

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FAVORED TECH CORPORATION,

Petitioner,

v.

P2I LTD.,

Patent Owner.

CASE: IPR2020-01198

Patent No. 10,421,876

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,421,876**

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July 17, 2020

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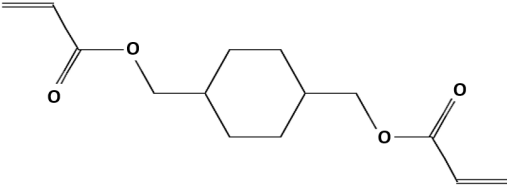
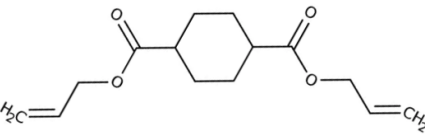
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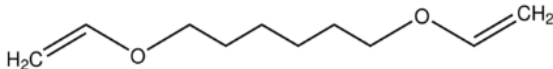
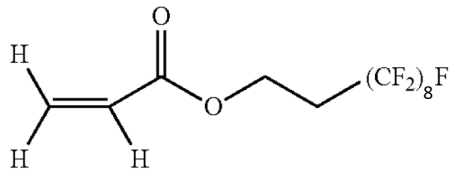
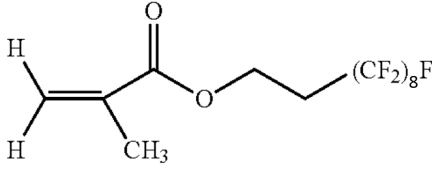
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TABLE OF ABBREVIATIONS AND CONVENTIONS

AIA	America Invents Act
Badyal	International Publication No. WO 99/64662, “Surface Coatings,” to Jas Pal Singh Badyal, et al. (Ex. 1005)
BDVE	1,4-butanediol divinyl ether $\text{H}_2\text{C}=\text{CH}-\text{O}-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2-\text{O}-\text{CH}=\text{CH}_2$
Board	Patent Trial and Appeal Board
CDMDA	cyclohexane-1,4-dimethanol diacrylate 
Coulson-122	International Publication No. WO 2007/083122, “Novel Products,” to Stephen Coulson (Ex. 1004)
Cohen	U.S. Patent 2,716,638, “Divinyltetramethyldisiloxane and Polymers Therefrom,” to Merrill Cohen and John R. Ladd (Ex. 1006)
DCHD	diallyl 1,4-cyclohexanedicarboxylate 
DVTMDS	divinyl tetramethyl disiloxane $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ \quad \\ \text{CH}_2=\text{CH}-\text{Si}-\text{O}-\text{Si}-\text{CH}=\text{CH}_2 \\ \quad \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$
Favored or Petitioner	petitioner Favored Tech Corporation

Francesch	, L. et al, “Fabrication of Bioactive Surfaces by Plasma Polymerization Techniques Using a Novel Acrylate-Derived Monomer,” <i>Plasma Processes and Polymers</i> , 2:605–611 (2005) (Ex. 1009)
HDVE	1,6-hexanediol divinyl ether 
Holliday	U.S. Patent 3,816,564, “Insulation Coating Compositions,” to Harvey Ray Holliday and Gary Lee Schurter (Ex. 1007)
IPR	<i>inter partes</i> review
Padiyath	U.S. Patent Application Publication US 2007/0020451, “Moisture Barrier Coatings,” to Raghunath Padiyath and Moses M. David (Ex. 1008)
PFAC8	1H, 1H, 2H, 2H-perfluorodecyl acrylate 
PFMAC8	1H, 1H, 2H, 2H-perfluorodecyl methacrylate 
POSA	person of ordinary skill in the art
P2i	patent owner P2i Ltd.
Tropsch	U.S. Patent 5,804,669, “Preparation of Polymers Comprising Peroxycarboxyl Groups,” to Jürgen Tropsch and Jörg Breitenbach (Ex. 1011)
WCA	static water contact angle

the '876 patent

U.S. Patent 10,421,876 (Ex. 1001)

xx:yy-zz

column xx, lines yy to zz

EXHIBIT LIST¹

Ex. 1001	U.S. Patent 10,421,876, “Coatings,” to Stephen Richard Coulson, et al. (“the ’876 patent”)
Ex. 1002	Declaration of Dr. Karen Gleason
Ex. 1003	Curriculum vitae for Dr. Karen Gleason
Ex. 1004	International Publication WO 2007/083122, “Novel Products,” to Stephen Coulson (“Coulson-122”)
Ex. 1005	International Publication No. WO 99/64662, “Surface Coatings,” to Jas Pal Singh Badyal, et al. (“Badyal”)
Ex. 1006	U.S. Patent 2,716,638, “Divinyltetramethyldisiloxane and Polymers Therefrom,” to Merrill Cohen and John R. Ladd (“Cohen”)
Ex. 1007	U.S. Patent 3,816,564, “Insulation Coating Compositions,” to Harvey Ray Holliday and Gary Lee Schurter (“Holliday”)
Ex. 1008	U.S. Patent Application Publication US 2007/0020451, “Moisture Barrier Coatings,” to Raghunath Padiyath and Moses M. David (“Padiyath”)

¹ Citation convention: Where an exhibit contains original page numbering that uniquely identifies each page in the exhibit, this petition uses those page numbers to refer to the pages in the exhibit. Where an exhibit contains original page numbering that does not clearly and uniquely identify each page in the exhibit (such as in the ’876 patent’s file history, Ex. 1028), or does not contain page numbering at all, unique page numbering added in the lower right corner of the exhibit will be used.

- Ex. 1009 Francesch, L. et al, “Fabrication of Bioactive Surfaces by Plasma Polymerization Techniques Using a Novel Acrylate-Derived Monomer,” *Plasma Processes and Polymers*, 2:605–11 (2005) (“Francesch”)
- Ex. 1010 Declaration of Dr. Salvador Borrós Gómez
- Ex. 1011 U.S. Patent 5,804,669, “Preparation of Polymers Comprising Peroxycarboxyl Groups,” to Jürgen Tropsch and Jörg Breitenbach (“Tropsch”)
- Ex. 1012 International Publication WO 2012/158953, “Coated Electronic Devices and Associated Methods,” to Filip Legein, et al.
- Ex. 1013 U.S. Patent Application Publication US 2013/0176700, “Electronic Devices with Internal Moisture Resistant Coatings,” to Blake Stevens, et al.
- Ex. 1014 International Publication WO 2014/026967, “Surface Coatings,” to Filip Legein, et al.
- Ex. 1015 U.S. Patent Application Publication US 2005/0141738, “Hydrophobic Coating of Individual Components of Hearing Aid Devices,” to Erdal Karamuk
- Ex. 1016 U.S. Patent 6,551,950, “Surface Coatings,” to Jas P S Badyal, et al.
- Ex. 1017 U.S. Patent 4,562,091, “Use of Plasma Polymerized Organosilicon Films in Fabrication of Lift-Off Masks,” to Harbans S. Sachdev and Krishna G. Sachdev
- Ex. 1018 U.S. Patent 7,439,315, “Polymer Film and Method for Producing the Same,” to Nobutaka Kunimi, et al.
- Ex. 1019 Coulson, S.R., et al., “Ultralow Surface Energy Plasma Polymer Films,” *Chemistry of Materials* 12(7):2031–2038 (2000)
- Ex. 1020 Declaration of S. Rampersad

- Ex. 1021 U.S. Patent Application Publication US 2010/0203347, “Method for Liquid Proofing an Item by Plasma Graft Polymerisation,” to Stephen Coulson (Coulson-347)
- Ex. 1022 International Publication WO 98/58117, “Surface Coatings,” to Jas Pal Singh Badyal, et al.
- Ex. 1023 Tarducci, C., et al., “Synthesis of Cross-Linked Ethylene Glycol Dimethacrylate and Cyclic Methacrylic Anhydride Polymer Structures by Pulsed Plasma Deposition,” *Macromolecules* 35(23):8724–8727 (2002)
- Ex. 1024 U.S. Patent 6,214,423, “Method of Forming a Polymer on a Surface,” to Wei William Lee, et al.
- Ex. 1025 International Publication WO 2012/168440, “A Coated Substrate Having Hydrophobic Moiety-Repelling Surface Characteristics and Process for Preparing the Same,” to Christian Taesler
- Ex. 1026 Yagüe, J.L. and Gleason, K.K., “Enhanced Cross-Linked Density by Annealing on Fluorinated Polymers Synthesized via Initiated Chemical Vapor Deposition to Prevent Surface Reconstruction,” *Macromolecules* 46(16):6548-6554 (2013)
- Ex. 1027 U.S. Patent 6,207,238, “Plasma Enhanced Chemical Deposition for High and/or Low Index of Refraction Polymers,” to John D. Affinito
- Ex. 1028 Prosecution history of the ’876 patent
- Ex. 1029 Yao, W., et al., “Fluorinated poly(meth)acrylate: Synthesis and properties,” *Polymer* 55(24):6197-6211 (2014)
- Ex. 1030 U.S. Patent Application Publication US 2013/0135936, “Gas Barrier Base Material and Gas Barrier Laminate,” to Takeshi Morozumi, et al.
- Ex. 1031 U.S. Patent Application Publication US 2011/0148979, “Curable Phase Change Inks,” to Marcel P. Breton, et al.

- Ex. 1032 Sartomer Company Material Safety Data Sheet, Product CD406, dated June 9, 2005
- Ex. 1033 U.S. Patent Application Publication US2005/0034667, “Method and Apparatus for Forming Silicon-Containing Insulation Film Having Low Dielectric Constant,” to Naoto Tsuji, et al.
- Ex. 1034 Yasuda, H., *Plasma Polymerization*, 1985 Academic Press, London (Excerpts)
- Ex. 1035 Kurosawa, S., et al., “Detection of deposition rate of plasma-polymerized acrylate and methacrylate derivatives using quartz crystal microbalance,” *Thin Solid Films* 457:26-33 (2004)
- Ex. 1036 Kurosawa, S., et al., “Detection of deposition rate of plasma-polymerized silicon-containing films by quartz crystal microbalance,” *Thin Solid Films* 407:1–6 (2002)
- Ex. 1037 Joback, K.G. and Reid, R.C., “Estimation of Pure-Component Properties from Group-Contributions,” *Chem. Eng. Comm.* 57:233-243 (1987)
- Ex. 1038 U.S. Patent Application Publication US 2006/0122301, “Fluorinated divinyl ethers,” to Haridasan K. Nair and David Nalewajek
- Ex. 1039 Chemical information obtained from chemspider.com

I. Introduction

Petitioner Favored Tech Corporation (“Favored” or “Petitioner”) requests IPR and cancelation of claims 1-15 of U.S. Patent 10,421,876 (’876 patent) (Ex. 1001).

Patent owner P2i first applied for the ’876 patent in 2015. The ’876 patent
5 claims electronics having a protective coating applied by co-polymerizing prior-art fluorinated monomers with prior-art crosslinking reagents under known plasma conditions. But P2i and others had already long-since described (and repeatedly patented) using the same monomers and the same plasma-coating approach to protect various articles, including electronics, against water and other contaminants. P2i had also
10 described combining those same fluorinated monomers with a crosslinking reagent to obtain protective coatings with enhanced durability. By 2007, every aspect of the ’876 claims was well known: protecting electronics with polymer coatings, combining a fluorinated monomer with a crosslinker to make such coatings, and using plasma polymerization to apply them.

15 P2i’s effort to obtain still more claims on fluorinated plasma-polymer coatings through the ’876 patent eventually turned on identifying a hodgepodge of specific crosslinkers that the examiner failed to uncover in the prior art during prosecution. As a result, the claims recite various crosslinkers having two double bonds and a mix of different bridging groups from several different structural categories. All of
20 those claimed crosslinkers, however, fell within a prior-art genus that had been

described for use with the claimed monomers more than 15 years earlier. Furthermore, the claimed crosslinkers—like the prior-art genus to which they all belonged—were well known and long used in the polymer art. For example, the claims cover divinyl tetramethyl disiloxane (DVTMDS), which had been used since the
5 1950s as a crosslinker in water-repellent polymer coatings for electrical devices.

In short, the '876 claims represent the combination of familiar elements according to known methods with predictable results. They present a textbook case of obviousness and should be canceled on the grounds presented here. Favored asks that the Board institute IPR and hold the challenged claims unpatentable under
10 U.S.C. § 103.

II. Mandatory notices

In compliance with 37 C.F.R. § 42.8(b), Petitioner submits the following mandatory notices.

A. Real party in interest

15 The real-parties-in-interest are Favored Tech Corporation; Shenzhen Favored Nanotechnology Co., Ltd.; and Jiangsu Favored Nanotechnology Co., Ltd.

B. Related matters

Petitioner and counsel for Petitioner are not aware of any judicial or administrative matter that would affect, or be affected by, a decision in this proceeding.

C. Counsel and service information

20 Pursuant to 37 C.F.R. §§ 42.8(b) and 42.10(a), Petitioner appoints the

following lead and back-up counsel:

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Counsel can be reached using the contact information provided above, and Petitioner consents to electronic service at the indicated e-mail addresses. Petitioner has executed and is filing a corresponding power of attorney.

5 **III. Requirements for *inter partes* review**

This petition complies with all requirements, including 37 C.F.R. §§ 42.104, 42.105, and 42.15, and should be accorded a filing date under 37 C.F.R. § 42.106. Petitioner authorizes the Director to charge any required fees to Deposit Account

50-0665, charge number 127908.0001.

A. Grounds for standing

Petitioner certifies under § 42.104(a) that the '876 patent is available for IPR and that Favored is not barred or estopped from requesting IPR on the grounds identified. Favored meets all requirements under 35 U.S.C. §§ 315(a)(1), 315(b), and 315(e)(1), and 37 C.F.R. §§ 42.73(d)(1), 42.101, and 42.102.

B. Identification of challenge

Under 37 C.F.R. §§ 42.104(b) and 42.22, Petitioner requests IPR and cancellation of claims 1-15 on the following grounds under § 103:

Ground	Claims	Basis for Unpatentability
Ground 1	1-3, 9, 11-15	Obvious over Coulson-122, Badyal, and Cohen
Ground 2	1-8, 10-15	Obvious over Coulson-122, Badyal, and Holliday
Ground 3	1-4, 10, 12-15	Obvious over Coulson-122, Badyal, and Padiyath
Ground 4	1-3, 5-8, 11-15	Obvious over Coulson-122, Badyal, and Francesch
Ground 5	1-3, 5-8, 12-15	Obvious over Coulson-122, Badyal, and Tropsch

Each ground includes Coulson-122 (Ex. 1004) and Badyal (Ex. 1005). Coulson-122 and Badyal described protective plasma-polymer coatings prepared using the same fluorinated monomers claimed in the '876 patent, and Badyal described combining those monomers with the same family of crosslinkers as the '876 patent. The third reference differs in each ground: Cohen (Ex. 1006), Holliday (Ex. 1007),

Padiyath (Ex. 1008), Francesch (Ex. 1009), and Tropsch (Ex. 1011). Those references described specific, prior-art crosslinkers that fell within Badyal's prior-art genus and had bridging groups matching the various structures specified in each subset of the '876 claims.

5 Coulson-122 was considered during prosecution, but the remaining references (Badyal, Cohen, Holliday, Padiyath, Francesch, and Tropsch) were not before the examiner. Petitioner further relies on the declaration of Dr. Karen Gleason (Ex. 1002) and other references in the exhibit list. Section VII details how the claims are unpatentable and identifies where each limitation appeared in the prior art.

10 **IV. The '876 patent and protective coatings for electronic devices**

The '876 patent claims electronics with a protective coating applied under plasma conditions using two components: (1) an acrylate-based monomer, and (2) a crosslinking reagent having two double bonds and a bridging group with one of several structural formulas.

15 Those features were well known by the patent's asserted priority date in June 2015. Portable electronics were everywhere, and the recognized risk of damage from spills and environmental exposure provided ample motivation to apply protective, water-repellent coatings. Plasma polymerization was by then widely used to apply such coatings to various substrates, including electronics. Moreover, the types of
20 monomers and crosslinkers in the '876 claims were known, and the prior art had

already suggested using them together. The '876 patent simply claimed the use of known compounds according to their known functions to produce an expected result. Those claims were obvious over the prior art.

A. The earliest priority date is June 9, 2015

5 The '876 patent claims priority to European Patent Application No. 15386017, filed on June 9, 2015. For purposes of this proceeding, Petitioner assumes but does not concede that priority date. The AIA versions of 35 U.S.C. §§ 102 and 103 apply.

B. The state of the art by June 2015

**1. Ubiquitous portable electronics were being coated to
10 protect against environmental contaminants**

By June 2015, portable electronics like mobile phones and laptop computers were commonplace. It was well known that such devices could be damaged by environmental contaminants, including corrosive gases like water vapor or oxygen and liquids from rain, spills, etc. *E.g.*, Ex. 1004 1:9-34; Ex. 1012 1:9-2:12; Ex. 1013 ¶¶ 1-
15 2; Ex. 1008 ¶ 2. Accordingly, skilled artisans had described various polymer coatings to protect electronic devices against such damage. Ex. 1004 Abstract; Ex. 1008 ¶¶ 5, 21-24; Ex. 1012 2:8-3:14, 7:3-21; Ex. 1013 ¶¶ 2-6, 44-46; Ex. 1014 4:14-6:11; Ex. 1015 ¶¶ 11, 30-34. Such coatings were designed to serve known functions like repelling water (Ex. 1012 11:4-11; Ex. 1013 ¶¶ 3-4, 41-46; Ex. 1014 11:17-12:25; Ex.
20 1015 ¶ 11), creating a barrier against passage of water or other molecules between the device and the environment (Ex. 1008 ¶ 24; Ex. 1012 7:3-10; Ex. 1013 ¶¶ 39-40;

Ex. 1014 16:7-9), and providing electrical insulation (Ex. 1012 7:3-10; Ex. 1014 5:13). *See* Ex. 1002 ¶¶ 56-58, 128.

2. Plasma polymerization was routine and had been used to apply protective coatings to electronics

5 One common method for applying prior-art coatings was plasma polymerization. Ex. 1004 2:33-4:3; Ex. 1012 7:22-8:7; Ex. 1014 6:10-11; Ex. 1008 ¶ 11; 1013 ¶¶ 45-46; Ex. 1015 ¶ 29.

Plasma polymerization referred to forming polymeric materials under plasma conditions. Ex. 1002 ¶ 32; Ex. 1004 2:33-3:12; Ex. 1012 3:5-14. Typically, plasma
10 polymerization involved vaporizing one or more organic compounds and passing the resulting gas through an enclosed plasma chamber, where an electrical field was applied to induce a plasma state. Ex. 1002 ¶¶ 33-38; Ex. 1004 3:20-4:3, 7:6-17; Ex. 1012 11:17-13:20; Ex. 1014 21:20-25. The term *plasma* described gas in an ionized state, which POSAs sometimes referred to as a “glow discharge” because plasmas
15 often give off visible light. Ex. 1002 ¶¶ 32, 34; Ex. 1004 7:14-17; Ex. 1017 3:26-33. When a substrate is present, reactive species in the plasma impinge on the substrate where they form a plasma-polymer film on its surface. Ex. 1002 ¶ 36; Ex. 1005 2:14-24; Ex. 1012 13:5-20; Ex. 1014 21:20-22:2; Ex. 1018 8:17-48.

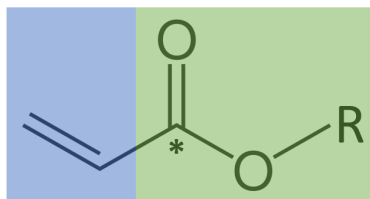
Plasma polymerization was widely used by 2015. Ex. 1002 ¶¶ 32, 64, 134.
20 The ’876 patent acknowledges that conditions for applying plasma-polymer coatings could be determined “using routine methods.” Ex. 1001 14:59-67. Plasma

polymerization had by then been “quite widely used for the deposition of polymeric coatings onto a range of surfaces,” and equipment for applying plasma coatings was “conventional” and “known in the art.” Ex. 1005 2:10-12, 11:26-27; *see also* Ex. 1004 6:25-7:12; Ex. 1005 10:8-12, 11:26-27; Ex. 1012 8:22-10:12; Ex. 1016 1:40-50; Ex. 1017 3:26-40; Ex. 1027 1:20-41; Ex. 1002 ¶¶ 27, 54, 64.

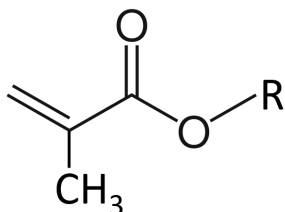
3. Fluorinated acrylate and methacrylate monomers had long been used for coating many substrates, including electronics

Polymers created via plasma polymerization (or other conventional activation techniques) generally comprise repeating monomers linked together to form larger chains or networks. Ex. 1002 ¶¶ 32, 40-41. Monomers for polymer production typically included at least one reactive group, such as a double bond, capable of facilitating intermolecular bond formation. Ex. 1002 ¶¶ 39-41.

Acrylate-based molecules were among the most well-known and widely used monomers for polymer production. Ex. 1002 ¶¶ 39, 42-44. Most acrylates used for polymerization were acrylate esters, as illustrated below:

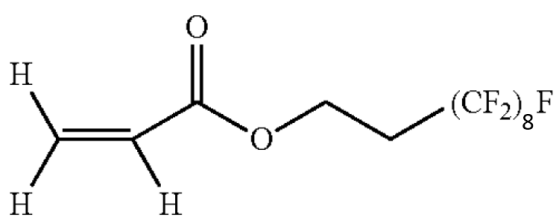


Ex. 1002 ¶ 43. Acrylate esters characteristically contained a vinyl group (blue) directly linked to the carbonyl carbon (starred) of an ester group (green). *Id.* Methacrylates, a common type of modified acrylate, contained a methylated vinyl group:

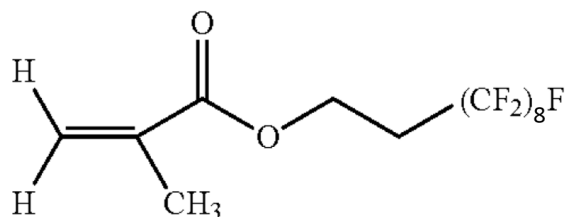


Id.

Acrylate-based monomers were known as bifunctional and versatile: the vinyl group's double bond facilitated polymerization, and the ester group could introduce various functional substituents at the variable R position. Ex. 1002 ¶¶ 43-44. By 2015, acrylate and methacrylate monomers with fluoroalkyl groups had long been used for their beneficial properties in plasma-polymer coatings, including water repellency and electrical insulation. Ex. 1002 ¶¶ 43-44, 47. Two such monomers were 1H,1H,2H,2H-perfluorodecyl acrylate (PFAC8) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8):



PFAC8



PFMAC8

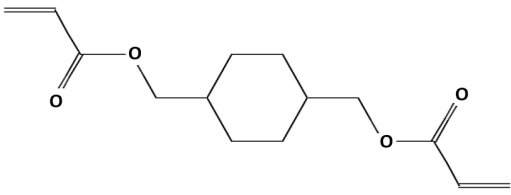
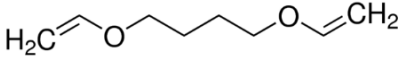
Ex. 1002 ¶45; Ex. 1004 12:7-22, 14:7-23; Ex. 1005 8:15-9:27, Ex. 1014 16:16-27;
Ex. 1019 at 2032; Ex. 1016 7:49-67; Ex. 2021 ¶28; Ex. 1022 6:1-7:31, 16:19-17:3.

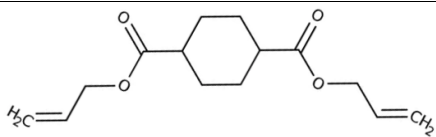
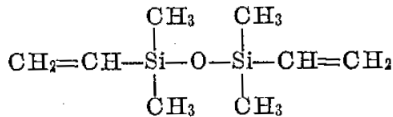
15 Those and other structurally similar fluorinated monomers had been used for protec-
tive coatings on various substrates, including electronics. Ex. 1002 ¶¶45, 48; *e.g.*,

Ex. 1004 12:7-14:23; Ex. 1014 16:11-27; Ex. 1029 at 6197-98.

4. Crosslinkers were commonplace in polymer production

In addition to monomers like PFAC8 and PFMAC8, POSAs regularly incorporated crosslinkers into prior-art polymer coatings. In general, crosslinkers have at least two reactive sites, usually two double bonds. Ex. 1002 ¶51. Numerous crosslinking reagents containing two double bonds had been used with acrylate-based monomers to produce crosslinked coatings. Ex. 1002 ¶¶ 50-53, 117; *e.g.*, Ex. 1006 1:15-30, 3:50-65; Ex. 1007 3:20-60; Ex. 1008 ¶¶ 11, 52-54; Ex. 1009 at 607; Ex. 1011 3:1-4:39; Ex. 1025 ¶¶ 11, 20. Crosslinkers were often grouped into families characterized by their structural configurations around the reactive double bonds. Familiar categories included diacrylate, divinyl ether, diallyl, and divinyl crosslinkers:

<i>Diacrylate</i>	
configuration	$\text{CH}_2=\text{CH}-(\text{C}=\text{O})-\text{O}-\text{Z}-\text{O}-(\text{C}=\text{O})-\text{CH}=\text{CH}_2$
example	 cyclohexane-1,4-dimethanol diacrylate (CDMDA)
<i>Divinyl ether</i>	
configuration	$\text{CH}_2=\text{CH}-\text{O}-\text{Z}-\text{O}-\text{CH}=\text{CH}_2$
example	 1,4-butanediol divinyl ether (BDVE)

<i>Diallyl</i>	
configuration	$\text{CH}_2=\text{CH}-\text{CH}_2-\text{Z}-\text{CH}_2-\text{CH}=\text{CH}_2$
example	 diallyl 1,4-cyclohexanedicarboxylate (DCHD)
<i>Divinyl</i>	
configuration	$\text{CH}_2=\text{CH}-\text{X}-\text{Z}-\text{X}-\text{CH}=\text{CH}_2$ <i>**X is not O, O-(C=O), or CH₂</i>
example	 divinyl tetramethyl disiloxane (DVTMDS)

Ex. 1002 ¶ 51.

Crosslinking was known to impart “good chemical and mechanical stability characteristics.” Ex. 1023 at 8724. For example, the prior art taught that water-repellent coatings could be improved by co-polymerizing fluorinated acrylate-based monomers with a crosslinking reagent. Ex. 1005 4:1-9. The resulting crosslinked coating that demonstrated improved durability while retaining protective properties obtained with the monomer alone. Ex. 1005 4:1-9, 4:17-5:5; Ex. 1002 ¶¶ 49-50.

POSAs also knew that crosslinking led to improved barrier properties against passage of liquids or gases and resulted in greater solvent and chemical resistance. Ex. 1002 ¶ 50; Ex. 1006 3:50-65; Ex. 1008 ¶¶ 2, 11, 25, 52; Ex. 1025 ¶¶ 20-21, 34, 36; Ex. 1009 at 610. When used with monomers like PFAC8, crosslinkers were also

known to reduce the tendency of hydrophobic fluorinated groups to migrate away from the coating surface when exposed to water (known as hysteresis), thus improving water repellency under wet conditions. Ex. 1002 ¶ 50; Ex. 1026 at 6552.

C. Overview of prior-art references

5 The prior art taught the use of plasma polymerization to provide protective coatings for electronics, the beneficial use of crosslinking reagents in protective polymeric coatings, and specific examples of such reagents.

1. Coulson-122 described protective plasma-polymer coatings for electronics made using PFAC8 and PFMAC8

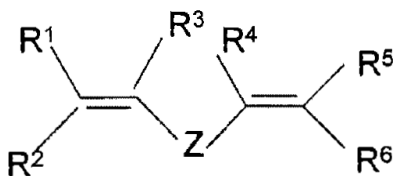
10 Coulson-122 (Ex. 1004) described electronics with liquid-repellent polymer coatings. Ex. 1004 Abstract. The coatings were applied by plasma polymerizing fluorinated monomers including PFAC8 or PFMAC8. Ex. 1004 3:14-25, 11:1-12:22; Ex. 1002 ¶¶ 66-68, 114. Coulson-122 taught that such monomers produced “highly liquid-repellent nano-coatings,” such that treated devices like mobile phones could
15 be “fully immersed in water ... without any lasting harm.” Ex. 1004 3:14-18, 4:29-5:10.

2. Badyal described plasma-polymer coatings combining PFAC8 or PFMAC8 with a generic crosslinker

Badyal (Ex. 1005) described liquid-repellent plasma-polymer coatings that
20 could be applied to “any solid substrate” using the same PFAC8 and PFMAC8 monomers in Coulson-122. Ex. 1005 7:17-9:19, 9:28-30, 11:19-24; Ex. 1002 ¶¶ 69, 115.

To improve the durability of such coatings, Badyal taught combining the

monomer with a crosslinker, preferably of the following generic formula:



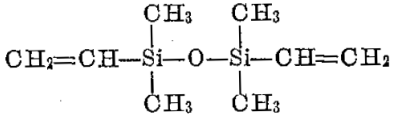
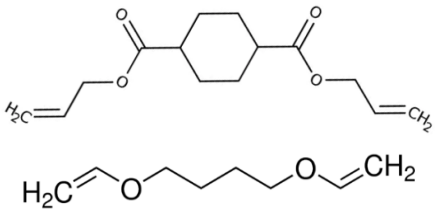
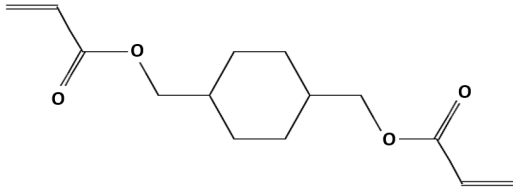
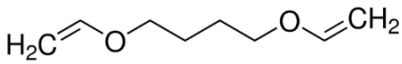
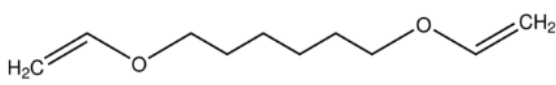
Ex. 1005 4:1-5:5. The R₁-R₆ positions could include hydrogen or alkyl groups, and bridging group Z could include substituents “known in the polymer art,” including alkyl groups interposed with oxygen atoms. Ex. 1005 5:1-5, 5:18-23. Badyal thus described suitable crosslinkers in expansive terms but provided few examples of specific bridging groups. Ex. 1005 6:15-20; Ex. 1002 ¶¶ 69-70, 116.

Plasma polymerizing monomers like PFAC8 with a crosslinker produced crosslinked, well-adhered coatings with excellent water-repellency and durability.

Ex. 1005 4:4-29, 10:32-11:17.

3. Cohen, Holliday, Padiyath, Francesch, and Tropsch described crosslinkers with the claimed bridging groups

While Badyal taught the value of crosslinkers and described them in broad terms, other references described specific crosslinking reagents. Cohen, Holliday, Padiyath, Francesch, and Tropsch described specific crosslinkers having the same generic structure described by Badyal, each with two double bonds separated by a bridging group:

Cohen (Ex. 1006 1:25-30)	DVTMDS	
Holliday (Ex. 1007 3:34-35, 3:52-53)	DCHD BDVE	
Padiyath (Ex. 1008 ¶ 54)	CDMDA	
Francesch (Ex. 1009 at 606-07)	BDVE	
Tropsch (Ex. 1011 4:34-39)	HDVE	

D. Overview of the '876 patent

The '876 patent claims electronic devices with a plasma-polymer coating prepared using an acrylate or methacrylate monomer and a crosslinker. Ex. 1001 2:10-21, 18:26-19:57 (claim 1). Every feature of the '876 claims was known, and they

5 recite the predictable use of known compounds for known purposes. The claims are therefore unpatentable over the prior art.

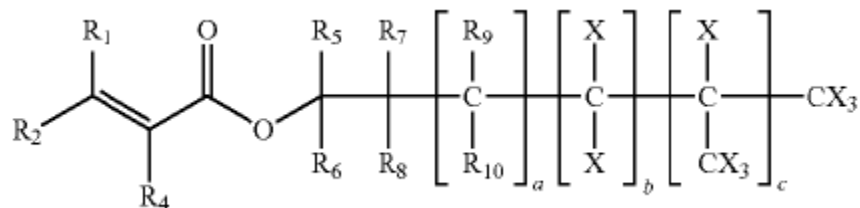
1. Specification and claims

In the '876 patent, coated devices include “a wide variety of substrates” like smartphones, microphones, or circuit boards. Ex. 1001 14:30-58. Conditions for ap-

10 plying the plasma polymers are flexible and “can be determined using routine methods.” Ex. 1001 14:59-67. Most of the specification focuses on the structures of the

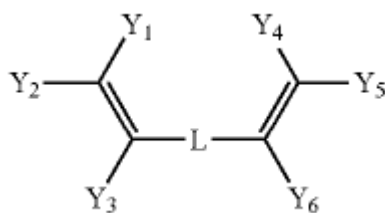
monomer and crosslinker in the claimed coatings. Ex. 1001 4:36-13:8; Ex. 1002 ¶ 59.

Claim 1, the sole independent claim, recites a monomer with the following generic structure:



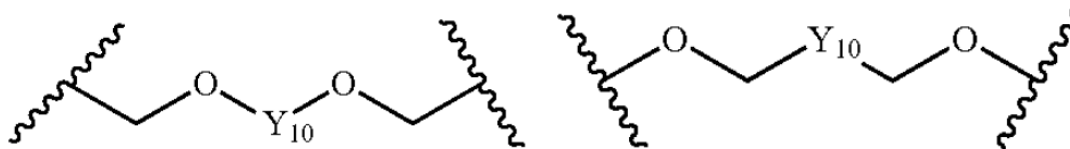
5 Ex. 1001 18:30-53. The monomer is an acrylate, with a vinyl group, an ester group and an optionally halogen-substituted alkyl tail. Ex. 1002 ¶ 60; Ex. 1001 18:49-53. PFAC8 and PFMAC8 both satisfy the generic formula recited in claim 1, and both are described as particularly preferred embodiments. Ex. 1001 10:22-11:56, 21:7-22:21 (claims 12-15); Ex. 1002 ¶¶ 60, 122. The '876 patent admits that such mono-
 10 mers were known and used to make hydrophobic plasma-polymer coatings. Ex. 1001 1:16-46 (citing Ex. 1022).

For the crosslinker, claim 1 recites the following generic structure:

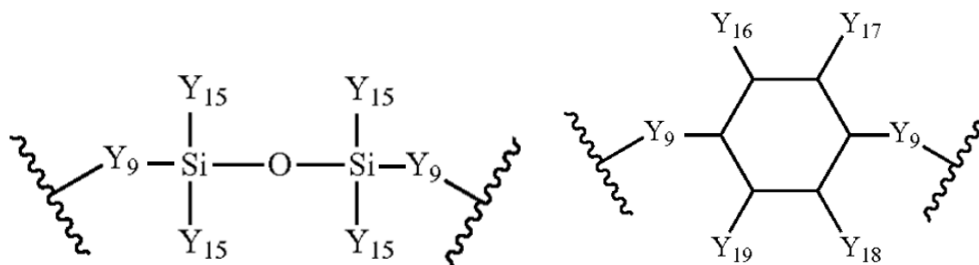


Ex. 1001 18:54-19:8.¹ That structure includes two double bonds flanking a generic bridging group (“linker moiety L”). Ex. 1001 4:51-67; Ex. 1002 ¶¶ 61. The ’876 patent explains that the “basic requirement” for a crosslinker is two or more unsaturated bonds. Ex. 1001 4:36-40; Ex. 1002 ¶¶ 61. In contrast, the bridging group “is not especially limited” and need only bridge the two double bonds. Ex. 1001 4:40-42.

Claim 1 covers four alternative generic structures for the bridging group. The claims group the first two as “formula A”:



Ex. 1001 19:9-19. The next two represent “formula B”:



Ex. 1002 ¶¶ 62; *see* Ex. 1001 19:20-57. Those four generic structures encompass a wide variety of diacrylate, divinyl ether, diallyl, and divinyl crosslinkers. Ex. 1002 ¶¶ 63, 51; *see* Ex. 1001 5:1-9:20. Dependent claims 4-10 add further structural

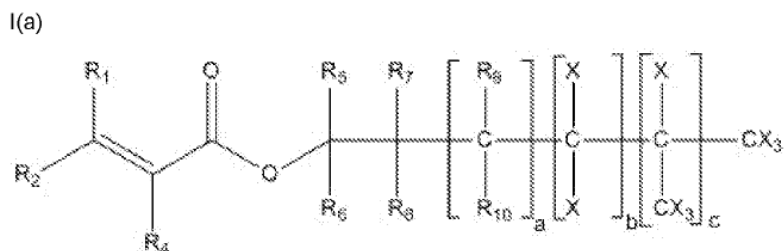
¹ Alternatively, claim 1 recites crosslinkers having two triple bonds. Ex. 1001 19:1-4. Those compounds are not relevant to the asserted grounds.

limitations within one or more of the claimed bridging-group configurations. Ex. 1001 19:65-20:64. Several specific examples appear in Table 1 and dependent claim 11. Ex. 1001 8:19-9:20, 20:65-21:6 (claim 11).

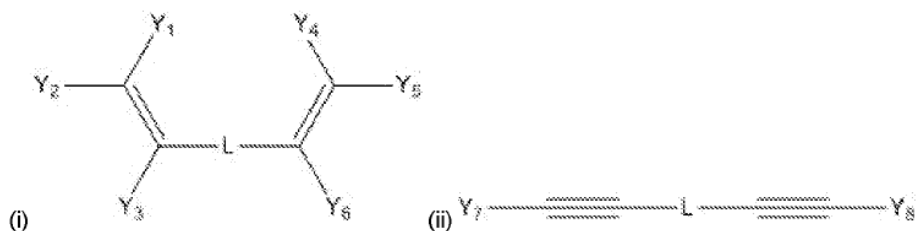
Other dependent claims recite that the coating provides liquid repellency or a physical barrier (claims 2-3), or recite specific monomer species, including PFAC8 and PFMAC8 (claims 12-15). Ex. 1001 19:58-64, 21:7-22:21.

2. Prosecution history

The initial claims during prosecution recited a coating made using any acrylate-based monomer of formula 1(a)



and any crosslinker of structure (i) or (ii)



Ex. 1028 at 177-84 (preliminary amendment). Numerous dependent claims specified options for the bridging group. Ex. 1028 at 180-82.

The examiner's first action indicated allowable subject matter in dependent claims 7 and 12-15 because the examiner had not identified art showing the bridging

groups in those claims. Ex. 1028 at 251. The remaining 14 claims were rejected for obviousness over U.S. 2010/0203347 (Coulson-347, Ex. 1021) and Coulson-122 (Ex. 1004). Ex. 1028 at 243, 247-51.

The applicant responded by amending claim 1 to incorporate the various bridging groups from original claims 5, 7, 12, and 14 as “Formula A” or “Formula B.” Ex. 1028 at 295, 391-93. Less than two months later, the examiner allowed the claims. Ex. 1028 at 400. According to the examiner, the claims were allowed because Coulson-347 and Coulson-122 did not teach those specific crosslinking reagents. Ex. 1028 at 406-07.

The examiner did not consider Badyal’s teachings about the benefits of cross-linking or the specific prior-art crosslinkers described by Cohen, Holliday, Padiyath, Francesch, and Tropsch. Those references were not before the examiner.

E. Level of ordinary skill in the art

A person of ordinary skill in the art (“POSA”) in June 2015 would have had at least a bachelor’s degree in a field such as chemistry, physics, or chemical engineering, as well as at least two years of experience with plasma-polymerization techniques. Ex. 1002 ¶¶ 22-29.

V. Claim construction

The Board construes claims “using the same claim construction standard that would be used in a civil action.” 37 C.F.R. § 42.100(b). Accordingly, “a claim

receives the meaning it would have to persons in the field of the invention, when read and understood in light of the entire specification and prosecution history.”

Fenner Invs., Ltd. v. Cellco P’ship, 778 F.3d 1320, 1323 (Fed. Cir. 2015).

A. “Halogen” includes at least fluorine, chlorine, and bromine

5 As understood by a POSA in light of the intrinsic record, the term “halogen” in claim 1 includes at least fluorine, chlorine, and bromine.

The ’876 patent refers to a halogen as an optional substituent at selected sites in some monomers. Ex. 1001 Abstract, 2:35-43, 9:45, 9:64, 10:36-37, 10:55. Several preferred monomers include fluorine at those same sites. Ex. 1001 11:16-17, 11:30-

10 56. Furthermore, the specification expressly states that “[t]he halogen may be chlorine or bromine, but is preferably fluorine.” Ex. 1001 10:57-58. The specification therefore demonstrates that “halogen” includes at least fluorine, chlorine, and bromine. That is also consistent with the ordinary understanding in the art. Ex. 1002 ¶¶ 109-111. POSAs understood “halogen” as a generic term for the elements within
15 Group 17 of the periodic table, which was known to include fluorine, chlorine, and bromine, among others. *Id.*

Accordingly, a POSA would have understood “halogen” as used in the claims to include at least fluorine, chlorine, and bromine.

VI. The cited references are prior art

20 Each of the cited patents and printed publications was patented or published

before June 9, 2015.

A. Coulson-122

Coulson-122 (Ex. 1004) was published as International Publication WO 2007/083122 on 7-26-2007 and is therefore prior art under § 102(a)(1). Coulson-122
5 was before the examiner during prosecution of the '876 patent.

B. Badyal

Badyal (Ex. 1005) published as International Publication WO 99/64662 on 12-16-1999 and is prior art under § 102(a)(1). Badyal was not before the examiner.

C. Cohen

10 Cohen (Ex. 1006) issued as U.S. Patent 2,716,638 on 8-30-1955 and qualifies as prior art under § 102(a)(1). Cohen was not before the examiner.

D. Holliday

Holliday (Ex. 1007) issued as U.S. Patent 3,816,564 on 6-11-1974 and qualifies as prior art under § 102(a)(1). Holliday was not before the examiner.

15 **E. Padiyath**

Padiyath (Ex. 1008) published on 1-25-2007, as U.S. Patent Application Publication US 2007/0020451 and is prior art under § 102(a)(1). Padiyath was not before the examiner.

F. Francesch

20 Francesch (Ex. 1009) is a scientific article entitled "Fabrication of Bioactive Surfaces by Plasma Polymerization Techniques Using a Novel Acrylate-Derived

Monomer,” published in the journal *Plasma Processes and Polymers*. Francesch bears a year-2005 copyright notice as a publication of Wiley-VCH Verlag GmbH & Co., as well an abbreviated citation bearing the year 2005 (“*Plasma Process. Polym.* 2005, 2, 605–611”). Ex. 1009 at 605. A POSA would have recognized Wiley as an established publisher of scientific and technical articles and would have been familiar with *Plasma Processes and Polymers* as a well-known scientific journal in the polymer field. Ex. 1002 ¶ 77. The copyright and citation dates thus demonstrate that Francesch became publicly available as a printed publication during the year 2005. See *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 19-20 (PTAB Dec. 20, 2019) (precedential). In addition, the accompanying declaration provided by an author of the article demonstrates that Francesch was made publicly available in September 2005. Ex. 1010. Accordingly, Francesch is a prior-art printed publication under § 102(a)(1). Francesch was not before the examiner during prosecution.

G. Tropsch

Tropsch (Ex. 1011) issued as U.S. Patent 5,804,669 on 9-8-1998 and is prior art under § 102(a)(1). Tropsch was not before the examiner.

VII. Detailed discussion of the grounds for unpatentability

Every claim in the '876 patent would have been obvious over the prior art.

The claims cover protective coatings applied to an electronic device by plasma

polymerizing PFAC8 or PFMAC8 with a crosslinker having two double bonds and one of several different bridging groups. Applying protective plasma-polymer coatings to electronics was well known, and the prior art described using the claimed monomers and using crosslinkers with those monomers.

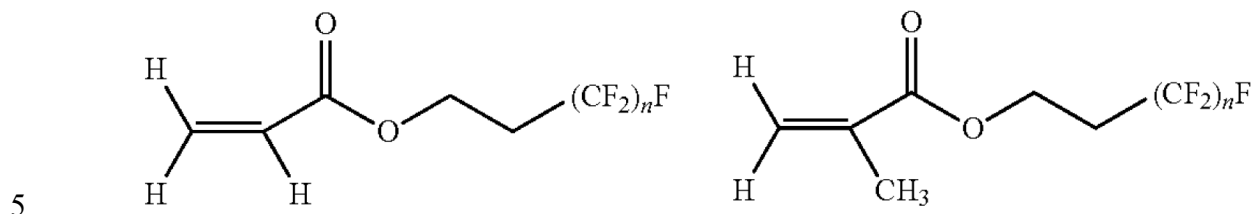
5 The '876 patent was nevertheless allowed to issue by claiming a jumble of crosslinkers because the examiner concluded that crosslinkers with several claimed bridging-group structures were absent from the prior art. That conclusion was wrong. As detailed below, the prior art taught *every* aspect the claims—including the collection of bridging groups in claim 1 and those recited separately in various dependent
10 claims. Crosslinking reagents with each of those bridging groups were known and would have been obvious for use in prior-art coatings. The asserted grounds have not previously been considered by the Office, and they demonstrate that the '876 patent never should have issued.

15 **A. All Grounds: Coulson-122 and Badyal described coatings applied using the same polymerization techniques, the same monomeric compounds, and the same group of crosslinkers as the '876 patent**

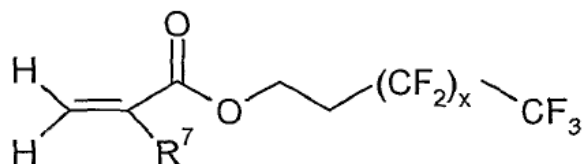
Coulson-122 and Badyal both were published well before June 2015, and those references together described nearly every aspect of the '876 claims.

20 Coulson-122 emphasized the “well-known” and “acute” need to protect electronic devices from liquids. *E.g.*, Ex. 1004 1:3-34. It then described coating electronics with protective, liquid-repellent polymer coatings formed by plasma

deposition using the same acrylate and methacrylate monomers as the '876 patent, including monomers *identical* to those specified in claims 12-15. *E.g.*, Ex. 1004 3:20-4:3, 12:7-23; Ex. 1001 21:7-22:21. For example, claims 1-15 all cover one or both of the following acrylate and methacrylate fluorinated monomer structures:



where n is 2-10, such as eight (PFAC8/PFMAC8). Ex. 1001 21:7-22:21 (dependent claims 12-15), 11:27-56; Ex. 1002 ¶ 60. Coulson-122 had long before described using the same monomers, as shown below:

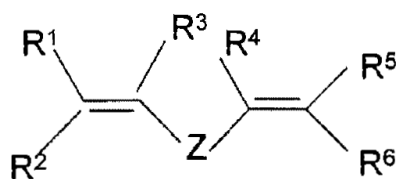


10 Ex. 1004 12:13-22. In particular, R^7 was described as hydrogen or methyl, and x was 1-9, such as seven (*i.e.*, PFAC8/PFMAC8).² Ex. 1004 12:13-22; Ex. 1002 ¶¶ 67, 114, 120. Badyal taught coatings applied to “any solid substrate,” and described using the

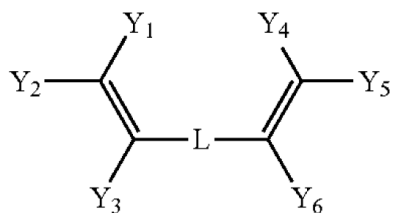
² Specifying x as seven in Coulson-122 and n as eight in the '876 patent identifies the same compounds (PFAC8 and PFMAC8) because Coulson-122 depicted the terminal CF_3 group separately from the repeating CF_2 chain, while the '876 patent presented the terminal carbon as part of the chain. Ex. 1002 ¶¶ 44, 114.

same monomers as Coulson-122 to apply liquid-repellent coatings by plasma polymerization. Ex. 1005 4:11-23, 7:20-9:34, 10:32-11:27; Ex. 1002 ¶¶ 69, 115, 118, 121.

Badyal further taught combining those monomers with a crosslinker to form crosslinked plasma-polymer coatings with improved durability. Ex. 1005 4:1-5:23. And Badyal described crosslinking reagents of the *same basic structure* as those claimed in the '876 patent:



Badyal



'876 patent

Ex. 1005 5:1-5 (Badyal Formula (I)); Ex. 1001 4:51-67, 18:60-67 ('876 patent formula (i), claim 1). The generic crosslinker structures reproduced above are identical. Ex. 1002 ¶ 116. Each has two double bonds, six substituent positions (R^1 - R^6 and Y_1 - Y_6), and a generic “bridging” or “linking” group (Z and L, respectively). Badyal taught that R^1 - R^6 are hydrogen, halo, or optionally substituted alkyl or aryl, and preferably all hydrogen. Ex. 1005 5:3-5, 6:5-7. In the '876 patent, Y_1 - Y_6 are likewise hydrogen or optionally substituted alkyl or aryl, with every preferred crosslinker

defining Y₁-Y₆ as hydrogen. Ex. 1001 4:64-67, Table 1.

Those references differed from the '876 claims in only *one* part of *one* component of the claimed coatings—specifically, the bridging group of the crosslinking reagent. Badyal described some exemplary bridging groups, especially those containing oxygen atoms, but more broadly taught that “suitable bridging groups ... are those known in the polymer art.” Ex. 1005 5:18-6:20. A POSA would have taken that advice and plugged in bridging groups from well-known crosslinkers to arrive at the '876 claims. In particular, each claim of the '876 patent recites crosslinkers that had long been known and used in the polymer art. Selecting known crosslinkers from Badyal's known crosslinker genus for use in a known plasma-coating procedure amounted to no more than altering “a structure already known in the prior art ... by the mere substitution of one element for another known in the field.” *KSR*, 550 U.S. at 416. Accordingly, the claims of the '876 patent would have been obvious over the prior art.

B. Ground 1: Claims 1-3, 9, and 11-15 were obvious over Coulson-122, Badyal, and Cohen

Coulson-122 and Badyal together expressly disclosed every limitation of the '876 claims except for the specific bridging-group structures. Cohen taught one claimed crosslinker that had been known and used for decades to create crosslinked co-polymer coatings used for electrical insulation. Coulson-122, Badyal, and Cohen together would have rendered claims 1-3, 9, and 11-15 of the '876 patent obvious.

1. Claim 1

a. Claim limitations

[Preamble] “An electronic or electrical device or electronic or electrical component thereof comprising”

5 To the extent this preamble is limiting, Coulson-122 described electronic devices and components with protective coatings applied via plasma polymerization. Ex. 1004 Abstract, 3:20-4:3, 4:17-5:26. Cohen similarly described polymer compositions used for insulating electrical devices, Ex. 1006 5:8-25, and Badyal taught that plasma deposition could be used to coat “any solid substrate,” which a POSA would
10 have known to include electronic devices, Ex. 1005 9:28-30, 2:10-20, 11:19-24; Ex. 1002 ¶ 118.

**[1a] “a protective cross-linked polymeric coating on a surface of said device or component; wherein the protective cross-linked polymeric coating is obtained by exposing said device or component to a plasma comprising a monomer compound and a crosslinking reagent for a
15 period of time sufficient to allow formation of the protective cross-linked polymeric coating on a surface thereof,”**

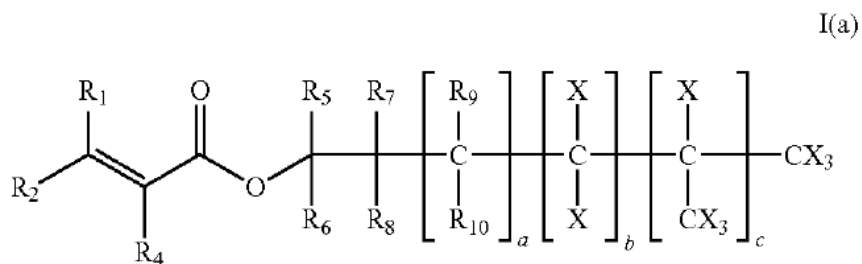
The '876 patent explains that a coating can be protective by repelling water or by forming a barrier to provide electrical insulation. Ex. 1001 1:8-13; Ex. 1002 ¶ 119.
20 Both Coulson-122 and Badyal described water-repellent coatings applied by plasma polymerization using a hydrophobic monomer, and Badyal expressly described copolymerizing the monomer with a crosslinking reagent to create crosslinked polymers as claimed.

Coulson-122 described electronic devices having a polymeric, liquid-

repellent coating “formed by exposing said device to pulsed plasma.” Ex. 1004 3:14-22. The substrates were exposed to a plasma comprising a monomer compound until a protective, water-repellent coating formed on the substrate surface. Ex. 1004 12:24-13:17, 7:14-30, 9:25-28, 10:11-16, 14:7-23.

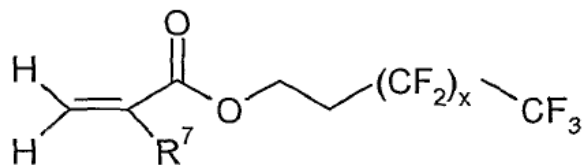
5 Badyal also described producing water-repellent coatings on a substrate surface. Ex. 1005 1:3-5, 9:28-32, 11:19-24. The coatings were formed by exposing the substrate to a plasma comprising multiple organic compounds, including a monomer and at least one crosslinking reagent comprising two double bonds, “so as to form a layer of cross-linked polymer” on the substrate’s surface. Ex. 1005 4:4-9; *see also*
 10 *id.* 4:17-27. Suitable monomers included the same water-repellent perhalogenated monomers described by Coulson-122. Ex. 1005 6:24-7:15, 8:15-9:19, 11:15-17; Ex. 1002 ¶¶ 69, 115, 121. Badyal described exposing the substrate to the plasma for a sufficient time to form a protective, water-repellent coating on the substrate surface. Ex. 1005 10:27-11:9; 12:5-9, 4:17-27. Badyal taught that its crosslinked coatings
 15 provided improved durability. Ex. 1005 4:1-9, 4:17-29.

[1b] “wherein the monomer compound is a compound of formula I(a):



wherein each of R₁, R₂, R₄ and R₅ to R₁₀ is independently selected from hydrogen or an optionally substituted C₁-C₆ branched or straight chain alkyl group; each X is independently hydrogen or halogen; a is from 0-10; b is from 3 to 7; and c is 0 or 1;”

Coulson-122 and Badyal both disclosed using monomer compounds matching the acrylate-based structure in claim 1. Coulson-122 described using acrylate-based monomers having the following structure:

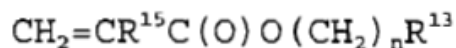


5 Ex. 1004 12:14-22; Ex. 1002 ¶¶ 67, 114, 120. Preferred substituents at the R⁷ position were hydrogen or methyl, and the number of CF₂ groups (x) was preferably 7. Ex. 1004 12:13-21. A POSA would have recognized the resulting preferred monomers as PFAC8 and PFMAC8.³ Ex. 1002 ¶ 120.

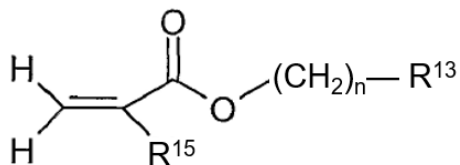
10 Badyal described the same fluorinated, acrylate-based monomers—PFAC8 and PFMAC8—as Coulson-122. Badyal provided the following preferred monomer

³ In Example 1, Coulson-122 identified PFAC8 by its unique Chemical Abstracts Service (CAS) number 27905-45-9 and as “1H, 1H, 2H, 2H-heptadecafluorodecylacrylate,” which a POSA would have understood as a misspelling of a common synonym for PFAC8: 1H,1H,2H,2H-heptadecafluorodecyl acrylate. Ex. 1004 14:7-10; Ex. 1002 ¶ 67.

formula:



Ex. 1005 9:10-16. A POSA would have understood that formula as corresponding to the following chemical structure:



Ex. 1002 ¶ 121. Badyal taught that R^{15} was hydrogen or an “alkyl, such as methyl.”

Ex. 1005 9:16. The number of CH_2 groups could be from 1-10, preferably two.⁴ Ex.

1005 9:15-16, 7:20-28, 8:26-28. And R^{13} was preferably a perfluoroalkyl chain of the formula $\text{C}_s\text{F}_{2s+1}$, such as C_8F_{17} . Ex. 1005 8:15-18, 9:15-16. From that description,

10 a POSA would have recognized PFAC8 and PFMAC8 as preferred monomer species.

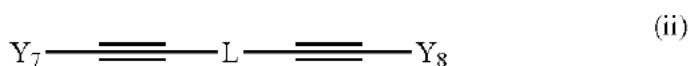
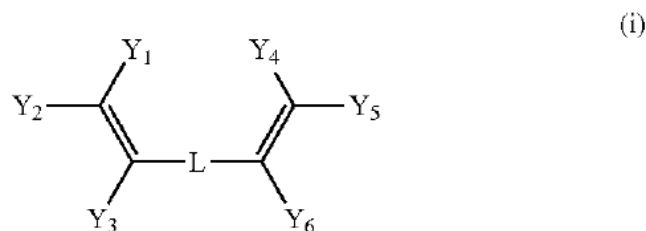
Ex. 1002 ¶ 121.

PFAC8 and PFMAC8 both satisfied the claimed monomer formula: (1) R_1 , R_2 , and R_5 - R_8 of claim 1 can be hydrogen; (2) R_4 of claim 1 includes hydrogen (like

⁴ Badyal’s monomer formula enumerated the CH_2 group using *n*, but the supporting text referred to *m*, and a POSA would have understood the formula should read $(\text{CH}_2)_m$ to align with the supporting discussion. Ex. 1005 9:15-16, 7:20-28, 8:26-28; Ex. 1002 ¶ 121.

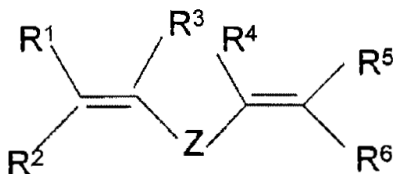
PFAC8) or C₁ alkyl (*i.e.*, methyl, like PFMAC8); (3) each X in claim 1 can be halogen, which includes fluorine; (4) claim 1 includes defining *a* and *c* as zero; and (5) claim 1 includes defining *b* as 7. Ex. 1002 ¶122. Furthermore, PFAC8 and PFMAC8 necessarily fell within the scope of claim 1 because claims 13 and 15 depend from claim 1 and specifically recite PFAC8 and PFMAC8, respectively, as covered monomers. Ex. 1001 21:20-22:21; *Alcon Research, Ltd. v. Apotex Inc.*, 687 F.3d 1362, 1367 (Fed. Cir. 2012).

[Ic] “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 Y₁, Y₂, Y₃, Y₄, Y₅, Y₆, Y₇ and Y₈ are each independently selected from hydrogen, optionally substituted cyclic, branched or straight chain C₁-C₆ alkyl or aryl; and L is a linker moiety;”

Badyal described a crosslinking reagent that matched structure (i) in '876 claim 1. Badyal's crosslinking reagent comprised two double bonds attached through a linker moiety identified as “bridging group Z”:



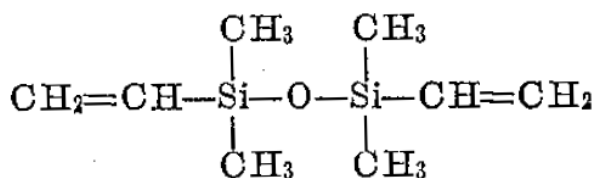
Ex. 1005 4:31-5:5. POSAs knew that a double bond is one type of unsaturated bond.

Ex. 1002 ¶ 124. Badyal disclosed that R¹-R⁶ in the prior-art crosslinking reagents could be hydrogen or alkyl, among others, and were preferably hydrogen. Ex. 1005

5 5:3-5, 6:5-8. Within the disclosed generic crosslinking structure above, Badyal taught that “suitable bridging groups Z” included “those known in the polymer art.”

Ex. 1005 5:18-19.

Cohen described one specific crosslinking reagent that matched the same generic structure in both Badyal and claim 1 and was “known in the polymer art” since
10 at least 1955: divinyl tetramethyl disiloxane (DVTMDS). The structure of DVTMDS is shown below:



Ex. 1006 1:25-30. DVTMDS contained two double bonds, hydrogen at each of Badyal’s R¹-R⁶ positions (positions Y₁₋₆ in claim 1), and a tetramethyl disiloxane

15 bridging group. Ex. 1002 ¶ 125. As a POSA would have known, the boiling point of DVTMDS at standard pressure is approximately 137°C (well below 500°C). Ex.

1006 3:44-45. Cohen taught that DVTMDS could be “copolymerized with other

copolymerizable materials,” especially molecules such as acrylates and methacrylates that contain a double bond. Ex. 1006 1:31-34, 2:14-30, 4:18-31. In addition, Cohen taught that DVTMDS copolymers could be made into films and that copolymerizing DVTMDS with a methacrylate produced a crosslinked polymer product.

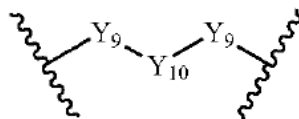
5 Ex. 1006 2:60-63, 3:52-65.

[1d] [Formula A] “wherein for compound (i) L is of formula A having one of the following structures:



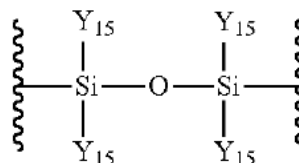
10 and Y₁₀ is selected from optionally substituted cyclic, branched or straight chain C₁-C₈ alkylene and a siloxane group; or

[Formula B] wherein for compound (i) L is of formula B having the following formula:



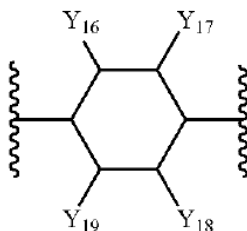
15 where each Y₉ is independently selected from, a bond, —O—, —O—C(O)—, —C(O)—O—, —Y₁₁—O—C(O)—, —C(O)—O—Y₁₁—, —OY₁₁—, and —Y₁₁O—, where Y₁₁ is an optionally substituted cyclic, branched or straight chain C₁-C₈ alkylene; and

[Formula B1] wherein Y₁₀ has the following formula:



and each Y₁₅ is independently selected from optionally substituted branched or straight chain C₁-C₆ alkyl; or

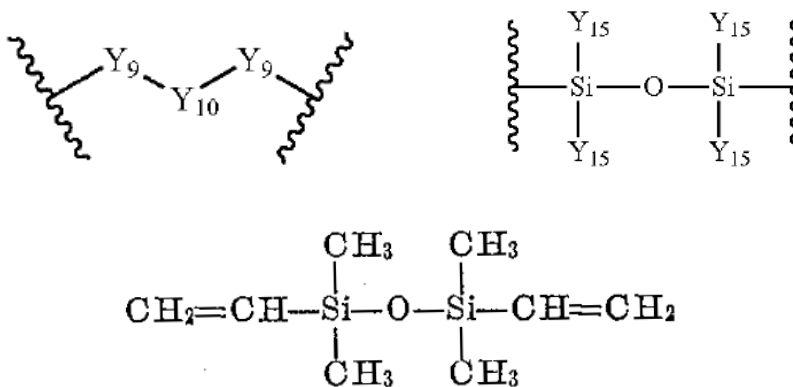
[*Formula B2*] wherein Y₁₀ has the following formula:



5 and Y₁₆ to Y₁₉ are each independently selected from H and optionally substituted branched or straight chain C₁-C₈ alkyl or alkenyl.”

Claim 1 concludes by reciting several alternative structures, any one of which can make up the crosslinking reagent’s bridging group. Claim 1 divides the covered structures into Formulas A and B, and the claim further presents two alternative sub-
10 structures for Y₁₀ of Formula B—denoted above as Formulas B1 and B2.

Cohen disclosed DVTMDS, which fell within the scope of Formula B1. For comparison, Formulas B and B1 are compared with DVTMDS below:



15 As shown, the bridging group in DVTMDS satisfied Formula B1 because it contained: (1) a bond at each Y₉ position of Formula B; (2) the disiloxane structure of

Formula B1 at the Y₁₀ position of Formula B; and (3) C₁-C₆ alkyl, specifically methyl, at each Y₁₅ position of Formula B1. Ex. 1002 ¶ 127. Furthermore, DVTMDS necessarily fell within the scope of claim 1 because claim 11, which depends from claim 1, specifically recites DVTMDS as a covered crosslinker. Ex. 1001 21:2-3;

5 *Alcon*, 687 F.3d at 1367.

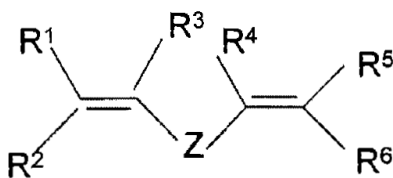
b. Motivation to combine Coulson-122, Badyal, and Cohen's crosslinking reagent

As documented by Coulson-122 and numerous other references, there was by 2015 a clear market incentive to protect sensitive electronic devices from damage due to environmental exposure—driven especially by the ongoing proliferation of portable electronics. Ex. 1004 1:9-34; Ex. 1002 ¶¶ 58, 128. That design incentive would have motivated a POSA to improve upon preexisting technology, like Coulson-122, to seek new and more robust protective coatings for electronic devices. Ex. 1002 ¶¶ 128-131; *KSR*, 550 U.S. at 417-18.

15 Coulson-122 identified plasma polymerization as a clean, dry, and efficient technique for coating various surfaces, Ex. 1001 2:33-3:12, and described PFAC8 and PFMAC8 as specific fluorinated, acrylate-based monomers that safely provided effective liquid-repellent coatings on electronic devices through plasma polymerization, Ex. 1001 3:14-18, 4:29-5:13, 12:7-22. Badyal would have motivated the POSA to improve the Coulson-122 coatings by adding a crosslinking reagent during plasma polymerization because Badyal taught—and a POSA would have known—that 20

crosslinked polymer coatings typically exhibited improved durability, barrier properties, smoothness, and solvent resistance. Ex. 1005 1:31-2:1, 4:1-29; Ex. 1006 3:51-65; Ex. 1002 ¶¶ 129-131. A POSA would have viewed protective coatings with enhanced durability as highly desirable, particularly for devices like mobile phones that typically receive daily use under various conditions for years on end. Ex. 1002 ¶ 129. Furthermore, Badyal described successfully producing crosslinked coatings containing the same monomers used in Coulson-122, so a POSA would naturally have looked to Badyal for guidance on which crosslinking reagents to add into Coulson-122's plasma-polymer coatings.⁵ Ex. 1002 ¶ 131.

Badyal taught that suitable crosslinkers should comprise two double bonds and conform to the following basic structure:



⁵ Badyal's preferred embodiments drawn to coated fabrics rather than electronics "do not negate the motivation to combine the references." *In re Hyon*, 679 F.3d 1363, 1366 (Fed. Cir. 2012). Badyal's teachings were not limited to preferred fabric embodiments—the crosslinked coatings could be applied to "any solid substrate." Ex. 1005 9:28-34, 11:19-24; Ex. 1002 ¶ 131.

Ex. 1005 4:31-5:5. Regarding the bridging group Z, Badyal broadly taught that suitable structures “are those known in the polymer art.” Ex. 1005 5:18-19. Badyal further taught that the linker group could be interposed with oxygen atoms and need not include haloalkyl substitutions, particularly when using a monomer—like the
5 perfluorinated acrylate derivatives of Coulson-122—that contains a halogenated group. Ex. 1005 6:24-7:2. Based on Coulson-122 and Badyal, a POSA would have been motivated to coat electronic devices via plasma polymerization using the prior-art Coulson-122 monomers combined with a crosslinker that was known in the polymer art, consistent with Badyal’s established crosslinker formula, and preferably
10 associated with protective properties for electronics. Ex. 1002 ¶ 132. A POSA also would have preferred crosslinking reagents like DVTMDS with a normal boiling point close to or less than those of PFAC8 and PFMAC8 (approximately 267°C and 300°C, respectively) to facilitate supplying a plasma chamber with monomer and crosslinker vapors. Ex. 1002 ¶¶ 47, 126, 133.

15 With the knowledge and incentives from Coulson-122 and Badyal described above, a POSA would have identified and been motivated to use DVTMDS as a suitable crosslinker in view of Cohen. As indicated by Cohen’s issue date in 1955, DVTMDS was familiar and had been widely used in the polymer art by June 2015. Ex. 1006 2:10-14, 3:51-65; Ex. 1002 ¶¶ 125, 132-133. DVTMDS matched Badyal’s
20 generic structural formula for suitable crosslinking reagents. Ex. 1002 ¶¶ 125, 132.

DVTMDS also had known properties that would have commended its use to a POSA as a crosslinker with the teachings of Coulson-122 and Badyal. A POSA would have known that DVTMDS was widely compatible for co-polymerization with other compounds, including acrylate derivatives. Ex. 1006 2:14-27, 3:51-65, 4:18-56; Ex. 1002 ¶¶ 73, 125, 132. A POSA also would have known that DVTMDS was compatible with various polymerization methods, including plasma polymerization Ex. 1002 ¶ 132; *see e.g.*, Ex. 1006 1:31-34; Ex. 1017 Abstract, 4:1-30; Ex. 1033 at [0040-43]. In addition, a POSA would have known that DVTMDS had been used in polymers applied to electronics, Ex. 1002 ¶ 132; *see* Ex. 1006 5:1-25, and that coatings containing DVTMDS or other organosilicon compounds were associated with water-repellent, barrier, and electrically insulating properties, Ex. 1002 ¶ 132; *see also* Ex. 1006 5:1-12 (insulating); Ex. 1018 1:6-11 (insulating); Ex. 1033 ¶¶ 37, 40-45, (insulating) Ex. 1017 3:27-41, 6:31-36 (moisture-resistant, barrier); Ex. 1014 4:5-5:13 (insulating, water-repellent). In addition, a POSA would have recognized that the relatively low boiling point of DVTMDS (137°C) would have been compatible for combined use with vaporized PFAC8 or PFMAC8 in plasma polymerization. Ex. 1002 ¶¶ 54-55, 126, 133.

Accordingly, the combined teachings of Coulson-122, Badyal, and Cohen would have motivated a POSA to prepare an electronic device bearing a protective plasma-polymer coating as recited in claim 1.

c. Reasonable expectation of success

A POSA reasonably would have expected to succeed in combining Coulson-122, Badyal, and Cohen as in claim 1 because the claimed combination represented no more than known elements with each performing its known and expected function.

Plasma polymerization was routine and well within the skill of a POSA by June 2015. Ex. 1002 ¶¶ 32, 64, 134; Ex. 1001 14:59-67; Ex. 1005 2:10-13, 10:8-12.

A POSA would have expected a known compound like DVTMDS that fit Badyal's generic crosslinker structure to yield protective coatings when co-polymerized under plasma with Coulson-122's PFAC8 and PFMAC8 monomers because Badyal taught that crosslinkers sharing the same basic structure would be suitable for that purpose. Ex. 1002 ¶ 135; Ex. 1005 4:17-5:19. In addition, Cohen taught that DVTMDS was broadly compatible for co-polymerization with various compounds including modified acrylates using various polymerization techniques. Ex. 1006 1:31-34, 2:14-27.

A POSA thus would have expected DVTMDS to serve as an effective crosslinker in the Coulson-122/Badyal combination because PFAC8 and PFMAC8 are also acrylate-based monomers and because a POSA would have known that DVTMDS had been used for plasma polymerization and at any rate a polymerization reaction successfully carried out using one activation method (like free-radical polymerization) generally can be carried out using another (like plasma polymerization). Ex. 1002

¶¶ 53, 135. Badyal reinforced that understanding by teaching that suitable crosslinking structures included those known “in the *polymer art*,” without subdividing by activation technique. Ex. 1005 4:18-19 (emphasis added); Ex. 1002 ¶ 53.

Given the known properties associated with DVTMDS as described above, a
5 POSA would have expected coatings to exhibit protective water-repellent and barrier properties. Ex. 1002 ¶¶ 132, 135. And a POSA would have expected the combined coating to be successful as applied to electronic devices because Coulson-122 and Cohen described electronics applications for the relevant polymer substituents and Badyal taught that the crosslinked combination could be applied to any solid
10 surface. Ex. 1002 ¶ 135.

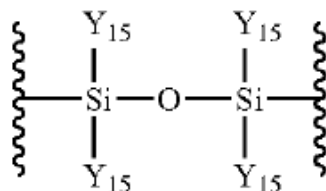
In view of the foregoing, claim 1 would have been obvious over Coulson-122, Badyal, and Cohen.

2. Claims 2, 3

These claims are discussed in light of all grounds in Subsection G, below.

3. Claim 9

“The device or component according to claim 1, wherein when for compound (i) L is of formula B and Y₁₀ has the following formula:



each Y₁₅ is methyl, and each Y₉ is a bond.”

As explained above, DVTMDS has the methylated Formula B1 bridging-group structure recited in claim 9. Ex. 1002 ¶¶ 127, 137. Accordingly, claim 9 would have been obvious over the combination of Coulson-122, Badyal, and Cohen for the same reasons as claim 1.

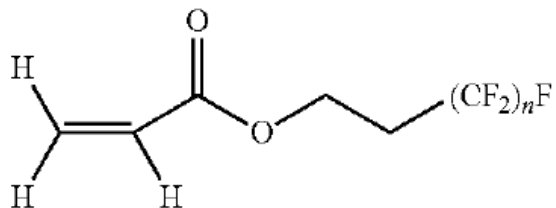
4. Claim 11

“The 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-divinyltetramethyldisiloxane (DVTMDS), diallyl 1,4-cyclohexanedicarboxylate (DCHD), 1,6-divinylperfluorohexane (DVPFH), 1H,1H,6H,6H-perfluorohexanediol diacrylate (PFHDA) and glyoxal bis (diallyl acetal) (GBDA).”

As explained above, DVTMDS is the crosslinker in the asserted combination of Coulson-122, Badyal, and Cohen. Accordingly, claim 11 would have been obvious for the same reasons as claim 1.

5. Claims 12, 13

“12. The device or component according to claim 1, wherein the compound of formula I(a) has the following formula:



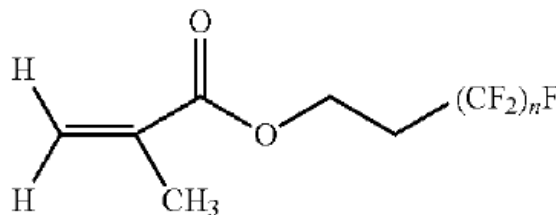
where n is from 2 to 10.”

“13. The device or component according to claim 12, 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).”

As explained above for claim 1, both Coulson-122 and Badyal described PFAC8 as a preferred monomer. Claims 12 and 13 therefore would have been obvious for the same reasons as claim 1.

6. Claims 14, 15

“14. The device or component according to claim 1, wherein the compound of formula I(a) has the following formula:



where n is from 2 to 10.”

5 **“15. The device or component according to claim 14, wherein the compound of formula I(a) is selected from 1H,1H,2H,2H-perfluorohexyl methacrylate (PFMAC4), 1H,1H,2H,2H-perfluorooctyl methacrylate (PFMAC6) and 1H,1H,2H,2H-perfluorodecyl methacrylate (PFMAC8).”**

As explained above for claim 1, both Coulson-122 and Badyal described PFMAC8 as a preferred monomer. Claims 14 and 15 therefore would have been obvious for the same reasons as claim 1.

10 **C. Ground 2: Claims 1-8 and 10-15 were obvious over Coulson-122, Badyal, and Holliday**

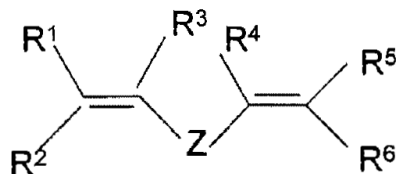
1. **Claim 1**

a. **Claim limitations**

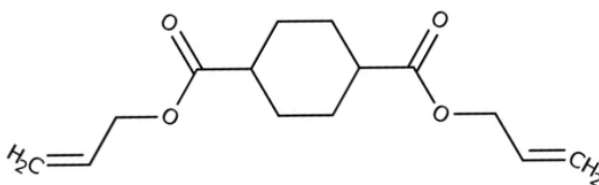
As explained above in Sections VII.A and VII.B.1, Coulson-122 and Badyal described every limitation of claim 1 except the specific bridging groups identified for the crosslinking reagent, and those references would have motivated a POSA to use structurally compatible crosslinkers that had favorable properties and were known in the polymer art.

Holliday taught polymer compositions “for use in providing electrical insulation.” Ex. 1007 1:11-12; Ex. 1002 ¶¶ 74, 143. Holliday described applying a mixture of a polyolefin, polyvinyl chloride, and at least one crosslinking compound to an electrical device or component and then initiating polymerization, which “cured” the composition “to form a crosslinked insulation layer.” Ex. 1007 2:39-70; Ex. 1002 ¶ 143. Holliday identified several crosslinking reagents for use in those coatings,

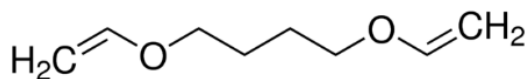
including two that matched Badyal's specified structural criteria: diallyl-1,4-cyclohexanedicarboxylate (DCHD) and 1,4-divinyl-oxybutane (also known as 1,4-butanediol divinyl ether (BDVE)):



Badyal



DCHD

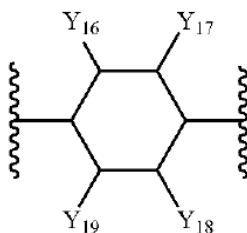


BDVE

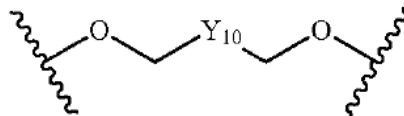
Ex. 1002 ¶ 144; Ex. 1005 5:1-5; Ex. 1007 3:34-35, 3:52-53.

As shown, DCHD and BDVE both contained two double bonds. DCHD satisfied Formula B2 of claim 1, where Y₁₋₆ are hydrogen, Y₉ is —Y₁₁—O—C(O)—,

Y₁₁ is C₁ alkylene, Y₁₀ is



and Y₁₆₋₁₉ are hydrogen. Ex. 1002 ¶ 148. BDVE satisfied Formula A, where Y₁₋₆ are hydrogen, the linker group is



and Y₁₀ is straight-chain C₂ alkylene. Ex. 1002 ¶ 149. The calculated boiling points of DCHD and BDVE are approximately 331°C and 201°C, respectively. Ex. 1002 ¶¶ 145-147. Furthermore, DCHD and BDVE necessarily fell within the scope of claim 1 because claim 11, which depends from claim 1, specifically recites both as covered crosslinkers. Ex. 1001 20:67, 21:3-4.

b. Motivation to combine and reasonable expectation of success

A POSA would have been motivated to use Holliday's DCHD and BDVE crosslinkers in the Coulson-122/Badyal combination because those compounds were known in the polymer art, aligned with Badyal's suitable crosslinking reagents, and had useful properties for applying protective coatings to electronics. DCHD and BDVE were known crosslinkers in the polymer art at least since Holliday's issue date in 1974. Ex. 1007; Ex. 1002 ¶ 150. Both fit well within Badyal's class of preferred crosslinking structures, including linker moieties comprising "alkyl groups ... interposed with oxygen atoms." Ex. 1005 5:18-21; Ex. 1002 ¶ 150. Furthermore, both had boiling points near to or less than the boiling points of PFAC8 and PFMAC8, which a POSA would have known would provide good compatibility for supplying those reagents together to a plasma chamber. Ex. 1002 ¶¶ 145-147, 152. Holliday directed POSAs to include acrylate or methacrylate compounds in the

disclosed polymerizable mixture, Ex. 1007 3:55-60, which would have suggested to a POSA that DCHD and BDVE would be compatible for polymerizing with the preferred acrylate/methacrylate monomers (PFAC8/PFMAC8) of Coulson-122 and Badyal. Ex. 1002 ¶ 151. Holliday taught that its crosslinkers could be cured using multiple polymerization techniques. Ex. 1007 2:50-52, 2:68-70 (peroxide and irradiation curing). And Holliday taught that polymer coatings produced with the disclosed crosslinkers provided excellent durability, chemical resistance, and electrical insulation. Ex. 1007 5:34-54. Accordingly, a POSA reading Holliday would have been motivated to use DCHD and BDVE as crosslinking reagents in combination with Coulson-122/Badyal to produce protective polymer coatings as in claim 1. Ex. 1002 ¶¶ 151-152.

In addition, a POSA reasonably would have expected to succeed with those prior-art combinations. As noted above in Sections IV.B.2 and VII.B.1.c, POSAs considered plasma polymerization routine by June 2015. In addition, a POSA would have expected compounds like DCHD and BDVE that fit Badyal's generic crosslinker structure to successfully co-polymerize with the Coulson-122 monomers because Badyal taught that such crosslinkers would work. Ex. 1002 ¶ 153; Ex. 1005 4:17-5:19. In addition, Holliday taught that its crosslinkers were compatible with acrylates and methacrylates and with various polymerization activators. Ex. 1007 2:50-70, 3:55-60. A POSA thus would have expected DCHD and BDVE to serve as

effective crosslinkers in the Coulson-122/Badyal combination because those references used acrylate-based PFAC8 and PFMAC8 monomers and because a POSA would have known that a polymerization reaction successfully carried out using one activation method (like irradiation) generally can be carried out using another (like plasma polymerization). Ex. 1002 ¶¶ 53, 153. Furthermore, a POSA would have been aware the BDVE had already been used as a crosslinker for plasma polymerization. Ex. 1002 ¶ 153; Ex. 1009 at 606-07. And a POSA would have expected the combined coating to be successful as applied to electronic devices because Coulson-122 and Holliday described electronics applications for the relevant polymer substituents and Badyal taught that the crosslinked combination could be applied to any solid surface. Ex. 1002 ¶ 153.

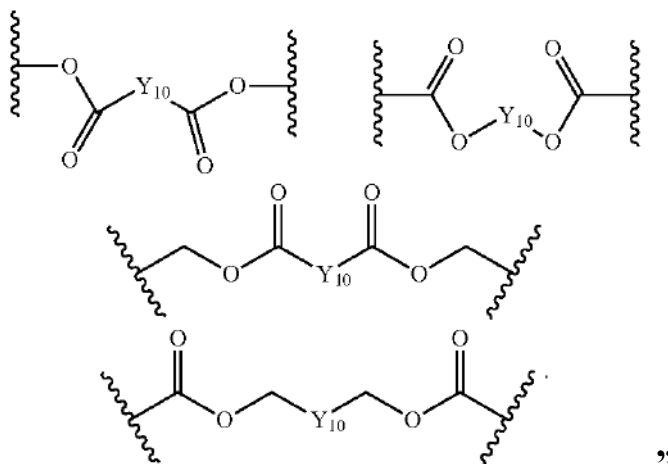
Accordingly, claim 1 would have been obvious over Coulson-122, Badyal, and Holliday.

2. Claims 2, 3

See Subsection G below.

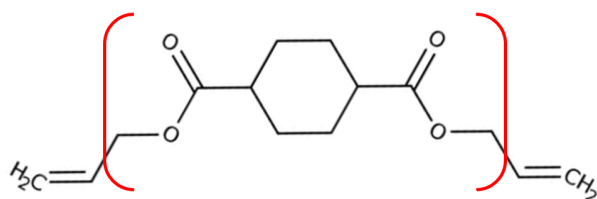
3. Claim 4

“The device or component according to claim 1, wherein when for compound (i) L is of the formula B, L has one of the following structures:



5

As described, the combination of Coulson-122, Badyal, and Holliday includes devices coated using DCHD as the crosslinking reagent. As described, DCHD matches formula B2 of claim 1, and the third of the four linker structures shown in claim 4 matches the linker moiety of DCHD (bracketed in red below):

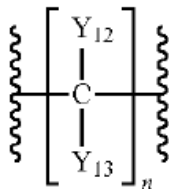


10

Ex. 1002 ¶ 155. Accordingly, claim 4 would have been obvious over the combination of Coulson-122, Badyal, and Holliday’s disclosure of DCHD as a known, suitable crosslinking reagent for the same reasons as claim 1.

4. Claims 5, 6

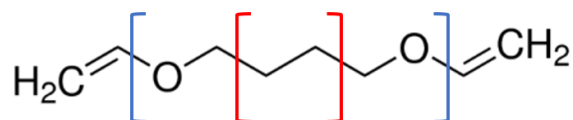
“5. The device or component according to claim 1, wherein when for compound (i) L is of formula A, Y₁₀ has the following formula:



wherein each Y₁₂ and Y₁₃ is independently selected from H, halo, optionally substituted cyclic, branched or straight chain alkyl, or —OY₁₄, where Y₁₄ is selected from optionally substituted branched or straight chain C₁-C₈ alkyl or alkenyl, and n is an integer from 1 to 10.”

“6. The device or component according to claim 5, wherein each Y₁₂ is H and each Y₁₃ is H.”

As described, the combination of Coulson-122, Badyal, and Holliday includes devices coated using BDVE as the crosslinking reagent. The linker moiety of BDVE (bracketed in blue below) matches Formula A and includes a two-carbon chain (bracketed in red below) corresponding to Y₁₀ in claim 1, where Y₁₂ and Y₁₃ are both hydrogen and n is 2:



Ex. 1002 ¶¶ 156-157. Accordingly, claims 5 and 6 would have been obvious over the combination of Coulson-122, Badyal, and Holliday’s disclosure of BDVE as a known, suitable crosslinking reagent for the same reasons as claim 1.

5. Claim 7

“The device or component according to claim 5, wherein each Y₁₂ is fluoro and each Y₁₃ is fluoro.”

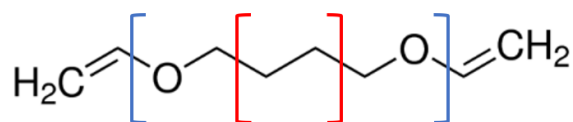
As noted for claims 5 and 6, BDVE contains a CH₂-CH₂ chain corresponding
5 to Y₁₀ of Formula A. Badyal taught that alkyl chains in bridging group Z could be perfluoroalkyl chains and that highly fluorinated coatings exhibit “super-hydrophobicity.” Ex. 1005 5:18-23, 10:32-11:1. Consistent with Badyal’s teachings, it was well known that perfluorinated alkyl groups were strongly hydrophobic when incorporated into polymer coatings, Ex. 1005 1:19-23, and a POSA would have wanted
10 to maximize hydrophobicity in protective coatings intended for electronic devices. Ex. 1002 ¶¶ 58, 158. A POSA therefore would have been motivated to substitute fluorine at every Y₁₂ and Y₁₃ hydrogen position in BDVE for enhanced hydrophobicity while maintaining the flanking alkylene spacers to preserve reagent stability and a POSA would have reasonably expected to succeed because methods for preparing
15 fluorinated divinyl ethers were known and because Badyal taught that the bridging group could include fluorine substitutions. Ex. 1002 ¶¶ 158, 46; Ex. 1005 at 5:18-6:13.

Accordingly, claim 7 would have been obvious over the combination of Coulson-122, Badyal, and Holliday.

6. Claim 8

“The device or component claim 5, wherein n is from 4 to 6.”

As noted for claims 5 and 6, BDVE contains a CH₂-CH₂ chain corresponding to Y₁₀ of Formula A. A POSA would have known that the longer an alkyl chain is, the more hydrophobic and flexible the resulting molecule will be. Ex. 1002 ¶ 159. Accordingly, a POSA seeking to make a protective, resilient, water-repellent coating for an electronic device in view of Coulson-122, Badyal, and Holliday would have been motivated to lengthen the two-carbon alkyl chain of the disclosed BDVE crosslinker (bracketed red below) to produce more hydrophobic coatings, such as by doubling its length. *Id.*

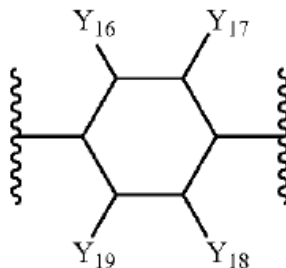


Doing so would have resulted in a crosslinker with four CH₂ groups, just as recited in claim 8. A POSA reasonably would have expected to succeed in making and using the resulting crosslinker (HDVE) because the change required only straightforward chemical modification, which would have been well within the skill of a POSA and because HDVE was a known crosslinker that had been used with acrylate-based monomers. *Id.*

Accordingly, claim 8 would have been obvious over the combination of Coulson-122, Badyal, and Holliday.

7. Claim 10

“The device or component according to claim 1, wherein when for compound (i) L is of formula B and Y₁₀ has the following formula:



5 **Y₁₈ is H or vinylene, and Y₁₆, Y₁₇ and Y₁₉ are each H.”**

As explained for claim 1, the combination of Coulson-122, Badyal, and Holliday includes devices coated using DCHD as the crosslinking reagent, and the linker moiety of DCHD has the same formula recited in claim 10, where Y₁₆-Y₁₉ are each hydrogen. Ex. 1002 ¶¶ 148, 160. Accordingly, claim 10 would have been obvious

10 for the same reasons as claim 1.

8. Claim 11

The asserted combination of Coulson-122, Badyal, and Holliday included DCHD and BDVE as crosslinking reagents. Accordingly, claim 11 would have been obvious for the same reasons as claim 1.

15 **9. Claims 12, 13**

As explained above in Sections VII.B.1 and VII.B.5, both Coulson-122 and Badyal described PFAC8 as a preferred monomer. Claims 12 and 13 therefore would have been obvious for the same reasons as claim 1.

10. Claims 14, 15

As explained above in Sections VII.B.1 and VII.B.6, both Coulson-122 and Badyal described PFMAC8 as a preferred monomer. Claims 14 and 15 therefore would have been obvious for the same reasons as claim 1.

D. Ground 3: Claims 1-4, 10, and 12-15 were obvious over Coulson-122, Badyal, and Padiyath

1. Claim 1

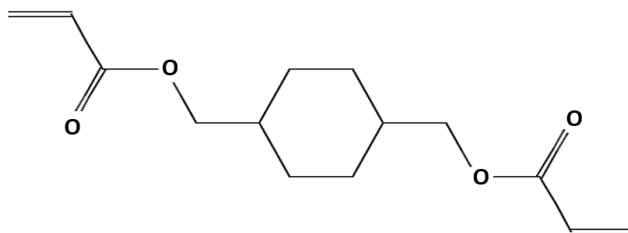
a. Claim limitations

As explained above in Sections VII.A and VII.B.1, Coulson-122 and Badyal described every limitation of claim 1 except the specific linker moieties identified for the crosslinking reagent, and those references would have motivated a POSA to use structurally compatible crosslinkers that had favorable properties and were known in the polymer art.

Padiyath disclosed such a prior-art crosslinker. That reference described “barrier films for protection of moisture or oxygen sensitive articles.” Ex. 1008 ¶0001. The barrier coatings reduced or prevented “transfer of moisture and oxygen, or other contaminants, to an underlying substrate,” Ex. 1008 ¶0024, particularly electronics such as LCD or OLED display devices, Ex. 1008 ¶¶0023-24, 0027, 0063-64. Padiyath’s barrier coatings comprised one or more polymers, which could be homopolymers or copolymers and could be applied using plasma polymerization. Ex. 1008 ¶¶0005-07, 0011, 0025, Fig. 3. Padiyath taught that the polymers were preferably

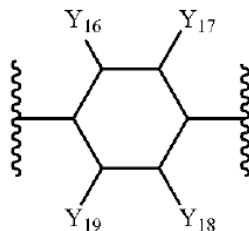
crosslinked. Ex. 1008 ¶¶ 0002, 0025, 0052.

Particularly preferred compounds for preparing the disclosed polymer layers included acrylates and methacrylates used alone or in combination with other acrylates or methacrylates. Ex. 1008 ¶ 0052. As one especially preferred compound, Padiyath described “cyclohexane dimethanol diacrylate esters (e.g., CD-406, commercially available from Sartomer Co.).” *Id.* ¶ 0054. A POSA would have understood Padiyath as identifying the following reagent, more commonly known as cyclohexane-1,4-dimethanol diacrylate (CDMDA):



Ex. 1002 ¶¶ 76, 166; Ex. 1030 ¶¶ 144-46 (identifying Sartomer CD406 as CDMDA); Ex. 1031 ¶ 27 (same); Ex. 1032 (Sartomer data sheet for CD406). The boiling point of CDMDA at standard pressure is approximately 333°C. Ex. 1002 ¶ 168. A POSA would have recognized that CDMDA was a crosslinking reagent because it was a multifunctional diacrylate containing two double bonds, each capable of bonding with other molecules. Ex. 1002 ¶ 167; Ex. 1008 ¶¶ 52, 54.

CDMDA satisfied crosslinker Formula B2 of claim 1, where Y₁-Y₆ are hydrogen, Y₉ is —C(O)—O—Y₁₁—, Y₁₁ is C₁ alkylene, Y₁₀ is



and Y₁₆-Y₁₉ are hydrogen. Ex. 1002 ¶¶ 166, 169.

b. Motivation to combine and reasonable expectation of success

5 A POSA would have been motivated to use Padiyath's CDMDA crosslinker in the Coulson-122/Badyal combination because CDMDA was known in the polymer art, had a structure consistent with Badyal's suitable crosslinking reagents, and had been used in protective barrier coatings for electronics. Ex. 1002 ¶¶ 164, 170-72. CDMDA fit within Badyal's class of preferred crosslinking reagents, including those
10 with linker moieties comprising "alkyl groups ... interposed with oxygen atoms." Ex. 1005 5:1-21; Ex. 1002 ¶ 171. Padiyath taught that CDMDA is volatile, and CDMDA's boiling point fell near those of PFAC8 and PFMAC8, which would have suggested good compatibility for plasma polymerization. Ex. 1008 ¶ 54; Ex. 1002 ¶¶ 168, 172, 174. Furthermore, Padiyath taught that its barrier coatings could be
15 formed using plasma polymerization and that CDMDA could be copolymerized with other acrylates or methacrylates, which would have further encouraged a POSA to select CDMDA as a crosslinker with Coulson-122 and Badyal. Ex. 1008 ¶¶ 11, 52; Ex. 1002 ¶¶ 167, 172. A POSA also would have been motivated to select CDMDA because Padiyath had demonstrated its utility for preparing protective, moisture-

resistant barrier coatings on electronic devices. Ex. 1002 ¶¶ 164-165, 171-72.

In addition, a POSA reasonably would have expected to succeed using the combination of Coulson-122, Badyal, and Padiyath. As noted in Sections IV.B.2 and VII.B.1.c above, POSAs considered plasma polymerization routine by June 2015. In

5 addition, a POSA would have expected CDMDA to co-polymerize successfully with PFAC8 and PFMAC8 because Badyal taught that compounds matching its generic crosslinker structure would work. Ex. 1002 ¶ 173; Ex. 1005 4:17-5:19. Moreover,

Padiyath taught its preferred compounds like CDMDA could be used in combination with other acrylates or methacrylates, Ex. 1008 ¶¶ 0011, 0052, which would have

10 indicated to a POSA that CDMDA could successfully be combined PFAC8 and PFMAC8. Ex. 1002 ¶¶ 167, 173. Padiyath described protective barrier properties for

CDMDA-derived polymer coatings, so a POSA would have expected coatings produced by the combination of Coulson-122, Badyal, and Padiyath to exhibit protective water-repellent and barrier properties. Ex. 1002 ¶ 173. And a POSA would have

15 expected the combined coating to be successful as applied to electronic devices because Coulson-122 and Padiyath described polymer-coated electronic devices and Badyal taught that the crosslinked combination could be applied to any solid surface.

Ex. 1002 ¶¶ 165, 171, 173.

Accordingly, claim 1 would have been obvious over Coulson-122, Badyal,
20 and Padiyath.

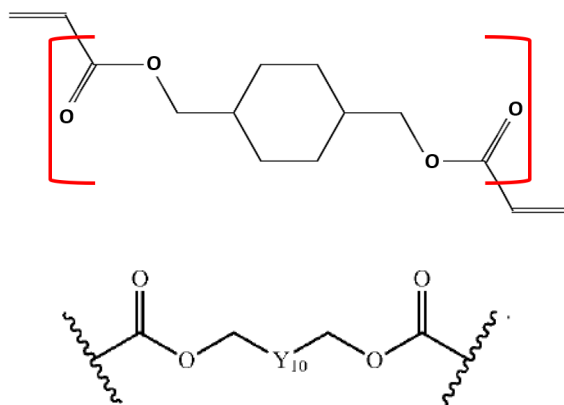
2. Claims 2, 3

See subsection G, below.

3. Claim 4

CDMDA fits Formula B2 of claim 1, as described above. Furthermore, the

5 linker moiety of CDMDA (bracketed in red below) also matches the fourth of the four generic linker structures specified in claim 4:



Ex. 1002 ¶ 176. Accordingly, claim 4 would have been obvious over the combination

10 of Coulson-122, Badyal, and Padiyath for the same reasons as claim 1.

4. Claim 10

The linker moiety of CDMDA includes the same cyclic substructure recited in claim 10, where Y₁₆-Y₁₉ are each hydrogen. Ex. 1002 ¶ 177. Accordingly, claim 10 would have been obvious for the same reasons as claim 1.

5. Claims 12, 13

As explained above in Sections VII.B.1 and VII.B.5, both Coulson-122 and Badyal described PFAC8 as a preferred monomer. Claims 12 and 13 therefore would

have been obvious for the same reasons as claim 1.

6. Claims 14, 15

As explained above in Sections VII.B.1 and VII.B.6, both Coulson-122 and Badyal described PFMAC8 as a preferred monomer. Claims 14 and 15 therefore would have been obvious for the same reasons as claim 1.

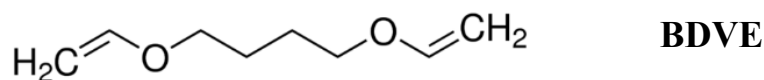
E. Ground 4: Claims 1-3, 5-8, and 11-15 were obvious over Coulson-122, Badyal, and Francesch

1. Claim 1

a. Claim limitations

As explained above in Sections VII.A and VII.B.1, Coulson-122 and Badyal described every limitation of claim 1 except the specific linker moieties identified for the crosslinking reagent, and those references would have motivated a POSA to use structurally compatible crosslinkers that had favorable properties and were known in the polymer art.

Francesch described polymer coatings containing a labile pentafluorophenyl surface group that could subsequently be used to attach a biotin ligand for versatile surface functionalization. Ex. 1009 at 606. The disclosed copolymer coatings were produced by plasma polymerization using a fluorinated methacrylate (pentafluorophenyl methacrylate) with BDVE as a crosslinker. Ex. 1009 at 606-07.



Ex. 1002 ¶ 181. As noted in Section VII.C.1 above, BDVE fit within Badyal's structurally defined group of suitable crosslinkers and has a normal boiling point less than 500°C. Ex. 1005 4:31-5:5; Ex. 1002 ¶¶ 144-147, 149.

The copolymer coatings were applied to silicon-wafer substrates. Ex. 1009 at 5 607. Francesch taught performing plasma deposition for 2-8 hours and disclosed that the BDVE-crosslinked copolymer was deposited at a rate of 8 nm per hour, so a POSA would have understood that Francesch taught applying such polymer coatings at thicknesses of 16-64 nm. Ex. 1009 607-08; Ex. 1002 ¶ 184. The resulting coatings showed flat, homogenous, pinhole-free surfaces. Ex. 1009 at 609-610; Ex. 1002 10 ¶ 184. Francesch taught BDVE was included as a crosslinker "to improve the solvent resistance of the resulting deposited thin films." Ex. 1009 at 610.

As explained in Section VII.C.1 above, BDVE was a crosslinking reagent under Formula A of claim 1.⁶ In addition, BDVE necessarily fell within the scope of claim 1 because claim 11, which depends from claim 1, specifically recites BDVE

⁶ The other crosslinker Francesch described, 1,7-octadiene (Ex. 1009 at 607), was also identified as a most-preferred choice in the '876 patent, Ex. 1001 8:6. A POSA seeking a crosslinker for use in coatings like those described by Coulson-122 and Badyal would have selected BDVE over 1,7-octadiene because of the oxygen atoms in the bridging group of BDVE. Ex. 1002 ¶ 182; Ex. 1005 5:18-6:20.

as a covered crosslinker. Ex. 1001 20:67, 21:3-4.

b. Motivation to combine and reasonable expectation of success

A POSA would have been motivated to use BDVE as a crosslinker in view of Coulson-122/Badyal and Francesch because BDVE was a known crosslinker for plasma deposition applications in the polymer art, aligned with Badyal's suitable crosslinking reagents, had a boiling point compatible for plasma polymerization with PFAC8 or PFMAC8, and had useful properties for applying protective coatings to electronics. Ex. 1002 ¶¶145-147, 151-152, 180, 182, 184-186. As Francesch expressly taught, BDVE was a crosslinker used in plasma polymerization well before the '876 patent's priority date. Ex. 1009 at 606-07; Ex. 1002 ¶¶183-184. BDVE fit well within Badyal's class of preferred crosslinking structures, including linker moieties comprising "alkyl groups ... interposed with oxygen atoms." Ex. 1005 5:18-21; Ex. 1002 ¶¶182-183. In addition, Francesch showed that a "methacrylate was successfully used as a monomer for plasma polymerization ... copolymerized with" BDVE, Ex. 1009 at 610, which further would have motivated a POSA to use BDVE as a crosslinking reagent in the Coulson-122/Badyal combination because those references described using similar fluorinated acrylate and methacrylate monomers, Ex. 1002 ¶183.

Francesch also taught that the coatings made with BDVE showed solvent resistance and a uniform structure without pinholes, Ex. 1009 at 609-10, both

properties that would have been valued by a POSA seeking to produce protective barrier coatings. Ex. 1002 ¶ 184. The coatings could be applied at a thickness of at least 64 nm, which a POSA would have recognized as a coating thickness well suited to protective barrier applications. *Id.*; see Ex. 1001 3:5-8. Accordingly, a POSA would have been motivated to use BDVE as a crosslinking reagent, as described by Francesch, in combination with Coulson-122/Badyal to produce protective polymer coatings as in claim 1.

In addition, a POSA reasonably would have expected to succeed with the asserted combination based on teachings from Coulson-122, Badyal, and Francesch.

As noted in Sections IV.B.2 and VII.B.1.c, POSAs considered plasma polymerization routine by June 2015. In addition, a POSA would have expected BDVE, which fit Badyal's generic structural criteria for suitable crosslinkers, to successfully copolymerize with the fluorinated monomers like PFAC8 and PFMAC8 taught by Coulson-122 and Badyal because Badyal taught that such crosslinkers would work.

Ex. 1002 ¶¶ 153, 183; Ex. 1005 4:17-5:19. In addition, Francesch taught that BDVE was compatible for plasma coating applications with another fluorinated methacrylate (pentafluorophenyl methacrylate). Ex. 1009 606-07. A POSA thus would have expected BDVE to serve as an effective crosslinker in the Coulson-122/Badyal combination because those references used acrylate-based PFAC8 and PFMAC8 monomers similar to the monomer successfully used by Francesch. Ex. 1002 ¶¶ 183, 185.

Given the known properties associated with BDVE and the BDVE-based coatings disclosed by Francesch, a POSA would have expected coatings based on BDVE copolymerized with PFAC8 or PFMAC8 based on the combination of Coulson-122, Badyal, and Francesch to exhibit protective water-repellent and barrier properties.

5 Ex. 1002 ¶ 185. And a POSA would have expected the combined coating to be successful as applied to electronic devices because Coulson-122 described electronics applications for the relevant polymer substituents, Francesch taught applying BDVE-based coatings to solid silicon substrates, and Badyal taught that the cross-linked combination could be applied to any solid surface. Ex. 1002 ¶ 186.

10 Accordingly, claim 1 would have been obvious over Coulson-122, Badyal, and Francesch.

2. Claims 2, 3

See Subsection G below.

3. Claims 5, 6

15 The asserted combination of Coulson-122, Badyal, and Francesch includes devices coated using BDVE as the crosslinking reagent. As described in Section VII.C.4 above, the linker moiety of BDVE meets every limitation of claims 5 and 6. Accordingly, claims 5 and 6 would have been obvious over the combination of Coulson-122, Badyal, and Francesch for the same reasons as claim 1.

4. Claim 7

20 BDVE contains a CH₂-CH₂ chain corresponding to Y₁₀ of Formula A. Badyal

taught that alkyl chains in bridging group Z could be perfluoroalkyl chains and that highly fluorinated coatings exhibit “super-hydrophobicity.” Ex. 1005 5:18-23, 10:32-11:1. Consistent with Badyal’s teachings, it was well known that perfluorinated alkyl groups were strongly hydrophobic when incorporated into polymer coatings, Ex. 1005 1:19-23, and a POSA would have wanted to maximize hydrophobicity in protective coatings intended for electronic devices. Ex. 1002 ¶158. A POSA therefore would have been motivated to substitute fluorine at every Y₁₂ and Y₁₃ hydrogen position in BDVE for enhanced hydrophobicity while maintaining the flanking alkylene spacers to preserve reagent stability, and a POSA would have reasonably expected to succeed because methods for preparing fluorinated divinyl ethers were known and because Badyal taught that the bridging group could include fluorine substitutions. Ex. 1002 ¶¶158, 189, 46; Ex. 1005 at 5:18-6:13.

Accordingly, claim 7 would have been obvious over Coulson-122, Badyal, and Francesch combined using the ordinary skill and creativity of a POSA.

5. Claim 8

BDVE contains a CH₂-CH₂ chain corresponding to Y₁₀ of Formula A. A POSA would have known that the longer an alkyl chain is, the more hydrophobic the resulting molecule will be. Ex. 1002 ¶159. Accordingly, a POSA seeking to make a protective, water-repellent coating for an electronic device in view of Coulson-122, Badyal, and Francesch would have been motivated to lengthen the two-

carbon alkyl chain of the disclosed BDVE crosslinker to produce more hydrophobic coatings, such as by doubling or tripling its length. Ex. 1002 ¶¶ 159, 190. Doing so would have resulted in a crosslinker with 4-6 CH₂ groups, just as recited in claim 8. A POSA reasonably would have expected to succeed in making that straightforward chemical modification, which would have been well within the skill of a POSA. *Id.*

Accordingly, claim 8 would have been obvious over the combination of Coulson-122, Badyal, and Francesch.

6. Claim 11

The asserted combination of Coulson-122, Badyal, and Francesch included BDVE as the crosslinking reagent. Accordingly, claim 11 would have been obvious for the same reasons as claim 1.

7. Claims 12, 13

As explained above in Sections VII.B.1 and VII.B.5, both Coulson-122 and Badyal described PFAC8 as a preferred monomer. Claims 12 and 13 therefore would have been obvious for the same reasons as claim 1.

8. Claims 14, 15

As explained above in Sections VII.B.1 and VII.B.6, both Coulson-122 and Badyal described PFMAC8 as a preferred monomer. Claims 14 and 15 therefore would have been obvious for the same reasons as claim 1.

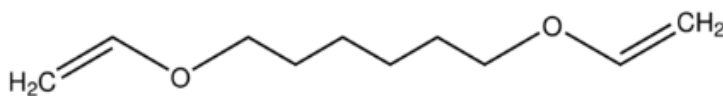
F. Ground 5: Claims 1-3, 5-8, and 12-15 were obvious over Coulson-122, Badyal, and Tropsch

1. Claim 1

a. Claim limitations

As explained above in Sections VII.A and VII.B.1, Coulson-122 and Badyal described every limitation of claim 1 except the specific linker moieties identified for the crosslinking reagent, and those references would have motivated a POSA to use structurally compatible crosslinkers that had favorable properties and were known in the polymer art.

Tropsch described a two-step process for preparing polymers containing peroxycarboxyl groups. Ex. 1011. Tropsch's methods required first preparing or obtaining a polymer, and then reacting that polymer with hydrogen peroxide. Ex. 1011 1:49-2:2. The input polymer contained at least an unsaturated dicarboxylic anhydride monomer. Ex. 1011 1:51-53, 2:13-39. The input polymer could further contain a comonomer, such as an acrylate or methacrylate, as well as a crosslinker. Ex. 1011 1:65-2:2, 3:1-8, 3:47-54. Preferred crosslinkers included 1,6-hexanediol divinyl ether (HDVE):

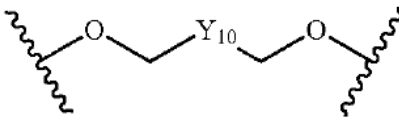


HDVE

Ex. 1011 4:34-39; Ex. 1002 ¶195. HDVE fit within Badyal's structurally defined group of suitable crosslinkers—it had two double bonds where R¹-R⁶ were hydrogen

and contained an alkyl bridging group interposed with oxygen atoms. Ex. 1005 4:41-5:21; Ex. 1002 ¶¶ 194-195, 197.

HDVE was a crosslinker within the scope of claim 1. It satisfied Formula A, where Y₁₋₆ are hydrogen, the linker group is



and Y₁₀ is straight-chain C₄ (HDVE) alkylene. Ex. 1002 ¶¶ 195-196. The boiling point of HDVE at standard pressure is approximately 233°C. Ex. 1002 ¶ 195

b. Motivation to combine and reasonable expectation of success

A POSA would have been motivated to use Tropsch's HDVE crosslinker in the Coulson-122/Badyal combination because HDVE was known in the polymer art, aligned with Badyal's suitable crosslinking reagents, and would have been expected to have beneficial properties for applying protective coatings to electronics. HDVE was a known crosslinker in the polymer art, as demonstrated by Tropsch's 1998 disclosure. Ex. 1002 ¶ 197. HDVE fit well within Badyal's class of preferred crosslinking structures, including linker moieties comprising "alkyl groups ... interposed with oxygen atoms." Ex. 1005 5:18-21; Ex. 1002 ¶¶ 195, 197. Tropsch disclosed that HDVE could be used to crosslink polymers containing acrylate and methacrylate monomers, Ex. 1011 3:1-10, which would have suggested to a POSA that HDVE would be compatible for polymerizing with the acrylate/methacrylate monomers

(PFAC8/PFMAC8) of Coulson-122 and Badyal. Ex. 1002 ¶197. In addition, a POSA would have been motivated to use HDVE as a crosslinker for protective barrier coatings on electronics because a POSA would have believed that the relatively long alkyl chains in the HDVE linker group would promote hydrophobicity in polymers containing that compound. *Id.*

Tropsch taught that its input polymers containing HDVE could be prepared using multiple polymerization methods, including suspension or precipitation polymerization. Ex. 1011 5:26-30. A POSA reading Tropsch would have expected that HDVE could also be polymerized using plasma activation because one activation technique can usually be substituted for another when using compatible reagents. Ex. 1002 ¶¶53, 198. In addition, the boiling point of HDVE would have indicated compatibility with PFAC8 and PFMAC8 for plasma applications. Ex. 1002 ¶197. Accordingly, a POSA reading Tropsch would have been motivated to use HDVE as a crosslinking reagent in combination with Coulson-122/Badyal to produce protective polymer coatings as in claim 1. Ex. 1002 ¶¶197-199.

In addition, a POSA reasonably would have expected to succeed with that prior-art combination. As noted in Sections IV.B.2 and VII.B.1.c, POSAs considered plasma polymerization routine by June 2015. In addition, a POSA “would have expected compounds like HDVE that fit Badyal’s generic crosslinker structure to successfully co-polymerize with the PFAC8/PFMAC8 monomers of Coulson-122 and

Badyal because Badyal taught that such crosslinkers would work.” Ex. 1002 ¶ 199; Ex. 1005 4:17-5:19. Furthermore, Tropsch taught that its crosslinkers were compatible with acrylates and methacrylates and with various polymerization activators. Ex. 1011 3:55-60. HDVE was also structurally similar to BDVE, which was known to be used successfully in plasma polymerization as a crosslinker with another fluorinated acrylate monomer, Ex. 1009 at 606-07, so a POSA would have expected similar performance from HDVE. Ex. 1002 ¶ 198. A POSA thus would have expected HDVE to serve as an effective crosslinker in the Coulson-122/Badyal combination because those references used acrylate-based PFAC8 and PFMAC8 monomers and because a POSA would have known that a polymerization reaction successfully carried out using one activation method (like irradiation) generally can be carried out using another (like plasma polymerization). Ex. 1002 ¶¶ 198-199.

Accordingly, claim 1 would have been obvious over Coulson-122, Badyal, and Tropsch.

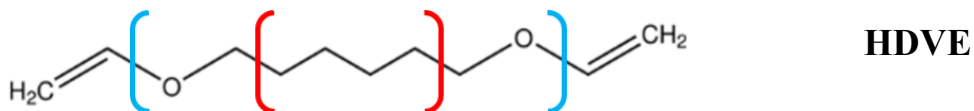
2. Claims 2, 3

See Subsection G below.

3. Claims 5, 6, 8

The asserted combination of Coulson-122, Badyal, and Tropsch includes polymer coatings containing HDVE as the crosslinking reagent. The linker moiety of HDVE (bracketed blue below) met every limitation of claims 5, 6, and 8.

Specifically, Y₁₀ (bracketed red below) is (CH₂)₄ in HDVE.



Ex. 1002 ¶201. For claims 5 and 6, Y₁₀ in HDVE is a 4-carbon chain (thus n is 4, between 1 and 10) and where each Y₁₂ and Y₁₃ is hydrogen. Ex. 1002 ¶202. For claim 8, the 4-carbon chain for Y₁₀ means that n=4. Ex. 1002 ¶¶202-203. Accordingly, claims 5, 6, and 8 would have been obvious over the combination of Coulson-122, Badyal, and Tropsch for the same reasons as claim 1.

4. Claim 7

HDVE contained a CH₂-CH₂ chain corresponding to Y₁₀ of Formula A.

Badyal taught that alkyl chains in bridging group Z could be perfluoroalkyl chains and that highly fluorinated coatings exhibit “super-hydrophobicity.” Ex. 1005 5:18-23, 10:32-11:1. Consistent with Badyal’s teachings, it was well known that perfluorinated alkyl groups were strongly hydrophobic when incorporated into polymer coatings, Ex. 1005 1:19-23, and a POSA would have wanted to maximize hydrophobicity in protective coatings intended for electronic devices. Ex. 1002 ¶¶158, 204. A POSA therefore would have been motivated to substitute fluorine at every Y₁₂ and Y₁₃ hydrogen position in HDVE for enhanced hydrophobicity while maintaining the flanking alkylene spacers to preserve reagent stability, and a POSA would have reasonably expected to succeed because methods for preparing fluorinated divinyl

ethers were known and because Badyal taught that the bridging group could include fluorine substitutions. Ex. 1002 ¶204, 46; Ex. 1005 at 5:18-6:13.

Accordingly, claim 7 would have been obvious over Coulson-122, Badyal, and Tropsch combined using the ordinary skill and creativity of a POSA.

5 **5. Claims 12, 13**

As explained above in Sections VII.B.1 and VII.B.5, both Coulson-122 and Badyal described PFAC8 as a preferred monomer. Claims 12 and 13 therefore would have been obvious for the same reasons as claim 1.

6. Claims 14, 15

10 As explained above in Sections VII.B.1 and VII.B.6, both Coulson-122 and Badyal described PFMAC8 as a preferred monomer. Claims 14 and 15 therefore would have been obvious for the same reasons as claim 1.

G. All Grounds: Claims 2 and 3 would have been obvious over the cited prior-art combinations

15 **1. Claim 2**

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

As explained for each ground above, it would have been obvious to prepare
20 the coated device of claim 1 in view of Coulson-122, Badyal, and each of the asserted references describing a compatible prior-art crosslinker. Claim 2 specifies barrier properties of the coating in claim 1. That would have been an expected and routine

result of each of those obvious combinations or inherent in those asserted combinations. Under either analysis, claim 2 would have been obvious over the references cited in each ground.

A POSA would have understood that a barrier to mass transport includes restricting passage of molecules, like water or oxygen, and that a barrier to electron transport restricts passage of electrons—in other words, an electrical insulator. Ex. 1002 ¶207; *see also* Ex. 1001 3:1-6, 3:41. A POSA would have viewed those as desirable properties when preparing a protective coating for electronics. Ex. 1002 ¶207. A POSA also would have known that polymer coatings made using PFAC8 and PFMAC8 monomers had insulating and molecular barrier properties. Ex. 1002 ¶208. Furthermore, a POSA would have expected crosslinking to improve barrier properties of such coatings by reducing crystallinity and the associated likelihood of channels for molecules or electrical conductance through the coatings, and prior-art crosslinkers in the asserted grounds had been used in coatings to prevent the passage of molecules and/or provide electrical insulation. *Id.*

A POSA therefore would have sought and expected coatings based on the asserted combinations to exhibit the claimed barrier properties. Ex. 1002 ¶¶208-211. The '876 patent admits that producing those properties using the prior-art monomers and crosslinkers of claim 1 would have been within the skill of a POSA. Ex. 1001 14:22-28. Similarly, the '876 patent indicates that a coating thickness of at least 50

nm typically suffices to provide a barrier coating, Ex. 1001 3:5-7, and a POSA would have known that greater coating thickness facilitates barrier properties and would have known how to increase coating thickness simply by increasing plasma polymerization time. Ex. 1002 ¶210; Ex. 1014 9:15-17, 28:23-25; Ex. 1009 at 608.

5 The barrier properties recited in claim 2 thus would have been expected and easy for a POSA to achieve using the monomer/crosslinker combinations and plasma polymerization techniques of the asserted prior-art combinations. Ex. 1002 ¶¶ 208-210.

Alternatively, the barrier properties in claim 2 would have been inherent in
10 the prior-art combinations asserted in each ground against claim 1. Inherency applies in an obviousness analysis “where the limitation at issue is ‘the natural result of the combination of prior art elements.’” *Persion Pharm. LLC v. Alvogen Malta Operations Ltd.*, 945 F.3d 1184, 1191 (Fed. Cir. 2019) (quoting *PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1194-95 (Fed. Cir. 2014)). A polymer’s properties de-
15 pend on its components. Ex. 1002 ¶211. It has long been established that coatings based on highly fluorinated organic compounds like the perfluorinated monomers described by Coulson-122 and Badyal are electrically insulating and restrict the pas-
sage of molecules. Ex. 1002 ¶208. Similarly, crosslinkers in the asserted grounds were also known to produce coatings with those properties. Ex. 1002 ¶¶ 132, 151,
20 153, 165, 171-172, 184, 197, 209. Combining two compounds having the claimed

barrier properties to form a copolymer coating would naturally and necessarily yield a copolymer exhibiting the same barrier properties. Ex. 1002 ¶211. Because the properties recited in claim 2 are the inherent result of combining components in the asserted grounds, claim 2 would have been obvious over the same combinations.

5 **2. Claim 3**

“The 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°.”

As explained for each Ground above, it would have been obvious to prepare
10 the coated device of claim 1 in view of each of the cited combinations of prior-art references. Claim 3 specifies a surface WCA of at least 90° for the same coated device of claim 1. That recited property would have been an expected and routine result of those obvious combinations or would have been inherent in those combinations. Either way, claim 3 would have been obvious over the prior art cited in each
15 Ground.

By June 2015, WCA was a well-known measure of surface hydrophobicity, and POSAs understood that water-repellent surfaces exhibit WCA greater than 90°. Ex. 1002 ¶212; Ex. 1001 4:27-29. As described in Sections IV.B.3, VII.A, and VII.B.1, the fluorinated PFAC8/PFMAC8 monomers that would have been used un-
20 der every asserted Ground were known to be hydrophobic and form water-repellent coatings. Ex. 1002 ¶¶66-69, 213-214. Furthermore, a POSA would have known or

expected that each prior-art crosslinker raised in the cited Grounds would have hydrophobic properties based on prior-art teachings regarding those compounds as well as well-established structure/function relationships for organic compounds known in the art. Ex. 1002 ¶ 213; Ex. 1005 4:21-23; Ex. 1014 16:7-14.

5 For each Ground, a POSA therefore would have expected coatings prepared by combining a hydrophobic monomer with a hydrophobic crosslinker to exhibit water repellency and, as a result, a WCA greater than 90°. Ex. 1002 ¶ 213. The '876 patent does not describe any specific requirements needed for a coating to achieve the claimed WCA. Rather, the patent admits that producing the claimed WCA using
10 the prior-art monomers and crosslinkers of claim 1 would have been within the knowledge and skill of a POSA. Ex. 1001 14:22-28. The WCA recited in claim 3 thus would have been an obvious and expected property for a POSA to achieve with co-polymer coatings prepared according to the combined teachings of the asserted prior art. Ex. 1002 ¶¶ 213-214 (cite Ex. 1029); *see Southwire Co. v. Cerro Wire LLC*,
15 870 F.3d 1306, 1312 (Fed. Cir. 2017) (claims reciting “mere quantification of the results of a known process” held obvious); *Ritchie v. Vast Res., Inc.*, 563 F.3d 1334, 1337 (Fed. Cir. 2009) (known properties of known components did not suffice to render combination nonobvious).

Alternatively, the WCA recited in claim 3 would have been an inherent result
20 of the combination of claim 1. The molecular composition of a polymer determines

hydrophobicity. Ex. 1002 ¶ 214. It had long been established that highly fluorinated organic compounds like the perfluorinated monomers described by Coulson-122 and Badyal are exceedingly hydrophobic and yield hydrophobic coatings when applied as a surface coating. Ex. 1002 ¶¶ 66-69, 213-214. Similarly, organosilicons like DVTMDS and hydrocarbon-based compounds like DCHD, BDVE, CDMDA, and HDVE were known to exhibit hydrophobic properties. Ex. 1002 ¶¶ 132, 165, 171, 184, 197, 213. As a POSA would have known, combining a hydrophobic crosslinker with the highly hydrophobic PFAC8 or PFMAC8 monomer to form a copolymer coating would naturally and necessarily yield hydrophobicity, manifesting with a WCA of at least 90°, in the resulting products. Ex. 1002 ¶ 214. Because the property recited in claim 3 is the natural, inherent result of combining hydrophobic components in the polymer composition recited in claim 1, claim 3 would have been obvious over the same asserted combination of prior art. *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1354 (Fed. Cir. 2012) (“merely testing and claiming an inherent property” cannot render an otherwise obvious formulation patentable).

VIII. Statement regarding § 325(d)

The Board should not deny institution under § 325(d). The same or substantially the same art or arguments were not previously presented, and the examiner erred in allowing the challenged claims during prosecution.

Regarding the prior art, the examiner cited Coulson-122, but the other

references in the grounds asserted here (Badyal, Cohen, Holliday, Padiyath, Francesch, and Tropsch) were not before the examiner during prosecution, much less used in a rejection. Cohen, Holliday, Padiyath, Francesch, and Tropsch are asserted here to supply teachings and to support arguments that were wholly absent during prosecution—namely, that the prior art *expressly described* the structures and properties of various claimed crosslinkers that would have made it obvious to use them for crosslinking the Coulson-122 and Badyal coatings. *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 15-16 (PTAB Oct. 16, 2019) (precedential in pertinent part). The examiner failed to identify a single prior-art crosslinker that satisfied Formulas A or B from claim 1 and did not consider any combination including such a compound. Ex. 1028 at 247-252, 406-07. Similarly, Badyal’s cited teachings, including those about the durability benefits of crosslinking, were absent from prosecution. Ex. 1005 4:1-29. The prior art asserted here is thus materially different and not cumulative with that considered during prosecution.

Furthermore, there was error during prosecution. The issued claims received limited substantive evaluation: even as to the little prior art that *was* considered, the examiner effectively issued a first-action allowance regarding the subject matter of the issued claims. Ex. 1028 at 251. Furthermore, the examiner made no apparent effort to identify references describing the claimed crosslinker structures. Ex. 1028 at 251, 406-07. As demonstrated in this petition, the prior art contained numerous

references describing those very crosslinkers and their use in polymer-coating applications, and the examiner “was simply not aware” of those teachings. *Oticon*, IPR2019-00975, Paper 15 at 19-20. That was substantial error.

In view of the substantially different art and arguments presented here, and
5 the errors during prosecution of the '876 patent, § 325(d) does not apply.

IX. Conclusion

Petitioner respectfully requests institution and cancelation of the challenged claims.

Dated: July 17, 2020

Respectfully submitted,

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CERTIFICATE OF WORD COUNT UNDER 37 CFR § 42.24(d)

Under 37 C.F.R. § 42.24(d), the undersigned certifies that this petition for *inter partes* review totals 13,988 words, excluding the parts exempted by 37 C.F.R. § 42.24(a). The word count was made using the built-in word count function in the Microsoft® Word software used to prepare this document.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of this petition for *inter partes* review of U.S. Patent 10,421,876 and supporting materials (power of attorney and Exhibits 1001-1039) have been served in their entireties on the patent owner by Federal Express at the correspondence address for the attorney of record for the '876 patent shown in the Office's Public PAIR system:

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