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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte University of Washington,
Patent Owner and Appellant

Appeal 2016-006039
Reexamination Control 90/013,318
Patent 7,585,349 B2
Technology Center 3900

Before CHUNG K. PAK, JEFFREY B. ROBERTSON, and
RAE LYNN P. GUEST, *Administrative Patent Judges*.

ROBERTSON, *Administrative Patent Judge*.

DECISION ON APPEAL

University of Washington, the owner of the patent under reexamination (hereinafter the "'349 Patent"), appeals under 35 U.S.C. §§ 134(b) and 306 from a final rejection of claims 7, 9–11, and 13–20 (Appeal Brief filed January 26, 2016, hereinafter "App. Br.," 4; Final Office Action mailed July 24, 2015).[1] We have jurisdiction under 35 U.S.C. §§ 134(b) and 306.

We REVERSE.

STATEMENT OF THE CASE

This reexamination proceeding arose from a third-party request for *ex parte* reexamination filed by Teresa A. Lavenue of the law firm Hogan Lovells US LLP, (Request for *Ex Parte* Reexamination filed August 13, 2014). The '349 Patent issued to Younan Xia and Yugang Sun on September 8, 2009, from Application 10/732,910, filed on December 9, 2003. Of particular importance to this proceeding is that Application 10/732,910 claims priority to Provisional Application 60/432,098 (the "'098 provisional application"), filed on December 9, 2002.

The '349 Patent is directed to the formation of silver nanostructures, and in particular, silver nanowires, in a controlled fashion. (Col. 3, ll. 40–58; col. 5, ll. 22–28.)

[1] We are informed that claims 1–4 were not subject to reexamination, claims 5 and 6 were determined to be patentable, claims 8, 12, and added claims 25–39 have been cancelled, and current claims 15–20 were originally presented as claim 16, 17, 19, 21, 22, and 24. (App. Br. 4, n.1; Final Office Action Summary.)

Claims 7 and 11 are the independent claims on appeal. Claim 7 on appeal is representative and reads as follows (with underlining to show additions relative to the claim as originally issued):

> 7. A method of manufacturing silver nanowires having a desired shape and size, the method comprising:
>
> obtaining a solution of silver nitrate in a solvent;
>
> obtaining a solution of poly(vinyl pyrrolidone) in a solvent;
>
> selecting at least one reaction condition to yield a silver nanowire having a desired shape and size;
>
> combining the solution of silver nitrate m solvent and the solution of poly(vinyl pyrrolidone) in solvent together; and
>
> allowing a reaction to occur at a reaction temperature over a growth time,
>
> <u>wherein the solution of silver nitrate in solvent has a concentration of less than about 0.1 mol/dm^3</u>.

(Claims App'x, App. Br. 18–19.)

The Examiner rejected claims 7, 9–11, and 13–20 under 35 U.S.C. § 103(a) as obvious over Sun et al., "Uniform Silver Nanowires Synthesis by Reducing $AgNO_3$ with Ethylene Glycol in the Presence of Seeds and Poly(Vinyl Pyrrolidone)," Chemistry of Material, Vol. 14, No. 11, 10/8/2002, pages 4736–4745 (hereinafter "Sun 1") as evidenced by Sun et al., "Polyol Synthesis of Uniform Silver Nanowires: A Plausible Growth Mechanism and the Supporting Evidence," Nano Letter, Vol. 3, No. 7, 6/10/2003, pp. 955–960 (hereinafter "Sun 2"). (Ans. 5–7.)

ISSUE

The central dispute in this appeal is whether the claims on appeal are entitled to priority to the '098 provisional application. As discussed above, the '349 Patent has a filing date of December 9, 2003, and the '098 provisional application was filed on December 9, 2002. The publication date of Sun 1 is October 8, 2002. Thus, if the claims on appeal are not entitled to claim priority to the '098 provisional application, Sun 1 was published more than a year prior to the filing of the '349 Patent and qualifies as prior art under 35 U.S.C. § 102(b) (pre-AIA). However, if the claims on appeal are entitled to the filing date of the '098 provisional application, then Sun 1 qualifies as prior art under 35 U.S.C. § 102(a) (pre-AIA), and may be disqualified as prior art.[2]

The Examiner found that that the '098 provisional application does not support every element of independent claims 7 and 11, and in particular that the '098 provisional application does not describe the step of "selecting at least one reaction condition to yield a silver nanowire having a desired shape and size," as recited in claim 7. (Ans. 5–7.)

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[2] In the Answer, the Examiner withdrew a rejection based on Sun 2, which was published on June 10, 2003 in view of Declarations filed by Patent Owner on September 15, 2015, stating that the work described in Sun 2 is that of the inventors, and the additional authors of Sun 2 were merely acting under the direction of the inventors. (Ans. 4.) A review of the electronic record reveals that no declarations were filed on September 15, 2015. Declarations under 37 C.F.R. § 1.132 of Yugang Sun ("Sun Declaration," executed on September 21, 2015) and Younan Xia ("Xia Declaration," executed on September 18, 2015) were filed on September 21, 2015 and contained the statements referenced by the Examiner. We are of the view that the September 15th date referenced by the Examiner, instead of September 21st, is harmless error.

Appellant contends that the '098 provisional application contains sufficient disclosure to support the nanowire limitations recited in the claims, because the '098 generally describes how to control shapes of silver nanoparticles, and explicitly describes silver nanowires. (App. Br. 6–7.) Appellant argues further that, in describing the products produced by the reaction of silver nitrate and poly(vinyl pyrrolidone), the '098 provisional application describes the concentration of silver nitrate necessary to produce silver nanowires as a major product versus silver nanocubes as a major product. (App. Br. 7–10.)

Thus, the principal issue in this appeal is:

Has Appellant identified reversible error in the Examiner's position that the '098 provisional application does not provide written descriptive support for the nanowire limitations present in the claims on appeal?

FINDINGS OF FACT ("FF")

1. The '098 provisional application discloses:

   > The intrinsic properties of a metal nanoparticle are mainly determined by its size, shape, composition, crystallinity, and structure (solid vs. hollow). In principle, one could control any one of these parameters to fine-tune the properties of this nanoparticle. Many metals can now be processed into monodisperse nanoparticles with controllable composition and structure (*13*), and sometimes in large quantities through solution-phase methods (*14, 15*). Despite this, the challenge to synthetically control the shape of metal nanoparticles has been met with limited success.
   >
   > (P. 2, ll. 6–13.)

2. The ’098 provisional application discloses:

   The primary reaction involved the reduction of silver nitrate with ethylene glycol at 160 °C. In this so-called polyol process (*23*), the ethylene glycol served as both reductant and solvent. We recently demonstrated that this reaction could yield bicrystalline silver nanowires in the presence of a capping reagent such as poly(vinyl pyrrolidone) (PVP) (*24*). Subsequent experiments suggested that the morphology of the product had a strong dependence on the reaction conditions. When the concentration of $AgNO_3$ was increased by a factor of three and the molar ratio between the repeating unit of PVP and $AgNO_3$ was kept at 1.5, single crystalline nanocubes of silver were obtained (*25*).

   (P. 2, l. 21 – p. 3, l. 4.)

3. The ’098 provisional application discloses:

   The morphology and dimensions of the product were found to strongly depend on reaction conditions such as temperature, the concentration of $AgNO_3$, and the molar ratio between the repeating unit of PVP and $AgNO_3$. For example, when the temperature was reduced to 120 °C or increased to 190 °C, the product was dominated by nanoparticles with irregular shapes. The initial concentration of $AgNO_3$ had to be higher than ~0.1 M, otherwise silver nanowires were the major product.

   (P. 4, ll. 4–9.)

4. The ’098 provisional application discloses:

   These silver and gold nanoparticles should find use in a variety of areas that include photonics, catalysis, and SERS-based sensing. This work and previous demonstrations from other groups (*17–22*) make it clear that chemical synthesis of metal nanoparticles with well-controlled shapes, sizes, and structures is a practical reality. The major requirement seems to be the selection of a capping reagent that is able to chemically modify various faces of a metal with an appropriate selectivity.

(p. 7, ll. 8–13.)

5. The '098 provisional application discloses:

> In a typical synthesis of silver nanocubes, 5 mL anhydrous ethylene glycol (Aldrich, 99.8%) was heated at 160 °C for 1 hour. 3 mL ethylene glycol solution of $AgNO_3$ (0.25 M, Aldrich, 99+%) and 3 mL ethylene glycol solution of PVP (0.375 Min repeating unit, Mw~55 000, Aldrich) were simultaneously added to the ethylene glycol using a two-channel syringe pump at a rate of 0.375 mL/min. The reaction mixture was then continued with heating at 160 °C for another 45 min. The product was dominated by cubic nanoparticles, with a small amount (<5%) of silver nanowires. These nanowires could be easily separated from nanocubes through filtration due to their large difference in dimension.

(P. 8, l. 20 – p. 9, l. 4 (endnote 25).)

PRINCIPLES OF LAW

In order to be entitled to the benefit of a provisional application, one requirement is that the invention presently claimed must have been disclosed in the provisional application in the manner provided by 35 U.S.C. § 112, first paragraph. *See* 35 U.S.C. § 119(e)(1); *New Railhead Mfg., L.L.C. v. Vermeer Mfg. Co.*, 298 F.3d 1290, 1294 (Fed. Cir. 2002).

To satisfy the written description requirement, a patent applicant must "convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention." *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991) (emphasis omitted). The mere absence of literal support for a claim limitation "does not, in and of itself, establish a *prima facie* case for lack of adequate descriptive support

under the first paragraph of 35 U.S.C. 112." *Ex parte Parks*, 30 USPQ2d 1234, 1236 (BPAI 1993) (citations omitted).

ANALYSIS

Upon careful review of the record, we agree with Appellant, that claims 7, 9–11, and 13–20 are supported by the '098 provisional application. In its broadest disclosure, the '098 provisional application is directed to metal nanoparticles, which include both nanowires and nanocubes. (FF1, FF4; Title.) Although the discussion in the '098 provisional application focuses on the preparation of silver nanocubes, the '098 provisional application specifically discloses that silver nanowires are produced by the combination of silver nitrate and poly(vinyl pyrrolidone). (FF 2.) That is, the '098 provisional application conveys to one of ordinary skill in the art that when the concentration of silver nitrate is below 0.1 M, silver nanowires are the major product. (FF2, FF3.) Conversely, the '098 provisional application expressly describes conditions that lead to the preparation of silver nanocubes with a minor amount of nanowires, where the minor amount of nanowires can be easily separated. (FF5.) Thus, the '098 provisional application informs one of ordinary skill in the art that the inventors were in possession of processes producing silver nanocubes and silver nanowires. In addition, the '098 provisional application provides conditions necessary to obtain nanowires, in particular, that the concentration of silver nitrate is below 0.1 M, a teaching that is acknowledged by the Examiner. (FF3; Ans. 6.)

As to the Examiner's position that the '098 provisional application does not disclose how to select a reaction condition to yield a silver

nanowire having a desired shape and size as recited in claim 7, and specifically, that the '098 provisional application does not make any statements to suggest that the same adjustments disclosed for nanocubes would work for nanowires, we disagree. (Ans. 6.) The '098 provisional application makes clear that the concentration of silver nitrate is what is used to select between nanocubes and nanowires. (FF3, FF4.) Because the '098 provisional is directed to nanoparticles, one of ordinary skill in the art would understand that other conditions such as temperature and growth time to select a desired size and shape would apply equally to nanocubes and nanowires. (*See* FF3.)

The '349 Patent is consistent with our understanding of the '098 application, as the '349 Patent's disclosure specific to silver nanowires references temperature and growth time as a means to control the production of silver nanowires. (Col. 5, ll. 22–28.) In addition, Example 2 of the '349 Patent is directed to the synthesis of nanocubes, and Example 3 of the '349 Patent is directed to the synthesis of nanowires, where the only difference between the two methods is the concentrations of silver nitrate and poly(vinylpyrrolidone). (Col. 10, ll. 37–67.)

Accordingly, Sun 1 only qualifies as prior art under 35 U.S.C. § 102(a)(pre-AIA), because it was published less than a year before the effective filing date of the claims on appeal in the '349 Patent. As a result, the Examiner's rejection of claims 7, 9–11, and 13—20 under 35 U.S.C. § 102(b) is reversed. In addition, both the Sun Declaration and the Xia Declaration contain statements that the work described in Sun 1 is that of the inventors of the '349 Patent, and that the additional authors of Sun 1 were

acting under the direction of Younan Xia and Yugang Sun. (Sun Decl. paras. 3–7; Xia Decl., paras. 3–7.) The Examiner found similar statements persuasive in withdrawing the rejection of claims 7, 9–11, and 13–20 under 35 U.S.C. § 102(a)(pre-AIA) as anticipated by Sun 2. (Ans. 4; Sun Decl. paras. 8–10; Xia Decl., paras. 8–10.) Therefore, a rejection under 35 U.S.C. § 102(a)(pre-AIA) would be improper.

CONCLUSION

On this record, Appellant has demonstrated error in the Examiner's position that the '098 provisional application does not provide support for the nanowire limitations present in the claims on appeal.

DECISION

The Examiner's decision to reject claims 7, 9–11, and 13–20 under 35 U.S.C. § 102(b) is reversed.

Requests for extensions of time in this *ex parte* reexamination proceeding are governed by 37 C.F.R. § 1.550(c). *See* 37 C.F.R. § 41.50(f).

REVERSED

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