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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte URI BANIN and YUN-WEI CAO

Appeal 2010-007980
Application 10/145,609
Technology Center 2800

Before BRUCE R. WINSOR, JAMES B. ARPIN,
and DAVID C. McKONE, *Administrative Patent Judges*.

McKONE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from a Non-Final Rejection of claims 1, 6-8, 14-18, 31-33, 35-37, 44, and 51-53, which constitute all the claims pending in this application. *See* App. Br. 3.¹

¹ Throughout this opinion, we refer to the Appeal Brief filed December 8, 2008 (“App. Br.”), the Examiner’s Answer mailed February 19, 2010 (“Ans.”), and the Reply Brief filed August 4, 2009 (“Reply Br.”). The Appeal Brief filed October 29, 2007, and the Examiner’s Answer mailed June 16, 2009, have not been considered as they are deemed to have been

Claims 2-5, 9-13, 19-30, 34, 38-43, and 45-50 are cancelled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

STATEMENT OF THE CASE

Appellants' invention relates to semiconductor composite nanocrystal materials, for use, for example, in electro-optical and laser devices. *See* Spec. 1:5-9. Claim 1, which is illustrative of the invention, reads as follows:

1. Semiconductor core/ shell nanocrystal comprising a semiconductor nanocrystal core that is luminescent in the near infra red (NIR), and having a crystalline shell encapsulating said core,

said shell having a bandgap and/or crystallographic structure such that emittance wavelength of the core material encapsulated therein is substantially not modified,

said semiconductor core/shell nanocrystal having a changed quantum yield and/or chemical and/or photostability that is different from that of the non-encapsulated nanocore,

wherein said semiconductor core-shell nanocrystal is selected from the group consisting of: InAs/GaAs; InAs/InP; InAs/CdSe; InAs/ZnSe; and InAs/ZnS and said emittance has a wavelength of from about 0.8 microns to about 4.3 microns.

THE REJECTIONS

The Examiner relies on the following prior art in rejecting the claims:

superseded by the later dated Appeal Brief and Examiner's Answer, respectively.

Bawendi	U.S. 6,251,303 B1	June 26, 2001 (filed Sep. 18, 1998)
Dobson	U.S. 6,596,194 B1	July 22, 2003 (filed Feb. 9, 1999) ²

Claims 1, 6, 14, 17, 18, 31-33, 35-37, 44, 52, and 53³ stand rejected under 35 U.S.C. § 102(b)⁴ as being anticipated by Bawendi. *See* Ans. 4-9.

Claims 7, 8, 15, 16, and 51 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bawendi and Dobson. *See* Ans. 9-11.

ISSUES

Appellants state that claims 1, 6-8, 14-18, and 51-53 stand or fall together. *See* App. Br. 4. Appellants argue that Bawendi is inoperable for producing the nanocrystals recited in claim 1 and, thus, that it is not an enabling reference. To support this argument, Appellants submit a declaration (“Markovich Decl.”) of Dr. Gil Markovich, a Senior Lecturer at

² The Examiner rejected Appellants’ claims over WO 00/17655 to Bawendi and WO 99/46204 to Dobson. *See* Ans. 4, 9-10. WO 00/17655 is a parent application to U.S. 6,251,303 and WO 99/46204 is a parent application to U.S. 6,596,194 B1. *See id.* Hereinafter, we refer to the issued U.S. patents, as do the Examiner, *see id.*, and Appellants, *see* App. Br. 4.

³ The Answer indicates that claims 9-13 and 47-50 are rejected. *See* Ans. 4-6, 8-9. However, these claims have been cancelled and are not appealed. *See* App. Br. 3. Accordingly, these claims are not discussed further.

⁴ The Answer refers to this ground for rejection alternately as an anticipation rejection, *see* Ans. 4, § (6), and an obviousness rejection, *see* Ans. 4, § (9). The rejection from which Appellants appeal refers to this rejection as being made under § 102(b). *See* Non-Final Rej. 2-5 (mailed March 17, 2008). We find that the weight of the evidence indicates that the Examiner intended a rejection for anticipation, and that Appellants understood it as such, *see* App. Br. 4, § (VI); *but compare* Reply Br. 4. Accordingly, we treat the rejection as an anticipation rejection under § 102(b).

Tel-Aviv University and a researcher in the field of semiconductor nanocrystals, *see* Markovich Decl. ¶ 1. According to Appellants, a person of ordinary skill in the art would not have been able to make the nanocrystals of claim 1, without undue experimentation, using the temperatures and solvents disclosed in Bawendi. *See* App. Br. 5-6 (relying on Markovich Decl.). The Examiner considered the Markovich Declaration to be “mere argument,” and entitled to little weight, because Dr. Markovich did not present any experimental data to support his conclusions. *See* Ans. 12-14. The Examiner also finds, in contradiction to Dr. Markovich’s opinions, that Bawendi specifically discloses the temperature and solvents that Appellants argue are necessary for producing the claimed nanocrystals. *See* Ans. 15-18. The issue is whether Appellants have shown, by a preponderance of the evidence, that Bawendi is inoperable and not enabled as to the nanocrystals recited in claim 1.

Appellants also argue that Bawendi does not disclose a core/shell nanocrystal with a changed quantum yield and/or chemical and/or photostability that is different from that of the non-encapsulated nanocrystal. *See* App. Br. 7. The Examiner finds that Bawendi discloses a nanocrystal with a changed quantum yield. *See* Ans. 23-25 (citing Bawendi, col. 1, ll. 9-27; col. 6, l. 66–col. 7, l. 7. The issue is whether the Examiner erred in finding that Bawendi discloses “semiconductor core/shell nanocrystal having a changed quantum yield and/or chemical and/or photostability that is different from that of the non-encapsulated nanocrystal,” as recited in claim 1.

Another issue is whether the Examiner erred in finding that Bawendi discloses the elements of claim 1 arranged as they are in the claim. *See* App. Br. 8-9.

Appellants separately argue claims 31-33 and 35-37, which are directed to lasers that incorporate the nanocrystals of claim 1. *See App. Br. 9-10.* The issue is whether the Examiner erred in finding that Bawendi discloses the laser components recited in claims 31-33 and 35-37. *See id.*

Appellants separately argue claim 44, which depends on claim 1. The issue is whether the Examiner erred in finding that Bawendi discloses nanocrystals as recited in claim 1 that are only soluble in an organic solvent. *See App. Br. 10.*

ANALYSIS

REJECTION OF CLAIMS 1, 6, 14, 17, 18, 31-33, 35-37, 44, 52, AND 53 UNDER 35 U.S.C. § 102(b)

Claims 1, 6, 14, 17, 18, 52, and 53

Appellants, relying on the Markovich Declaration, contend that Bawendi does not provide an enabling disclosure of the nanocrystals recited in claim 1. “Whether a prior art reference is enabling is a question of law based upon underlying factual findings.” *Minn. Mining & Mfg. Co. v. Chemque, Inc.*, 303 F.3d 1294, 1301 (Fed. Cir. 2002). “A claimed invention cannot be anticipated by a prior art reference if the allegedly anticipatory disclosures cited as prior art are not enabled.” *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354 (Fed. Cir. 2003). “Enablement of prior art requires that the reference teach a skilled artisan to make or carry out what it discloses in relation to the claimed invention.” *In re Antor Media Corp.*, 689 F.3d 1282, 1290 (Fed. Cir. 2012). Here, the burden is on Appellants to show that Bawendi is inoperable, since “[i]n patent prosecution the examiner is entitled to reject application claims as anticipated by a prior art patent without conducting an inquiry into whether or not that patent is enabled.” *Amgen*, 314 F.3d at 1355. Appellants can

overcome the presumption that Bawendi is enabled by “proving that the relevant disclosures of the prior art patent are not enabled.” *Id.* Appellants must show this by a preponderance of the evidence. *See In re Sasse*, 629 F.2d 675, 681 (CCPA 1980).

Bawendi discloses a nanocrystal core that emits energy in the near infra-red (“NIR”) range, listing indium arsenide (“InAs”) as an example. *See Bawendi*, col. 7, ll. 15-17. Bawendi describes coating such a core with a shell that has a band gap energy in the ultraviolet regions, listing zinc sulfide (“ZnS”) as an example. *See Bawendi*, col. 7, ll. 18-20. Thus, Bawendi discloses a core/shell nanocrystal of InAs/ZnS, one of the combinations listed in claim 1’s *Markush* group. *See Ans. 5.*

Appellants rely on the Markovich Declaration to show that their claimed nanocrystals could not have been made using the processes described in Bawendi. *See App. Br. 6.* In essence, Dr. Markovich opines that the description in Bawendi is directed to techniques for producing nanocrystals with a core of a II-VI semiconductor material and that such techniques would not work for creating nanocrystals with cores of III-V semiconductor material, as recited in claim 1. *See Markovich Decl.* ¶¶ 3-6.

The Examiner contends that the Markovich Declaration failed to show the results of any tests or experiments and, thus, was “mere argument” entitled to little weight. *Ans. 12-14* (citing MPEP § 716.01 and cases cited therein). According to the Examiner, because the Markovich Declaration is “opinion not supported by facts,” “no factual evidence exists that rebuts the operability of Biwandi’s [sic] patent.” *Ans. 13.* The Examiner concludes that because Appellants “submitted zero evidence,” they failed to meet their “preponderance of evidence” burden. *Ans. 14.*

“When a patent applicant puts forth rebuttal evidence, the Board must consider that evidence.” *In re Sullivan*, 498 F.3d 1345, 1351 (Fed. Cir. 2007). However, “[t]he Board has broad discretion as to the weight to give to declarations offered in the course of prosecution.” *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004). “Opinion testimony rendered by experts must be given consideration, and while not controlling, generally is entitled to some weight. Lack of factual support for expert opinion going to factual determinations, however, may render the testimony of little probative value in a validity determination.” *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 294 (Fed. Cir. 1985) (citations omitted).

We have considered, but are not persuaded by, the Markovich Declaration. Dr. Markovich provides little factual support for his opinions and instead relies almost exclusively on what he learned from reading the Specification. *See Am. Acad.*, 367 F.3d at 1368 (“[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations.” (citations omitted)). For example, Dr. Markovich’s opinion that the techniques described in Bawendi “would not work” for nanocrystals with a core of a III-V semiconductor material is based on “[h]aving read and understood the application [Specification] and the patent [Bawendi]” Markovich Decl. ¶ 4; *see also id.* at ¶ 6 (“As I learn from the application, instead, a new and different set of reaction conditions had to be developed including, among other factors, solvent composition and reaction temperature.”). Specifically, his opinion that “a high temperature range should be used to produce” Appellants’ nanocrystals, and that Bawendi does not describe such a range,

is based on a “finding by the inventors” that Dr. Markovich “learn[ed] from the application.” Markovich Decl. ¶ 6(A). Likewise, for his opinion that using the solvent disclosed in Bawendi “did not work” for producing Appellants’ nanocrystals, Dr. Markovich relied on “pages 29 to 36 of the application.” Markovich Decl. ¶ 6(C).

To be sure, Dr. Markovich does refer to his “experience,” and he notes that he “is actively engaged in research related to the properties and production of nanocrystals at the time of the invention described in the application.” Markovich Decl. ¶¶ 6(C), 7. However, as the Examiner explains, Dr. Markovich does not present any experimental data or research related to the use of Bawendi’s techniques in producing nanocrystals of the type claimed by Appellants. *See* Ans. 12-13. Appellants argue that “while Dr. Markovich did not conduct his own experiments, he did review and refer to references wherein relevant experiments were conducted – references that speak to the issue of whether Bawendi could be considered an enabling reference or whether Bawendi’s teachings render the appealed claims obvious.” Reply Br. 3 (citing Markovich Decl. p. 7 (¶ 6(C))). However, Dr. Markovich does not cite these references as supporting his opinions. Rather, Dr. Markovich lists these references as showing examples of using trioctylphosphine oxide (“TOPO”) in producing nanocrystals such as those described in Bawendi. *See* Markovich Decl. ¶ 6(C). In support of his opinion that such a solvent “did not work” for the nanocrystals recited in claim 1, Dr. Markovich cites to “pages 29 to 36 of the application [Specification].” *Id.* Thus, the opinions expressed by Dr. Markovich do not materially add to the disclosure already in the Specification. Appellants do

not contend that the Specification itself presents sufficient evidence to conclude that Bawendi is inoperable.

The Markovich Declaration is also contradicted by the Examiner's findings as to Bawendi's disclosure. Dr. Markovich opines that production of Appellants' claimed nanocrystals requires "a high temperature of at least 240°C and preferably higher (250-350°C)," while Bawendi "mentions using temperatures between 140-220°C." Markovich Decl. ¶ 6(A) (citing Bawendi, col. 15, ll. 28-30). The Examiner, on the other hand, finds that Bawendi discloses using a temperature of 350°C. *See* Ans. 15-16 (citing Bawendi, col. 14, ll. 24-25). Appellants do not adequately explain why the Examiner erred in this finding. Likewise, Appellants argue, relying on Dr. Markovich, that to produce Appellants' nanocrystals, trioctylphosphine ("TOP") was required as a solvent while Bawendi disclosed using TOPO. *See* App. Br. 6-7. The Examiner finds that Bawendi discloses a reaction solvent using TOPO and TOP similar to the solvent described in Appellants' Specification. *See* Ans. 16-17 (comparing Bawendi, col. 15, ll. 1-5, to Spec. 10:10-18). Appellants again do not adequately explain why the Examiner erred in this finding. Thus, Appellants have not met their burden to show, by a preponderance of the evidence, that Bawendi does not enable the nanocrystals recited in claim 1.

Appellants also argue that Bawendi does not disclose "that said semiconductor core/shell nanocrystal has a changed quantum yield and/or chemical and/or photostability that is different from that of the non-encapsulated nanocore." App. Br. 7. The Examiner points out that Bawendi discloses that coating its quantum dots (adding a shell to its nanocrystal cores) "results in higher efficiency in the luminescent process." Ans. 23-24

(quoting Bawendi, col. 6, l. 66–col. 7, l. 7). The Examiner finds that this is a disclosure of a changed quantum yield. *See* Ans. 24-25. Appellants do not adequately explain why this finding is erroneous.

Appellants further contend that Bawendi does not disclose each element of claim 1 arranged as in the claim. *See* App. Br. 8-9. Appellants admit that Bawendi includes “a general reference to a large genus of possible core and shell combinations which could in theory encompass nanocrystals of a Group III-Group V core and a Group II-Group VI shell,” as recited in claim 1, but argue that there is no teaching in Bawendi of how to obtain such nanocrystals. *See id.* As we explained above, Appellants do not adequately rebut the Examiner’s finding that Bawendi provides an enabling disclosure of the nanocrystals recited in claim 1, *see* Ans. 5-6. *See also* App. Br. at 26-28.

Accordingly, we sustain the rejection of (1) claim 1 and (2) claims 6, 14, 17, 18, 52, and 53, which Appellants contend stand or fall with claim 1, *see* App. Br. 4.

Claims 31-33 and 35-37

Claim 31 recites a laser that incorporates the nanocrystals of claim 1. Claims 32, 33, and 35-37 depend on claim 31 and more narrowly recite the components of claim 31’s laser. Appellants argue that Bawendi does not disclose a laser at all and, thus, does not disclose the claimed laser components beyond the nanocrystals of claim 1 (which we do find disclosed in Bawendi, for the above reasons). *See* App. Br. 9-10. We agree. Bawendi describes water-soluble fluorescent semiconductor nanocrystals. *See*

Bawendi, Title; Abstract; col. 1, ll. 13-16. However, Bawendi does not describe the applications in which those nanocrystals are to be used.

The Examiner concludes that claim 31's recitation of laser components was entitled to no patentable weight because those limitations were "functional recitation[s]" of a "particular use of the core/shell nanocrystal recited in claim 1." Ans. 29. Instead, the additional limitations are "the mere recitation of a newly discovered function or property (use of core/shell nanocrystal as laser), inherently possessed by" Bawendi's nanocrystals. *Id.* We disagree. Claim 31's recitations of laser components are structural and the Examiner has not shown that these components are merely inherent properties of nanocrystals.

For example, as Appellants contend (*see* App. Br. 9-10), Bawendi does not disclose a laser host medium, as recited in claim 31. According to Appellants' Specification, examples of a laser host medium include "a film, an optical fiber, a polymeric film, or an organic solvent such as hexane or toluene." Spec. 55:8-9. The Examiner finds that a laser host medium is taught in Bawendi's disclosure of an organic solvent. *See* Ans. 30 (citing Bawendi, col. 4; col. 14, ll. 59-60). This organic solvent, however, is used in an intermediate step in preparing Bawendi's nanocrystals, not as a component of a laser. *See* Bawendi, col. 14, ll. 57-67. Thus, Bawendi does not disclose "a laser host medium," as recited in claim 31. Accordingly, we do not sustain the rejection of (1) claim 31 and (2) claims 32, 33, and 35-37, which depend on claim 31.

We note that the Examiner has rejected claims 31-33 and 35-37 under §102(b). We express no opinion regarding whether a laser with the

components recited in these claims would constitute an obvious application of the nanocrystals of claim 1 in light of Bawendi and another reference.

Claim 44

Claim 44 recites a nanocrystal of claim 1 that “is only soluble in an organic solvent.” The Examiner finds that Bawendi discloses this element. *See* Ans. 20-22 (citing Bawendi, col. 2, ll. 6-61). Bawendi states that “[t]he quantum dots described above are soluble or dispersible only in organic solvents, such as hexane or pyridine.” Bawendi, col. 2, ll. 32-33.

Appellants point out that this disclosure “above” in Bawendi is directed to “only a limited number of specific examples of particles passivated with inorganic coatings and specifically to CdSe quantum dots capped with ZnS and a layer of thiophenyl groups.” App. Br. 10. Thus, Appellants argue, there “is no teaching either directly or inherently from within Bawendi that provides general support for nanocrystals other than those described by him being soluble in an organic solvent.” *Id.* We agree with Appellants. While, as we explain above, Bawendi discloses at least one of the nanocrystals recited in claim 1, the Examiner has not shown that Bawendi discloses a nanocrystal within Appellants’ claim 1 that is only soluble in an organic solvent. Nor has the Examiner shown that such solubility is an inherent property of the nanocrystals disclosed in Bawendi that the Examiner finds to be within claim 1. Accordingly, we do not sustain the rejection of claim 44.⁵

⁵ If prosecution continues, the Examiner should consider whether the Specification adequately describes a nanocrystal, as recited in claim 1, that is only soluble in an organic solvent.

REJECTION OF CLAIMS 7, 8, 15, 16, AND 51 UNDER 35 U.S.C. § 103(a)

Claims 7, 8, 15, 16, and 51 depend on claim 1. Appellants state that each of these claims stands or falls together with claim 1. *See* App. Br. 4. Accordingly, we sustain the rejection of claims 7, 8, 15, 16, and 51 for the reasons given above for claim 1.

ORDER

The decision of the Examiner to reject claims 1, 6-8, 14-18, and 51-53 is affirmed.

The decision of the Examiner to reject claims 31-33, 35-37, and 44 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2010).

AFFIRMED-IN-PART

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