

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BECKMAN COULTER, INC.,
Petitioner,

v.

SIRIGEN II LIMITED,
Patent Owner.

IPR2022-01208
Patent 8,575,303 B2

Before DONNA M. PRAISS, JON B. TORNQUIST, and
BRIAN D. RANGE, *Administrative Patent Judges*.

TORNQUIST, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Beckman Coulter, Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–15, 17–37, 40, and 41 of U.S. Patent No. 8,575,303 B2 (Ex. 1006, “the ’303 patent”). Paper 1 (“Pet.”). Sirigen II Limited (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). Petitioner subsequently filed a Reply (Paper 10, “Prelim. Reply”) and Patent Owner filed a Sur-Reply (Paper 11, “Prelim. Sur-Reply”) addressing claim construction and arguments related to discretionary denial.¹

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” For the reasons stated below, we determine that Petitioner does not establish a reasonable likelihood that it would prevail with respect to at least one claim of the ’303 patent. Thus, we do not institute an *inter partes* review.

II. BACKGROUND

A. Related Matters

The parties indicate that the ’303 patent is the subject of *Becton, Dickinson & Co., Sirigen, Inc., and Sirigen II Limited v. Beckman Coulter, Inc.*, No. 3:21-cv-01173-CAB-NLS (S.D. Cal.) (“the parallel district court litigation”). Pet. 3–4; Paper 5, 2. The parties also identify the following proceedings as related matters: IPR2022-01203 (U.S. Patent No. 10,458,989), IPR2022-01204 (U.S. Patent No. 10,365,285), IPR2022-01205

¹ Because we deny the Petition on the merits, we do not address the parties’ arguments related to discretionary denial.

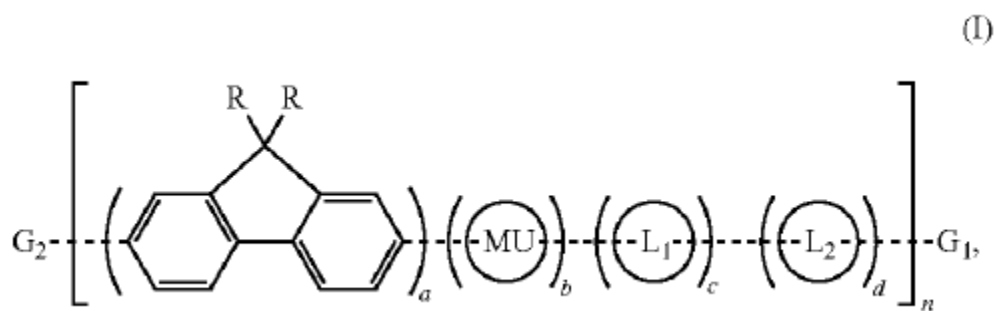
(U.S. Patent No. 10,955,417), IPR2022-01206 (U.S. Patent No. 10,302,648), and IPR2022-01207 (U.S. Patent No. 10,288,620). Pet. 3; Paper 5, 2.

B. The '303 Patent

The '303 patent is titled “Reagents for Directed Biomarker Signal Amplification.” Ex. 1006, code (54). The '303 patent explains that fluorescent hybridization probes have become an important tool for the sequence-specific detection of DNA and RNA. *Id.* at 1:21–23. The '303 patent describes conjugated polymers as having potential for improving the detection sensitivity of these probes. *Id.* at 1:29–33. Specifically, the '303 patent states that conjugated polymers “can be made water soluble and adapted to amplify the fluorescent output of various probe labels.” *Id.* at 1:33–35.

The '303 patent describes conjugated polymers as highly promising for nucleic acid diagnostics, which benefit from methods to amplify or replicate nucleic acid targets. *Id.* at 1:40–47. The '303 patent explains that because protein recognition lacks simple methods for amplifying targeted materials, integrating conjugated polymers into methods for detecting protein targets promises “to provide a dramatic boost in the performance of such assays, enabling detection levels previously unattainable with conventional fluorescent reporters (e.g., dyes).” *Id.* at 1:50–66.

The '303 patent describes water soluble conjugated polymers having a structure of the following formula (Formula I):

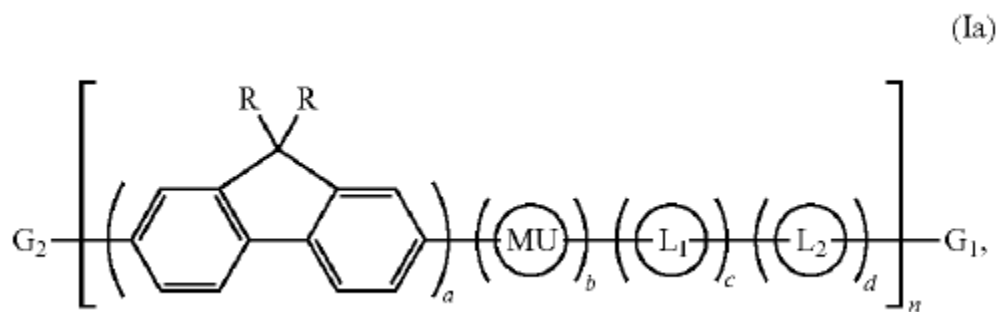


In this formula, “each R is independently a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL”; MU is “a polymer modifying unit or band gap modifying unit that is evenly or randomly distributed along the polymer main chain and is optionally substituted with one or more optionally substituted substituents,” which can be selected from various substances; L₁ and L₂ are optional linkers that are aryl or heteroaryl groups; G₁ and G₂ are each independently selected from a number of elements and compounds, including “hydrogen, halogen, amine, carbamate, carboxylic acid, . . . boronic esters, boronic acids, optionally substituted fluorene and aryl or heteroaryl substituted with one or more pendant chains terminated with a functional group . . . , for conjugation to another substrate, molecule or biomolecule”; n is an integer from 1 to about 10,000; and a, b, c, and d define the mol % of each unit within the structure. *Id.* at 2:16–3:5.

C. Illustrative Claim

Petitioner challenges claims 1–15, 17–37, 40, and 41. Pet. 1–2, 15. Independent claim 1 is illustrative of the challenged claims and is reproduced below:

1. A water soluble conjugated polymer having the structure of Formula (Ia):



wherein:

each R is independently a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL;

MU is a polymer modifying unit or band gap modifying unit that is evenly or randomly distributed along the polymer main chain and is optionally substituted with one or more optionally substituted substituents selected from halogen, hydroxyl, C₁-C₁₂ alkyl, C₂-C₁₂ alkene, C₂-C₁₂ alkyne, C₃-C₁₂ cycloalkyl, C₁-C₁₂ haloalkyl, C₁-C₁₂ alkoxy, C₂-C₁₈ (hetero)aryloxy, C₂-C₁₈ (hetero)arylamino, (CH₂)_x(OCH₂CH₂)_yOCH₃ where each x' is independently an integer from 0-20, y' is independently an integer from 0 to 50, or a C₂-C₁₈ (hetero)aryl group;

each optional linker L₁ and L₂ are aryl or heteroaryl groups evenly or randomly distributed along the polymer main chain and are substituted with one or more pendant chains terminated with a functional group selected from amine, carbamate, carboxylic acid, carboxylate, maleimide, activated esters, N-hydroxysuccinimidyl, hydrazines, hydrazids, hydrazones, azide, alkyne, aldehydes, thiols, and protected groups thereof for conjugation to another substrate, molecule or biomolecule;

G₁ and G₂ are each independently selected from hydrogen, halogen, alkyne, optionally substituted aryl, optionally substituted heteroaryl, halogen substituted aryl, boronic acid substituted aryl, boronic ester substituted aryl, boronic esters, boronic acids, optionally substituted fluorine and aryl or heteroaryl substituted with one or more pendant chains

terminated with a functional group, molecule or biomolecule selected from amine, carbamate, carboxylic acid, carboxylate, maleimide, activated esters, N-hydroxysuccinimidyl, hydrazines, hydrazids, hydrazones, azide, alkyne, aldehydes, thiols, and protected groups thereof for conjugation to another substrate, molecule or biomolecule;

wherein the polymer comprises at least 1 functional group selected from amine, carbamate, carboxylic acid, carboxylate, maleimide, activated esters, N-hydroxysuccinimidyl, hydrazines, hydrazids, hydrazones, azide, alkyne, aldehydes, and thiols within G₁, G₂, L₁ or L₂ that allows, for functional conjugation to another molecule, substrate or biomolecule;

n is an integer from 1 to about 10,000; and

a, b, c and d define the mol % of each unit within the structure which each can be evenly or randomly repeated and where a is a mol % from 10 to 100%, b is a mol % from 0 to 90%, and each c and d are mol % from 0 to 25%.

Ex. 1006, 239:29–240:56 (spacing added to aid in readability).

D. Asserted Grounds of Unpatentability

Petitioner, supported by the declaration of Colin P. Nuckolls, Ph.D. (Ex. 1007), asserts the following nine grounds of unpatentability (Pet. 15):

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
1, 4, 5, 7, 13, 23, 24, 27, 35–37, 40	102	Xue ³

² The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. The ’303 patent was filed on January 19, 2011. Ex. 1006, code (22). Thus, for the purposes of this Decision pre-AIA statutes apply.

³ Xue et al., *Highly Water-Soluble, Fluorescent, Conjugated Fluorene-Based Glycopolymers with Poly(ethylene glycol)-Tethered Spacers for Sensitive*

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
10, 41	103(a)	Xue, Gaylord ⁴
25	103(a)	Xue, optionally in view of Sumranjit ⁵
1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, 41	102	Gaylord
1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, 41	103(a)	Gaylord, optionally in view of Bazan ⁶
3, 25	103(a)	Gaylord, optionally in view of Xue or Sumranjit
6, 8, 9, 11, 13	103(a)	Gaylord in view of Gauthier, ⁷ Gordon, ⁸ or Lou, ⁹ in further view of Haugland ¹⁰

Detection of Escherichia coli, Chem. Eur. J., vol. 15, 2289–2295 (2009), Ex. 1010 (“Xue”).

⁴ US 2008/0293164 A1, published November 27, 2008, Ex. 1009 (“Gaylord”).

⁵ Jitapa Sumranjit, *Conjugated Organic Molecules as Models for Potential Sensors*, Ph.D. Dissertation, University of Massachusetts Amherst (Feb. 2007), Ex. 1014 (“Sumranjit”).

⁶ US 2006/0183140 A1, published August 17, 2006, Ex. 1011 (“Bazan”).

⁷ Gauthier et al., *Peptide/protein-polymer conjugates: synthetic strategies and design concepts*, Chem. Comm., pp. 2591–2611 (2008), Ex. 1015 (“Gauthier”).

⁸ Gordon, et al., *Synthesis of end-labeled multivalent ligands for exploring cell-surface-receptor-ligand interactions*, Chem. & Biol., vol. 7, pp. 9–16 (1999), Ex. 1016 (“Gordon”).

⁹ Lou et al., *Polymer-Based Elemental Tags for Sensitive Bioassays*, Angew. Chem. Int’l Ed., vol. 46, pp. 6111–6114 (2007), Ex. 1017 (“Lou”).

¹⁰ Rosaria P. Haugland, *Antibody Conjugates for Cell Biology*, Current Protocols in Cell Biology, 16.5.1–16.5.22 (2001), Ex. 1018 (“Haugland”).

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
18	103(a)	Gaylord, Haugland or Hermanson ¹¹
19	103(a)	Gaylord, Hermanson

III. ANALYSIS

A. *Legal Standard*

“To anticipate, the reference must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements arranged as in the claim.” *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1083 (Fed. Cir. 2008) (internal quotation omitted). In other words, it is not enough to be able to find all of the pieces of the claimed invention somewhere in a prior art reference; rather, those elements must be set out in the prior art reference in the same way they are in the claimed invention. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (“Because the hallmark of anticipation is prior invention, the prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’”) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and “the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

¹¹ Greg T. Hermanson, *Bioconjugate Techniques*, 2nd Edition (2008), Ex. 1013 (“Hermanson”).

subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

In order to determine whether an invention would have been obvious at the time the application was filed, we consider the level of ordinary skill in the pertinent art at the critical time. *Graham*, 383 U.S. at 17. We consider various factors when assessing the level of ordinary skill in the art, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quotation omitted).

Petitioner asserts that a person having ordinary skill in the art (POSITA) “would have at least a Ph.D. degree in chemistry, or a bachelor’s or master’s degree plus experience involving the use and design of fluorescent probes or dyes.” Pet. 17 (citing Ex. 1007 ¶¶ 14–18). Patent Owner agrees that a POSITA may have a Ph.D. degree or master’s degree in chemistry, but asserts that a POSITA would also have “some experience with fluorescence” in addition to a Ph.D. degree in chemistry and that the experience of a POSITA with a master’s degree in chemistry is alternatively “industry experience in the field of biological detection systems.” Prelim. Resp. 9–10 (citing Ex. 2001 ¶ 7).

For purposes of this Decision, we need not choose between the parties' proposed levels of one of ordinary skill in the art, which are quite similar, as neither party asserts that the anticipation or obviousness analyses in this case would turn on which definition is adopted. *See, e.g., id.* at 10 (noting that the arguments and conclusions reached in the Preliminary Response “would not change” if Petitioner’s definition of the ordinarily skilled artisan were applied).

C. *Claim Construction*

In an *inter partes* review proceeding based on a petition filed on or after November 13, 2018, a patent claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (as amended Oct. 11, 2018). This rule adopts the same claim construction standard used by Article III federal courts, which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. Under this standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Both parties provide constructions for terms that were agreed upon by the parties during the district court proceeding and adopted by the district court. Pet. 16; Prelim. Resp. 10–11. Beyond the agreed upon constructions, Petitioner does not contend that any terms require express construction for purposes of this Decision. Pet. 16. Patent Owner contends the term “a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL” requires construction. Prelim. Resp. 12–14.

Upon review of the prior art and the parties' arguments and evidence, we determine that only the term "a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL" requires construction. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL

Claim 1 recites "A water soluble conjugated polymer having the structure of Formula (Ia)," including specific MU, L₁ and L₂, G₁ and G₂, n, and a, b, c, and d (which define the mol % of each unit within the structure) constituents, wherein each R group must be a "[n]on-ionic side group capable of imparting solubility in water in excess of 10 mg/mL." Ex. 1006, 239:29–240:56. The '303 patent expressly defines the phrase "[n]on-ionic side groups capable of imparting solubility in water" to refer to "side groups which are not charged and allow the resulting polymer to be soluble in water or aqueous solutions with no visible particulates." *Id.* at 54:31–34.

In view of structure of claim 1 and the express definition provided in the '303 patent, we agree with Patent Owner that claim 1 requires that the non-ionic side group R must be capable of imparting solubility to the claimed conjugated polymer (having constituents that satisfy the claimed variables noted above) in excess of 10 mg/mL. Prelim. Resp. 13. On this record, it is not sufficient to show that a particular R group is capable of

imparting solubility in excess of 10 mg/mL to a conjugated polymer that does not satisfy the structural limitations of claim 1.

Petitioner contends this construction is inconsistent with the claim language because the claims themselves do not say that the resulting conjugated polymer must have a 10 mg/mL solubility. Prelim. Reply 1–2. In support of this argument, Petitioner notes that dependent claim 25, which depends directly from claim 1, recites that the “water soluble conjugated polymer” has “a water solubility of greater than 50 mg/mL in pure water.” *Id.*

Petitioner’s argument is not persuasive because the ’303 patent expressly defines the phrase “[n]on-ionic side groups capable of imparting solubility in water,” as used in claim 1, to refer to “side groups which are not charged and allow the *resulting polymer* to be soluble in water or aqueous solutions with no visible particulates.” Ex. 1005, 54:31–34 (emphasis added). This directly ties the R groups to the solubility of the claimed “conjugated polymer,” and in claim 1 that solubility is in excess of 10 mg/mL.

In view of the foregoing, we construe the term “A water soluble conjugated polymer having the structure of formula (Ia) . . . wherein each R is independently a non-ionic side group capable of imparting solubility in water in excess of 10 mg/mL,” to require that the R groups are capable of imparting a solubility in excess of 10 mg/mL to the conjugated polymer (as defined by the variables expressly recited in claim 1).

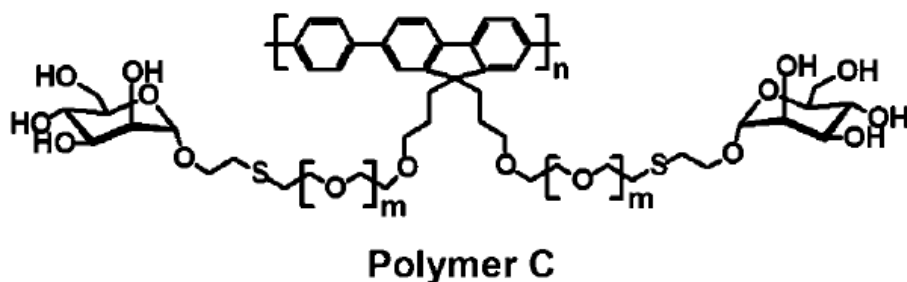
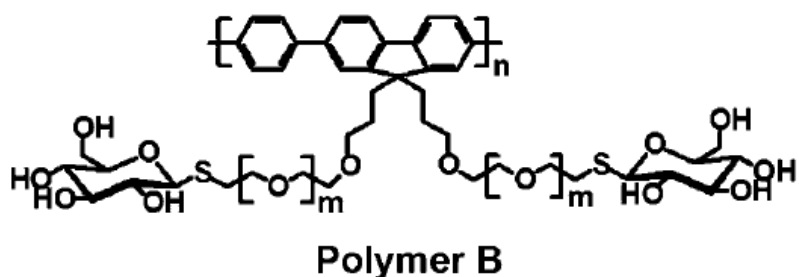
D. Anticipation by Xue

Petitioner asserts that claims 1, 4, 5, 7, 13, 23, 24, 27, 35–37, and 40 are anticipated by Xue under 35 U.S.C. § 102, citing the Declaration of Dr. Colin P. Nuckolls for support. Pet. 29–38 (citing Ex. 1007).

1. Xue (Exhibit 1010)

Xue is a paper titled “Highly Water-Soluble, Fluorescent, Conjugated Fluorene-Based Glycopolymers with Poly(ethylene glycol)-Tethered Spacers for Sensitive Detection of *Escherichia coli*.” Ex. 1010, 1. Xue explains that a few fluorescent conjugated glycopolymers have been prepared for biosensing applications for lectins and bacteria but some neutral conjugated glycopolymers display low water solubility. *Id.* Xue describes the introduction of anionic groups, such as carboxylic acid, to conjugated polymers to enhance water solubility but also explains that this could cause potential interfering responses of the conjugated polymers. *Id.* In view of this, Xue states that “it is important to explore new approaches to prepare a variety of highly water-soluble, neutral, fluorescent, conjugated glycopolymers for bacterial and viral biosensing applications.” *Id.*

Xue describes the synthesis of “bromide-bearing, fluorene-based, conjugated polymers with oligo(ethylene glycol)- and poly(ethylene glycol)-tethered spacers.” *Id.* Xue states that two of the glycopolymers, polymers B and C, “are highly water-soluble due to their long, flexible, hydrophilic spacers.” *Id.* The structure of Xue’s polymers B and C are reproduced below.



Id. at 2290. Xue describes incubating polymer C with strains of *E. coli* to investigate binding to polymer C. *Id.* at 2292. According to Xue, this resulted “in the formation of fluorescently stained bacterial clusters from which the polymer was not removed by rinsing and centrifugation” and the bacterial clusters could be visualized under a fluorescent microscope. *Id.*

2. Analysis: Claim 1

As discussed above, claim 1 requires that the R groups are capable of imparting a solubility in excess of 10 mg/mL to the conjugated polymer. Petitioner contends it is evident that the PEG polymers of Xue are capable of imparting a solubility in excess of 10 mg/mL because they fall within the genus recited in dependent claim 2. Pet. 30 (citing Ex. 1007 ¶ 435; Ex. 1006, 54:53–55, 72:42–48; *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997)).

PO argues in response that there is no evidence that the PEG polymers identified in Xue impart a solubility to the conjugated polymer of greater than 10 mg/mL, as required by claim 1. Prelim. Resp. 14–17.

In response, Petitioner reiterates its position that because the PEG polymer of Xue expressly falls within the scope of dependent claim 2, the PEG polymer of Xue must satisfy the functional requirements of claim 1, from which claim 2 depends. Prelim. Reply 2–3. In support of this position, Petitioner cites to *Alcon Research, LTD v. Apotex Inc.*, 687 F.3d 1362, 1368 (Fed. Cir. 2012) for the proposition that a compound claimed in a dependent claim must satisfy the functional limitations set forth in the independent claim from which that claim depends. Prelim. Reply 3.

Xue discloses that polymers B and C are “highly water-soluble due to their long, flexible, hydrophilic [poly(ethylene glycol)-tethered] spacers.” Ex. 1010, Abstract. Neither Xue nor Petitioner quantify, however, what “highly water-soluble” means in comparison to the claimed minimum solubility of 10 mg/mL of claim 1. Pet. 30; Ex. 1007 ¶ 435. Thus, on this record, we are not persuaded that Xue expressly discloses that its poly(ethylene glycol)-tethered spacers impart a solubility to the conjugated polymer in excess of 10 mg/mL.

In *Alcon*, the court addressed the circumstance where the independent claim recited using a “therapeutically effective amount” of a particular compound for stabilizing conjunctival mast cells and a dependent claim then recited a range of 0.0001 % w/v–5% w/v for that compound. *Id.* at 1367. Given the express claim language, the Court construed the independent claim to be broad enough to encompass the concentration of 0.0001 % w/v–5% w/v, and determined that “the concentration recited in the [challenged

patent's] dependent claims must necessarily meet claim 1's limitations of being therapeutically effective for treating allergic eye disease by stabilizing conjunctival mast cells.” *Id.* at 1367–68.

As noted by Petitioner, the polyethylene glycol spacers of Xue fall within the scope of the genus of compounds recited in dependent claim 2. We are not persuaded, however, that the structure of the claims, or the written description of the '303 patent, dictate or suggest that every compound falling within the genus of dependent claim 2 necessarily satisfies the solubility limitations of claim 1. In contrast to the claim structure discussed in *Alcon*, wherein the independent claim merely required a therapeutically effective amount of a particular pharmaceutical compound and the dependent claims provided specific concentration ranges for that pharmaceutical compound, here independent claim 1 and dependent claim 2 require selection of multiple variables. There is no evidence that each polymer recited in dependent claim 2 of the '303 patent would impart a solubility in excess of 10 mg/mL for all compounds within the broad scope of claim 1. Ex. 1006, 54:52–58 (“In some embodiments, each R is . . .”). Indeed, Patent Owner presents evidence that the solubility of Polymer C in Xue “was most likely lower than 0.075 mg/mL.” Ex. 2001 ¶ 54.

As such, we determine that the reasoning of *Alcon* does not apply in this case. *See, e.g., L'Oreal USA, Inc. v. Olaplex, Inc.*, 844 F. App'x 308, 325–326 (Fed. Cir. 2021) (non-precedential) (noting that the logic of *Alcon* does not necessarily apply to an independent claim that has a wide range of possible concentrations); *Spectrum Solutions LLC v. Longhorn Vaccines & Diagnostics, LLC*, IPR2021-00851, Paper 13 at 17–18 (PTAB Nov. 18, 2021) (declining to extend the reasoning of *Alcon* to situations where the

independent claim recites ranges for multiple components). Instead, claim 2 limits claim 1 to certain polymers, but only to the extent those polymers also meet claim 1's other requirements.

Thus, Petitioner must demonstrate that selection of the PEG polymer of Xue necessarily provides a solubility to the associated conjugated polymer that is in excess of 10 mg/mL. Petitioner provides no evidence of the solubility of the conjugated polymer of Xue, and Patent Owner presents evidence that the solubility was in fact much lower than 10 mg/mL. Prelim. Resp. 17 (citing Ex. 2001 ¶ 54). As such, Petitioner does not demonstrate a reasonable likelihood of showing that each limitation of claim 1 is expressly or inherently disclosed in Xue.

3. *Analysis: Remaining Challenged Claims*

Claims 4, 5, 7, 13, 23, 24, 35–37, and 40 depend, directly or indirectly from independent claim 1, and therefore require that R imparts a solubility in excess of 10 mg/mL. And, similar to independent claim 1, independent claim 27 also requires that “R is a non-ionic side group capable of imparting solubility in excess of 10 mg/mL.” Ex. 1006, 254:39–40.

Petitioner's arguments with respect to claims 4, 5, 7, 13, 23, 24, 27, 35–37, and 40 do not resolve the issues discussed above with respect to the “in excess of 10 mg/mL” solubility limitation of claim 1. *See* Pet. 35–38. Accordingly, for the reasons discussed above with respect to independent claim 1, Petitioner fails to demonstrate a reasonable likelihood that claims 4, 5, 7, 13, 23, 24, 27, 35–37, and 40 are anticipated by Xue.

E. Obviousness of claim 25 over Xue and optionally Sumranjit

Claim 25 depends from claim 1 and further requires that the water-soluble conjugated polymer comprises “a minimum number average

molecular weight of greater than 40,000 g/mol and a water solubility of greater than 50 mg/mL in pure water or a phosphate buffered saline solution.” Ex. 1006, 254:11–15. Petitioner contends the subject matter of claim 25 would have been obvious over Xue and, optionally, Sumranjit. Pet. 40–42.

1. Sumranjit

Sumranjit is a doctoral dissertation titled “Conjugated Organic Molecules as Models for Potential Sensors.” Ex. 1014, 3.¹² Sumranjit describes “water-soluble phenylenevinylene (PV) and sensor-capable PV systems,” including “oligo PVs and poly(phenylenevinylenes) (PPVs).” *Id.* at 10. Sumranjit further describes that a “type of water-soluble, segmented copolymer based on PPV was made that incorporated a nonionic but hydrophilic poly(ethylene glycol) (PEG),” which “was readily soluble in water, and exhibited strong blue fluorescence.” *Id.* Sumranjit explains that PEG’s “degree of water solubility can be adjusted by its degree of polymerization” and that PEG is biocompatible. *Id.* at 84.

2. Analysis

As noted above, dependent claim 25 further requires that the water-soluble conjugated polymer comprises “a minimum number average molecular weight of greater than 40,000 g/mol and a water solubility of greater than 50 mg/mL in pure water or a phosphate buffered saline solution.” Petitioner contends that the molecular weight of Polymers B and C of Xue have a number-average molecular weight of greater than 45,900 g/mol. Pet. 40–41 (citing Ex. 1010, 2294; Ex. 1007 ¶ 468). Petitioner

¹² Citations herein are to the sequentially numbered pages of the exhibit.

further argues that Xue discloses that Polymers B and C are “highly soluble” in water and that polymers with shorter PEG tethers, i.e., Polymer A, have lower solubility. *Id.* at 41 (citing Ex. 1010, 2289). Petitioner further contends that both Xue and Sumranjit teach that water solubility of conjugated polymers can be tuned by varying the number of PEG repeats. *Id.* (citing Ex. 1010, 2290; Ex. 1014, 67; Ex. 1007 ¶ 469).

Petitioner contends that because PEG chain length is a result-effective variable, one of ordinary skill in the art would have sought to vary the number of PEG repeats based on Xue and Sumranjit to “increase the water solubility of Xue’s polymers and would have arrived at the claimed water solubility of 50 mg/mL through routine optimization.” *Id.* at 41–42.

“Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456 (CCPA 1955). The “general conditions” of a claim may be disclosed when the prior art discloses “values overlapping the claimed ranges.” *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012). “This rule is limited to cases in which the optimized variable is a ‘result-effective variable.’” *Id.* (quoting *In re Antonie*, 559 F.2d 318, 620 (CCPA 1977)).

Assuming that PEG length is a result-effective variable, there is no evidence of conjugated polymers—having substituents satisfying the variables of claim 1—that have a solubility in pure water or a phosphate buffered saline solution that is “greater than 50 mg/mL.” Nor does Petitioner direct us to a range of solubilities in the art for similar conjugated

polymers that overlaps the claimed range. Thus, we are not persuaded that the general conditions of the claim are disclosed in the prior art.

Nor is there evidence that a person having ordinary skill in the art would have understood that the specific PEG polymer chains of Xue could have been extended to provide water solubility of 50 mg/mL to any conjugated polymer, much less Polymers B and C. Rather, Petitioner provides mere speculation that increasing the number of PEG repeats in Xue would result in a conjugated polymer having a solubility “greater than 50 mg/mL.” Prelim. Resp. 41. As such, on this record, we are not persuaded that the limitations of claim 25 would have been obvious over Xue and Sumranjit.

F. Anticipation by Gaylord

Petitioner contends that claims 1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 are anticipated by Gaylord. Pet. 42–58.

1. Gaylord

Gaylord describes “a multichromophore and/or multichromophore complex for identifying a target biomolecule.” Ex. 1009, code (57). Gaylord states that “[a] sensor biomolecule, for example, an antibody can be covalently linked to the multichromophore” and that “[a]dditionally, a signaling chromophore can be covalently linked to the multichromophore.” *Id.* Gaylord explains that “the signaling chromophore is capable of receiving energy from the multichromophore upon excitation of the multichromophore.” *Id.*

Gaylord's Figure 18 is reproduced below.

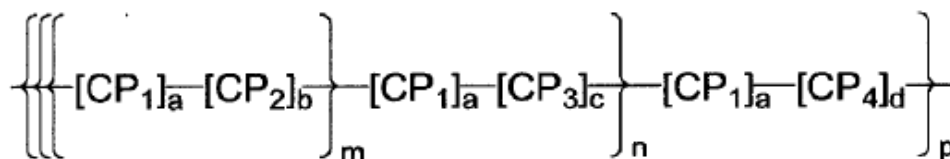
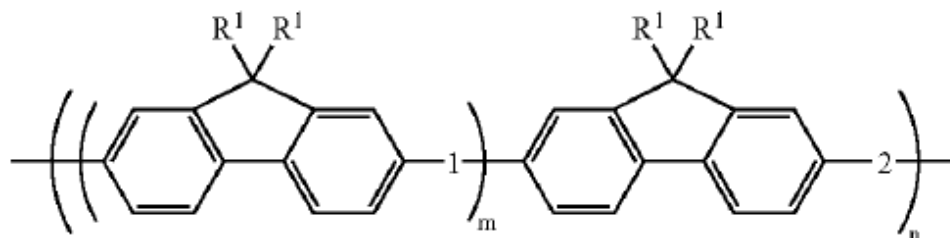


FIG. 18

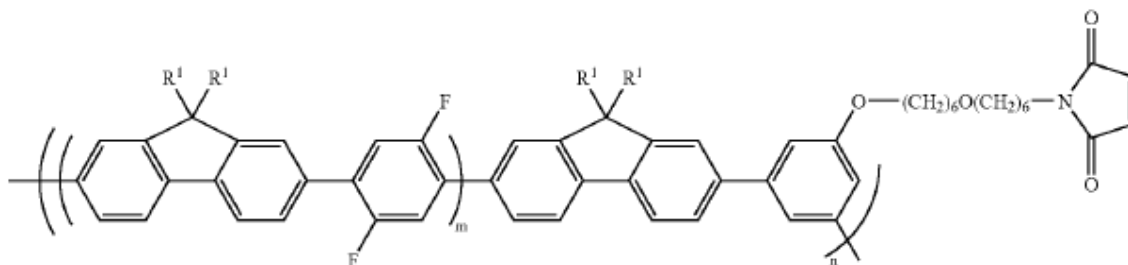
Figure 18 depicts the general structure for a conjugated polymer as a linear multichromophore. *Id.* ¶¶ 69, 184. Gaylord explains that the conjugated polymers include “low bandgap repeat units.” *Id.* ¶ 181. Gaylord describes CP1, CP2, CP3, and CP4 as “optionally substituted conjugated polymer segments or oligomeric structures, and may be the same or different from one another.” *Id.* ¶ 185. Gaylord states that “CP1, CP2, CP3, and CP4 may be aromatic repeat units” and may be fluorene. *Id.* Gaylord further describes CP1, CP2, CP3, and CP4 as being optionally substituted at one or more positions with certain groups “with the proviso that the polymer as a whole must be substituted with a plurality of cationic, anionic, or charge neutral water-soluble groups.” *Id.* ¶ 188.

Gaylord describes an embodiment of a multichromophore having the following structure:



Id. ¶ 13. Gaylord states that R¹ can be “a solubilizing group” that can be an

ethylene glycol oligomer, ethylene glycol polymer, or other substances. *Id.* Gaylord describes another multichromophore embodiment that has the following structure:



Id. ¶ 18. As with the previous embodiment, Gaylord states that R¹ can be “a solubilizing group” that can be an ethylene glycol oligomer, ethylene glycol polymer, or other substances. *Id.* ¶ 19.

2. Analysis: Claim 1

Petitioner contends that Polymers 1 and 2 of Gaylord expressly discloses every limitation of claim 1. Pet. 42–50. With respect to the solubility limitations of claim 1, Petitioner contends that Gaylord discloses the use of “charge-neutral water-soluble groups” such as “polyalkylene oxide having from 1 to about 22 carbons.” *Id.* at 43–44. According to Petitioner, these structures are the same as those “taught in the ’303 patent as corresponding to non-ionic side groups ‘capable of imparting water solubility in excess of 10 mg/mL’ and therefore disclose” the R limitation of claim 1. *Id.* at 44 (citing Ex. 1007 ¶ 476; Ex. 1006, 54:53–55, 72:42–52).

Patent Owner argues that Gaylord fails to provide the solubility of its conjugated polymers and does not disclose “a polymer having a solubility in water in excess of 10 mg/mL.” Prelim. Resp. 28. Patent Owner concedes that PEG groups as a class can impart solubility to a conjugated polymer, but contends a solubility in excess of 10 mg/mL is only achieved “in some

embodiments” of the ’303 patent. *Id.* at 29. Thus, Patent Owner contends merely identifying PEG polymers that fall within the scope of the ’303 patent’s disclosure is insufficient to show that the specific conjugated polymer of Gaylord has a solubility in water in excess of 10 mg/mL.

Petitioner responds that Gaylord teaches structures falling within the genus recited in claim 2 and therefore “[t]hose structures must necessarily meet the functional limitations of claim 1 as well.” Prelim. Reply 3 (citing *Alcon*, 687 F.3d at 1368).

As discussed above, we construe claim 1 to require that the non-ionic side group is capable of imparting water solubility to the *conjugated polymer* in excess of 10 mg/mL. Thus, merely noting that the PEG polymers of Gaylord are water soluble, or have been shown to provide a particular level of water solubility to other types of conjugated polymers, is not sufficient to anticipate claim 1. Rather, Petitioner must demonstrate that the PEG polymers of Gaylord are capable of imparting the claimed level of solubility to a water-soluble conjugated polymer of Formula Ia with the recited variables R, MU, L1 and L2, G1 and G2, n, and a, b, c, and d. Petitioner has not done so in this case, and provides no solubility data for the conjugated polymer of Gaylord.

In view of the foregoing, we determine that Petitioner fails to demonstrate a reasonable likelihood that claim 1 is anticipated by Gaylord.

3. *Analysis: Remaining Challenged Claims*

Challenged claims 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 all require, either directly or through dependency, a non-ionic side group that is capable of imparting water solubility in excess of 10 mg/mL. Petitioner’s arguments with respect to these claims do not resolve the

deficiencies noted above with respect to claim 1. Accordingly, Petitioner fails to demonstrate a reasonable likelihood that claims 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 are anticipated by Gaylord.

G. Obviousness of claims 1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 over Gaylord and Bazan

Petitioner contends that the subject matter of claims 1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 would have been obvious over the combined disclosures of Gaylord and Bazan. Pet. 58–62.

1. Bazan

Bazan “relates to polycationic multichromophores” and “to methods, articles and compositions for the detection and analysis of biomolecules in a sample.” Ex. 1011, code (57). The multichromophore may be conjugated polymer including “‘low bandgap repeat units’ of a type and in an amount that contribute an absorption to the polymer in the range of about 450 nm to about 1000 nm.” *Id.* ¶ 77. Bazan explains that the conjugated polymer can include a sufficient amount of an appropriate low bandgap repeat unit to render the conjugated polymer “capable of absorbing energy at a desired wavelength above 450 nm and providing a detectable signal.” *Id.* ¶ 81. Bazan further explains that the conjugated polymer “contains a sufficient density of solubilizing functionalities to render the overall polymer soluble in a polar medium,” such as water. *Id.* ¶ 90.

2. Analysis

Petitioner’s arguments with respect to Gaylord and Bazan do not remedy the deficiencies noted above with respect to anticipation by Gaylord. In particular, Petitioner does not demonstrate that it would have been obvious in view of Gaylord and Bazan to modify the conjugated polymers of

Gaylord such that “R is a non-ionic side group capable of imparting solubility in excess of 10 mg/mL.” Accordingly, Petitioner does not demonstrate a reasonable likelihood that claims 1, 2, 4, 5, 7, 10, 12, 14, 15, 17, 20–24, 26–37, 40, and 41 would have been obvious over Gaylord and Bazan.

H. Obviousness of claims 3 and 25 over Gaylord and Xue or Sumranjit

Claim 3 depends from claim 1 and further requires “wherein each R is $(\text{CH}_2)_3(\text{OCH}_2\text{CH}_2)_{11}\text{OCH}_3$.” Ex. 1006, 240:63–65. Claim 25 also depends from claim 1 and further requires that the conjugated polymer comprises “a minimum number average molecular weight of greater than 40,000 g/mol and a water solubility of greater than 50 mg/mL in pure water or a phosphate buffered saline solution.” *Id.* at 254:11–15. Petitioner contends the subject matter of claims 3 and 25 would have been obvious over the combined disclosures of Gaylord and Xue or Sumranjit. Pet. 62–64.

Petitioner contends that Example 16 of Gaylord teaches fluorene substituted with $(\text{CH}_2)_2(\text{OCH}_2\text{CH}_2)_3\text{OCH}_3$ and that Gaylord provides a range of molecular weights between 1,000 and 250,000 g/mol. *Id.* at 63 (citing Ex. 1009 ¶¶ 182, 279, 325, 485; Ex. 1011 ¶ 90; Ex. 1007 ¶ 545). Petitioner further contends that Gaylord teaches PEG polymers with variable numbers of PEG repeats, including from 1 to 22 carbon atoms, which Petitioner contends would include a PEG having 11 repeats, as recited in claim 3. *Id.* at 63 (citing Ex. 1009 ¶¶ 13–14; Ex. 1007 ¶ 474). Petitioner further contends that one of ordinary skill in the art would have understood that increasing the number of PEG repeats would lead to higher water solubility, as taught in Xue and Sumranjit, and therefore would have arrived at the claimed water solubility of 50 mg/mL through “routine optimization.” *Id.* at

63–64 (citing Ex. 1010, 2289; Ex. 1014, 67; Ex. 1007 ¶¶ 543–546).

On this record, we are not persuaded by Petitioner’s arguments. First, claim 3 depends from claim 1 and Petitioner’s arguments with respect to claim 3 do not cure the deficiencies noted above with respect to claim 1. Second, Petitioner does not demonstrate that routine optimization using polymers with PEG repeats within the range disclosed in Gaylord would result in a solubility for the conjugated polymer of greater than 50 mg/mL. Nor does Petitioner present sufficient evidence that modifying the number of PEG repeat units to a value higher than the range disclosed in the recited prior art would result in the claimed solubility level. Thus, we are left to speculate as to whether the claimed solubility could be achieved by increasing the number of PEG repeats. Such speculation does not satisfy the reasonable likelihood standard for institution.

In view of the foregoing, we determine that Petitioner has not demonstrated a reasonable likelihood that claims 3 and 25 would have been obvious over the combined disclosures of Gaylord and Xue or Sumranjit.

I. Remaining Grounds

Petitioner contends that claims 6, 8, 9, 11, and 13 would have been obvious over Gaylord, in view of Gauthier, Gordon, or Lou, in further view of Haugland; claim 18 would have been obvious over Haugland or Hermanson; and claim 19 would have been obvious over Gaylord, in view of Hermanson. Pet. 65–70.

Each of claims 6, 8, 9, 11, 13, 18, and 19 depend from claim 1, and Petitioner presents no evidence or argument in these grounds that would overcome the deficiencies discussed above with respect to independent claim 1. Accordingly, Petitioner fails to demonstrate a reasonable likelihood

that claims 6, 8, 9, 11, and 13 would have been obvious over Gaylord, in view of Gauthier, Gordon, or Lou, in further view of Haugland; claim 18 would have been obvious over Haugland or Hermanson; and claim 19 would have been obvious over Gaylord, in view of Hermanson.

IV. CONCLUSION

For the reasons above, we determine that the information presented in the Petition fails to establish that there is a reasonable likelihood that Petitioner would prevail with respect to challenged claims 1–15, 17–37, 40, and 41 of the '303 patent.

V. ORDER

For the foregoing reasons, it is

ORDERED that the Petition is *denied* as to all challenged claims and grounds and no trial is instituted.

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