:30 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N3	29	(L3 SAME L4 SAME L5 SAME L6).clm.	US-PGPUB; USPAT	OR	ON	ON	2020/12/18 11:54 AM

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

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/N.M.B./	1	20190335592	A1	2019-10-31	Coulson et al.	

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/N.M.B./	1	Guimond et al., "Influence of gas phase and surface reactions on plasma polymerization", Surface & Coatings Technology, Vol. 205, Supplement 2, Pages 447-450, 2011, (4 pages).
/N.M.B./	2	Yasuda, "Plasma Polymerization", Academic Press, Inc., Orlando, Florida, 1985, (22 pages).
/N.M.B./	3	Declaration of Gregory N. Parsons, PH.D., Exhibit 2001, Case IPR2020-01198, filed October 30, 2020, (109 pages).
/N.M.B./	4	Patent Owner's Preliminary Response, Case IPR2020-01198, filed October 30, 2020, (70 pages).
/N.M.B./	5	Patent Owner's SUR-Reply to Petitioner's Reply to Preliminary Response, Case IPR2020-01198, filed December 8, 2020, (9 pages).
/N.M.B./	6	Petitioner's Reply to Patent Owner's Preliminary Response, Case IPR2020-01198, filed December 1, 2020, (8 pages).

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/N.M.B./	1	2716638	A	1955-08-30	Cohen et al.	
/N.M.B./	2	3816564	A	1974-06-11	Holliday et al.	
/N.M.B./	3	4562091	A	1985-12-31	Sachdev et al.	
/N.M.B./	4	5804669	A	1998-09-08	Tropsch et al.	
/N.M.B./	5	6207238	B1	2001-03-27	Affinito	
/N.M.B./	6	6214423	B1	2001-04-10	Lee et al.	
/N.M.B./	7	6551950	B1	2003-04-22	Badyal et al.	
/N.M.B./	8	7439315	B2	2008-10-21	Kunimi, et al.	

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	Attorney Docket Number	GBL0007/US/2

/N.M.B./	9	10421876	B2	2019-09-24	Coulson et al.	

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/N.M.B./	1	20050034667	A1	2005-02-17	Tsuji et al.	
/N.M.B./	2	20050141738	A1	2005-06-30	Karamuk	
/N.M.B./	3	20060122301	A1	2006-06-08	Nair et al.	
/N.M.B./	4	20110148979	A1	2011-06-23	Breton et al.	
/N.M.B./	5	20130136936	A1	2013-05-30	Morozumi et al.	
/N.M.B./	6	20130176700	A1	2013-07-11	Stevens et al.	

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/N.M.B./	1	9964662	WO	A1	1999-12-16	Badyal et al.		
/N.M.B./	2	2012168440	WO	A1	2012-12-13	Taesler		
/N.M.B./	3	2014026967	WO	A1	2014-02-20	Legein et al.		

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/N.M.B./	1	Petition for Inter Partes Review for US Patent Application No. 10,421,876, mailed July 17, 2020, (90 pages).	
/N.M.B./	2	Yao et al., "Fluorinated poly(meth)acrylate: Synthesis and properties," Vol. 55, Isse. 24, Pages 6197-6211, 2014, (15 pages).	
/N.M.B./	3	Sartomer Company Material Safety Data Sheet, Product CD406, dated June 9, 2005, (7 pages).	
/N.M.B./	4	Declaration of Dr. Karen Gleason, Exhibit 1002, Case IPR2020-01198, filed July 17, 2020, (117 pages).	
/N.M.B./	5	Curriculum Vitae for Karen K. Gleason, Exhibit 1003, Case IPR2020-01198, filed July 17, 2020, (34 pages).	
/N.M.B./	6	Francesch et al., "Fabrication of Bioactive Surfaces by Plasma Polymerization Techniques Using a Novel Acrylate-Derived Monomer", Plasma Processes and Polymers, Vol. 2, Isse. 8, pages 605-611, 2005, (7 pages).	

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	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

/N.M.B./	7	Declaration of Dr. Salvador Borrós Gómez, Exhibit 1010, Case IPR2020-01198, filed July 17, 2020, (3 pages).
/N.M.B./	8	Coulson et al., "Ultralow Surface Energy Plasma Polymer Films", Chemistry of Materials, Vol. 12, No. 7, pages 2031-2038, 2000, (8 pages).
/N.M.B./	9	Tarducci et al., "Synthesis of Cross-Linked Ethylene Glycol Dimethacrylate and Cyclic Methacrylic Anhydride Polymer Structures by Pulsed Plasma Deposition", Macromolecules, Vol. 35, No. 23, pages 8724-8727, 2002, (4 pages).
/N.M.B./	10	Yagüe et al., "Enhanced Cross-Linked Density by Annealing on Fluorinated Polymers Synthesized via Initiated Chemical Vapor Deposition To Prevent Surface Reconstruction", Macromolecules, Vol. 46, Isse. 16, pages 6379-6670, 2013, (7 pages).
/N.M.B./	11	Yasuda, "Plasma Polymerization", Academic Press, London, 1985, (58 pages).
/N.M.B./	12	Kurosawa et al., "Detection of deposition rate of plasma-polymerized acrylate and methacrylate derivatives using quartz crystal microbalance," Thin Solid Films, Vol. 457, Isse. 1, pages 26-33, 2004, (8 pages).
/N.M.B./	13	Kurosawa et al., "Detection of deposition rate of plasma-polymerized silicon-containing films by quartz crystal microbalance," Thin Solid Films, Vol. 407, Isses. 1-2, pages 1-6, 2002, (6 pages).
/N.M.B./	14	Joback et al., "Estimation of Pure-Component Properties from Group-Contributions," CHEMICAL ENGINEERING COMMUNICATIONS, Vol. 57, Isses. 1-6, pages 233-243, 1987, (12 pages).
/N.M.B./	15	"Experimental Physico-chemical Properties" retrieved from 'www.chemspider.com/Chemical-Structure.68328.html?rid=8eaa4787-5d2d-42d7-a4bb-7b352bcd4806', on July 9, 2020, (14 pages).
/N.M.B./	16	Declaration of S. Rampersad, Exhibit 1020, Case IPR2020-01198, filed July 17, 2020, (7 pages).

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16547728
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	Attorney Docket Number	GBL0007/US/2

EXAMINER SIGNATURE			
Examiner Signature	/NICOLE M. BUIE-HATCHER/	Date Considered	12/18/2020

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SUITE 200, MAPLE ISLAND BUILDING
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By:/Bethany Lichtscheidl/
Name: Bethany Lichtscheidl

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

TITLE OF INVENTION: COATINGS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/30/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
BUIE-HATCHER, NICOLE M	1767	526-245000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

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1 Kagan Binder, PLLC
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(B) RESIDENCE: (CITY and STATE OR COUNTRY): Abingdon, United Kingdom

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Typed or printed name Paul J. Parins Registration No. 54,358

Electronic Patent Application Fee Transmittal

Application Number:	16547728
Filing Date:	22-Aug-2019
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large Entity

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Pages:				
Claims:				
Miscellaneous-Filing:				
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Patent-Appeals-and-Interference:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1200**

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EFS ID:	42268476
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	24-MAR-2021
Filing Date:	22-AUG-2019
Time Stamp:	13:25:03
Application Type:	Utility under 35 USC 111(a)

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	Filing Date	2019-08-22
	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

	1	Granting Institution of Inter Partes Review for US Patent No. 10,421,876, entered January 27, 2021, (50 pages).
	2	Scheduling Order for US Patent No. 10,421,876, entered January 27, 2021, (11 pages).

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	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

CERTIFICATION STATEMENT

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See attached certification statement.

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A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul J. Parins/	Date (YYYY-MM-DD)	2021-03-24
Name/Print	Paul J. Parins	Registration Number	54,358

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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.**

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 record s.

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.

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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:	16547728
Filing Date:	22-Aug-2019
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt

EFS ID:	42267614
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	24-MAR-2021
Filing Date:	22-AUG-2019
Time Stamp:	12:37:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E20213NC38112885
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	Information Disclosure Statement (IDS) Form (SB08)	GBL0007US2_SIDS.pdf	1055960 1b119e35b22f633d4c5e9f034b45326ee94ccdb3	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Non Patent Literature	NPL1_IPR2020-01198_Granting_Institution.pdf	423932 1d31c637bd159d087796461ce38dab3df35847e9	no	50
Warnings:					
Information:					
3	Non Patent Literature	NPL2_IPR2020-01198_Scheduling_Order.pdf	157588 7f1e7a90eb0a18a0ecc743982352c5d7cb7f4587	no	11
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30384 7a41a131c25b2ad03a14d0edd66e7cb8f5fbf5b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1667864		

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

33072 7590 04/05/2021

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

EXAMINER	
BUIE-HATCHER, NICOLE M	

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
04/05/2021	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):

docketing@kaganbinder.com

Corrected ***Notice of Allowability***	**Application No.** 16/547,728	**Applicant(s)** COULSON et al.	
	Examiner NICOLE M BUIE-HATCHER	**Art Unit** 1767	**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 IDS filed 03/24/2021.
   ☐ 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 1-3,11,13 and 15-23 . 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 20210324.
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 _____.

/NICOLE M. BUIE-HATCHER/
Primary Examiner, Art Unit 1767

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

/N.M.B./	1	Granting Institution of Inter Partes Review for US Patent No. 10,421,876, entered January 27, 2021, (50 pages).
/N.M.B./	2	Scheduling Order for US Patent No. 10,421,876, entered January 27, 2021, (11 pages).

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/NICOLE M. BUIE-HATCHER/	Date Considered	03/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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.
16/547,728	05/11/2021	11001728	GBL0007/US/2	6664

33072 7590 04/21/2021

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

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 0 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):

Stephen Richard COULSON, Abingdon, UNITED KINGDOM;
P2i Ltd, Abingdon, UNITED KINGDOM;
Delwyn EVANS, Abingdon, UNITED KINGDOM;
Angeliki SIOKOU, Abingdon, UNITED KINGDOM;
Clive TELFORD, Abingdon, UNITED KINGDOM, Deceased;

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.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16547728
	Filing Date	2019-08-22
	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

	1	Notice Regarding Filing of Disclaimer of Claims in a Patent Under 37 C.F.R §1.321(a) for US Patent No. 10,421,876, entered April 20, 2021, (4 pages).	
	2	Disclaimer in Patent Under 37 C.F.R § 1.321(a) filed on April 14, 2021 for US Patent No. 10,421,876, entered as exhibit 2004 on April 20, 2021, (9 pages).	
	3	Motion for Termination of Proceeding Pursuant to 37 C.F.R. §42.72 for US Patent No. 10,421,876, entered May 3, 2021, (8 pages).	
	4	Petitioner's Opposition to Patent Owners Motion for Termination for US Patent No. 10,421,876, entered May 3, 2021, (9 pages).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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	Application Number	16547728
	Filing Date	2019-08-22
	First Named Inventor	Stephen Richard COULSON
	Art Unit	1767
	Examiner Name	NICOLE M. BUIE-HATCHER
	Attorney Docket Number	GBL0007/US/2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul J. Parins/	Date (YYYY-MM-DD)	2021-05-04
Name/Print	Paul J. Parins	Registration Number	54,358

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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.

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/140 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**PETITION TO WITHDRAW AN APPLICATION FROM ISSUE AFTER PAYMENT OF THE ISSUE FEE UNDER 37 CFR 1.313(c)**
Application Number	16547728
Filing Date	22-Aug-2019
First Named Inventor	Stephen COULSON
Art Unit	1767
Examiner Name	NICOLE BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2
Title	COATINGS

An application may be withdrawn from issue for further action upon petition by the applicant. To request that the Office withdraw an application from issue, applicant must file a petition under this section including the fee set forth in § 1.17(h) and a showing of good and sufficient reasons why withdrawal of the application from issue is necessary.

APPLICANT HEREBY PETITIONS TO WITHDRAW THIS APPLICATION FROM ISSUE UNDER 37 CFR 1.313(c).

A grantable petition requires the following items:
(1) Petition fee; and
(2) One of the following reasons:
(a) Unpatentability of one or more claims, which must be accompanied by an unequivocal statement that one or more claims are unpatentable, an amendment to such claim or claims, and an explanation as to how the amendment causes such claim or claims to be patentable;
(b) Consideration of a request for continued examination in compliance with § 1.114 (for a utility or plant application only); or
(c) Express abandonment of the application. Such express abandonment may be in favor of a continuing application, but not a CPA under 37 CFR 1.53(d).

Petition Fee

◯	Small Entity
◯	Micro Entity
◉	Regular Undiscounted

Reason for withdrawal from issue

◯ One or more claims are unpatentable ◉ Consideration of a request for continued examination (RCE) (List of Required Documents and Fees) ◯ Applicant hereby expressly abandons the instant application (any attorney/agent signing for this reason must have power of attorney pursuant to 37 CFR 1.32(b)).
RCE request,submission, and fee. ☐ I certify, in accordance with 37 CFR 1.4(d)(4) that : The RCE request ,submission, and fee have already been filed in the above-identified application on ☒ Are attached.
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application. ◯ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity. ◯ A sole inventor ◯ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ◯ A joint inventor; all of whom are signing this e-petition

Signature	/Paul J. Parins/
Name	Paul J. Parins
Registration Number	54358

Electronic Patent Application Fee Transmittal

Application Number:	16547728
Filing Date:	22-Aug-2019
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Filer:	Paul John Parins/Bethany Lichtscheidl
Attorney Docket Number:	GBL0007/US/2

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PETITION FEE- 37 CFR 1.17(H) (GROUP III)	1464	1	140	140
RCE- 1ST REQUEST	1801	1	1360	1360
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1500**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : May 4, 2021

In re Application of :

Stephen COULSON

DECISION ON PETITION
UNDER CFR 1.313(c)(2)

Application No : 16547728

Filed : 22-Aug-2019

Attorney Docket No : GBL0007/US/2

This is an electronic decision on the petition under 37 CFR 1.313(c)(2), filed May 4, 2021 , to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED.**

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid in this application cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being referred to Technology Center AU 1767 for processing of the request for continuing examination under 37 CFR 1.114 .

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	42633109
Application Number:	16547728
International Application Number:	
Confirmation Number:	6664
Title of Invention:	COATINGS
First Named Inventor/Applicant Name:	Stephen Richard COULSON
Customer Number:	33072
Filer:	Paul John Parins/Bethany Lichtscheidl
Filer Authorized By:	Paul John Parins
Attorney Docket Number:	GBL0007/US/2
Receipt Date:	04-MAY-2021
Filing Date:	22-AUG-2019
Time Stamp:	15:40:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1500
RAM confirmation Number	E202154F40331007
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	Quick Path Information Disclosure Statement	GBL0007US2_QPIDS_Form.pdf	187395 3af11f785e8423b7e60ccb5f4a83214690afafac	no	2
Warnings:					
Information:					
2	Transmittal Letter	GBL0007US2_Transmittal_for_QPIDS.pdf	110662 3b3ec32502f4235677e78abc8b3ead1fa522cef0	no	1
Warnings:					
Information:					
3	Request for Continued Examination (RCE)	GBL0007US2_RCE.pdf	1366104 c3c7d26f6dcad23164ecbaf5848782a72e133f9b	no	3
Warnings:					
Information:					
4	Information Disclosure Statement (IDS) Form (SB08)	GBL0007US2_SIDS.pdf	1056479 319080ff759c90bba7e19dc16c50fc189a9923d2	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
5	Non Patent Literature	NPL1_Notice_Re_Filing_Disclaimer_of_Claims.pdf	1657718 6908731ce9ae2859be65c08e0dddd8ad8e10ecac	no	4
Warnings:					
Information:					

6	Non Patent Literature	NPL2_Disclaimer_in_Patent_Under_37_CFR_1_321.pdf	3284680 c465c8ae372e1117fee0ab79875fd2158cfe20da	no	9
Warnings:					
Information:					
7	Non Patent Literature	NPL3_Motion_to_Terminate_Proceeding.pdf	5095471 2740f8e5afa813aa97f940a7ccc9b4123cdeb49f	no	8
Warnings:					
Information:					
8	Non Patent Literature	NPL4_Petitioners_Opposition.pdf	6009200 b6b178918a3cfb3364072a0c0a3036ab22fbf83c	no	9
Warnings:					
Information:					
9	Petition automatically granted by EFS	petition-request.pdf	31499 ebc25f8563f0ced7989df9ff301859fdaaa0889b	no	2
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	31847 47bf36039fbb28d0a1c4e1f134a4126d553c87eb	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	18831055	

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.

PTO/SB/09 (09-18)

CERTIFICATION AND REQUEST FOR CONSIDERATION OF AN INFORMATION DISCLOSURE STATEMENT FILED AFTER PAYMENT OF THE ISSUE FEE UNDER THE QPIDS PROGRAM

Non-Provisional Application Number: 16/547,728	Filing Date: 2019-08-22
First Named Inventor: Stephen Richard Coulson	Title of Invention: COATINGS

THE UNDERSIGNED HEREBY CERTIFIES AND REQUESTS THE FOLLOWING FOR THE ABOVE-IDENTIFIED APPLICATION.

1. Consideration is requested of the information disclosure statement (IDS) submitted herewith, which is being filed after payment of the issue fee.
2. Check the box next to the appropriate selection:

   ☐ Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the IDS. See 37 CFR 1.97(e)(1).

   OR

   ☑ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the IDS. See 37 CFR 1.97(e)(2).

   OR

   ☐ See attached certification statement in compliance with 37 CFR 1.97(e).
3. Please charge the IDS fee set forth in 37 CFR 1.17(p) to Deposit Account No. 50-1775.
4. A Petition to Withdraw from Issue After Payment of the Issue Fee (37 CFR 1.313(c)(2)), including the petition fee set forth in 37 CFR 1.17(h), is submitted herewith as a **Web-based ePetition**. **WARNING:** Do not submit the petition as a follow-on paper via EFS-Web. Submit the petition as a Web-based ePetition by signing on to EFS-Web as a registered user, selecting the radio button next to "Existing application/patent," and then selecting the radio button next to "ePetition (for automatic processing and immediate grant, if all petitions requirements are met)." Failure to use the Web-based ePetition interface will result in automatic entry of the RCE.
5. A request for continued examination (RCE) under 37 CFR 1.114 and the RCE fee under 37 CFR 1.17(e) are submitted herewith.
6. The RCE will be treated as a "conditional" RCE. In the event the examiner determines that any item of information contained in the IDS necessitates the reopening of prosecution in the application, the undersigned understands that (i) the RCE will be processed and treated as an RCE under 37 CFR 1.114 and therefore (ii) the IDS fee under 37 CFR 1.17(p) will be returned in accordance with 37 CFR 1.97(b)(4). In the event that no item of information in the IDS necessitates reopening prosecution, the undersigned understands that the RCE will not be processed and the RCE fee under 37 CFR 1.17(e) will be returned.
7. This certification and request is being filed as a **Web-based ePetition** and is not accompanied by an amendment to the application. Inclusion of an amendment will result in automatic entry of the RCE.

Signature /Paul J. Parins/	Date May 04, 2021
Name (Print/Typed) Paul J. Parins	Practitioner Registration Number (If applicable) 54,358

Note: *Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the form of the signature. If necessary, submit multiple forms for more than one signature, see below.**

☐ *Total of _____ forms are submitted.

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

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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	**Stephen Richard COULSON**	**Examiner:**	**NICOLE M. BUIE-HATCHER**
Serial No.:	**16/547,728**	**Group Art Unit:**	**1767**
Filed:	**August 22, 2019**	**Confirmation No.:**	**6664**
For:	**COATINGS**	**Docket No.:**	**GBL0007/US/2**

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

I CERTIFY THAT ON **MAY 3, 2021,** THIS CORRESPONDENCE IS BEING ELECTRONICALLY TRANSMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA THE OFFICE'S EFS-WEB.

/Bethany Lichtscheidl/
BETHANY LICHTSCHEIDL

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL LETTER

Dear Commissioner:

This Information Disclosure Statement is filed to bring to the Examiner's attention to the documents listed on the enclosed PTO/SB/08a form.

The documents listed on the enclosed form are presented pursuant to Applicant's duty of disclosure under 37 C.F.R. 1.56.

Applicant notes that the present application is a Continuation of application Serial No. 15/735,130 filed December 8, 2017, which issued into U.S. Pat. No. 10,421,876 and is now involved in an Inter Partes Review having trial number IPR2020-01198 and filing date of July 17, 2020. The documents cited on the enclosed form are from Inter Partes Review having trial number IPR2020-01198.

Respectfully Submitted,

Dated: May 04, 2021

By: /Paul J. Parins/
Paul J. Parins, Reg. No. 54,358
Customer Number 33072
Phone: 651-275-9831
Fax: 651-351-2954

#131844



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :71530

Sale Accounting Date:05/13/2021

Sale Item Reference Number	Effective Date
16547728	05/05/2021

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20215CG04093045	1806	SUBMISSION- INFORMATION DISCLOSURE STMT	$260.00	Deposit Account

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.
16/547,728	08/22/2019	Stephen Richard COULSON	GBL0007/US/2	6664

33072 7590 05/20/2021

KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

EXAMINER	
BUIE-HATCHER, NICOLE M	

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
05/20/2021	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):

docketing@kaganbinder.com

Corrected ***Notice of Allowability***	**Application No.** 16/547,728	**Applicant(s)** COULSON et al.	
	Examiner NICOLE M BUIE-HATCHER	**Art Unit** 1767	**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 IDS filed 05/04/2021.
   ☐ 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 1-3,11,13 and 15-23 . 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 20210504.
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 _____.

/NICOLE M. BUIE-HATCHER/
Primary Examiner, Art Unit 1767

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16547728
Filing Date	2019-08-22
First Named Inventor	Stephen Richard COULSON
Art Unit	1767
Examiner Name	NICOLE M. BUIE-HATCHER
Attorney Docket Number	GBL0007/US/2

/N.M.B./	1	Notice Regarding Filing of Disclaimer of Claims in a Patent Under 37 C.F.R §1.321(a) for US Patent No. 10,421,876, entered April 20, 2021, (4 pages).	
/N.M.B./	2	Disclaimer in Patent Under 37 C.F.R § 1.321(a) filed on April 14, 2021 for US Patent No. 10,421,876, entered as exhibit 2004 on April 20, 2021, (9 pages).	
/N.M.B./	3	Motion for Termination of Proceeding Pursuant to 37 C.F.R. §42.72 for US Patent No. 10,421,876, entered May 3, 2021, (8 pages).	
/N.M.B./	4	Petitioner's Opposition to Patent Owners Motion for Termination for US Patent No. 10,421,876, entered May 3, 2021, (9 pages).	

If you wish to add additional non-patent literature document citation information please click the Add button [Add]

EXAMINER SIGNATURE

Examiner Signature	/NICOLE M. BUIE-HATCHER/	Date Considered	05/15/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C46472

Refund Accounting Date:05/26/2021

Effective Date	Sale Item Reference Number	Refund Total
05/04/2021	16547728	$1,360.00

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method	Account Number
I20215PG02562670	1801	RCE- 1ST REQUEST	$1,360.00	DA	501775



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C46472

Sale Adjustment Accounting Date:05/26/2021

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/547,728	06/22/2021	11041087	GBL0007/US/2	6664

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KAGAN BINDER, PLLC
SUITE 200, MAPLE ISLAND BUILDING
221 MAIN STREET NORTH
STILLWATER, MN 55082

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 0 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):

Stephen Richard COULSON, Abingdon, UNITED KINGDOM;
P2i Ltd, Abingdon, UNITED KINGDOM;
Delwyn EVANS, Abingdon, UNITED KINGDOM;
Angeliki SIOKOU, Abingdon, UNITED KINGDOM;
Clive TELFORD, Abingdon, UNITED KINGDOM, Deceased;

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