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571-272-7822

Paper 17
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

NANOCO TECHNOLOGIES LTD.,
Patent Owner.

IPR2021-00184
Patent 7,803,423 B2

Before ERICA A. FRANKLIN, GRACE KARAFFA OBERMANN, and CHRISTOPHER M. KAISER, *Administrative Patent Judges.*

FRANKLIN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Petitioner") filed a Petition requesting an *inter partes* review of claims 1–16 and 21–25 of U.S. Patent No. 7,803,423 B2 (Ex. 1001, "the '423 patent"). Paper 1 ("Petition" or "Pet."). Nanoco Technologies Ltd. ("Patent Owner") filed a Preliminary Response to the Petition. Paper 12 ("Prelim. Resp."). Pursuant to our authorization, Petitioner filed a Reply (Paper 14, "Reply"), and Patent Owner filed a Sur-reply (Paper 15, "Sur-reply").

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2020). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." Upon considering the arguments and evidence presented in the Petition and Preliminary Response, we determine that Petitioner has established a reasonable likelihood that it would prevail in showing the unpatentability of at least one claim challenged in the Petition. Accordingly, we institute an *inter partes* review of claims 1–16 and 21–25 of the '423 patent.

A. Real Parties-in-Interest

Petitioner identifies Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. as real parties-in-interest. Pet. 69. Patent Owner identifies Nanoco Technologies Ltd. as a real party-in-interest. Paper 6, 2.

B. Related Proceedings

Petitioner and Patent Owner provide notice of a district court litigation involving the '423 patent: *Nanoco Technologies Ltd. v. Samsung*

Electronics Co., Ltd., No. 2:20-cv-00038 (E.D. Tex.) (the "District Court case"). Pet. 66; Paper 6, 2. The parties further identify petitions for the four other patents asserted in this District Court case: IPR2021-00182 for U.S. Patent No. 9,680,068, IPR2021-00183 for U.S. Patent No. 7,588,828, IPR2021-00185 for U.S. Patent No. 7,867,557, and IPR2021-00186 for U.S. Patent No. 8,524,365. Pet. 69; Paper 6, 2–3.

C. The '423 Patent

The '423 patent is directed to the conversion of a nanoparticle precursor composition into nanoparticles, where "[t]he conversion is effected in the presence of a molecular cluster compound under conditions permitting seeding and growth of the nanoparticles." Ex. 1001, [57]. The Specification discloses that "[t]here has been substantial interest in the preparation and characterisation, because of their optical, electronic and chemical properties, of compound semiconductors consisting of particles with dimensions in the order of 2-100 nm" and such particles are "[o]ften referred to as quantum dots and/or nanocrystals." *Id.* at 1:11–15. The Specification explains that this interest in quantum dots is "mainly due to their size-tuneable electronic, optical and chemical properties and the need for the further miniaturization of both optical and electronic devices." *Id.* at 1:15–22. The Specification describes prior "bottom-up techniques" to produced quantum dot but states that "early routes applied conventional colloidal aqueous chemistry, with more recent methods involving the kinetically controlled precipitation of nanocrystallites, using organometallic compounds." *Id.* at 1:23–29, 2:52–56.

With regard to its invention, the Specification describes

> a method of producing nanoparticles comprising effecting conversion of a nanoparticle precursor composition to the

> material of the nanoparticles, said precursor composition comprising a first precursor species containing a first ion to be incorporated into the growing nanoparticles and a separate second precursor species containing a second ion to be incorporated into the growing nanoparticles, wherein said conversion is effected in the presence of a molecular cluster compound under conditions permitting seeding and growth of the nanoparticles.

Id. at 4:36–46. The Specification explains that "[a] nanoparticle may have a size falling within the range 2-100 nm" and that an important feature is that conversion of the precursor composition "is effected in the presence of a molecular cluster compound (which will be other than the first or second precursor species)," which "act as a template to direct nanoparticle growth." *Id.* at 4:57–61, 5:2–3.

The Specification states

> 'Molecular cluster' is a term which is widely understood in the relevant technical field but for the sake of clarity should be understood herein to relate to clusters of 3 or more metal or nonmetal atoms and their associated ligands of sufficiently well defined chemical structure such that all molecules of the cluster compound possess the same relative molecular mass. Thus the molecular clusters are identical to one another in the same way that one H_2O molecule is identical to another H_2O molecule.

Id. at 5:3–12. According to the Specification, molecular cluster compounds ("MCC") can provide an essentially monodisperse population of nanoparticles and a "significant advantage of the method of the present invention is that it can be more easily scaled-up for use in industry than current methods." *Id.* at 5:14–21.

The Specification explains that "any suitable molar ratio of the first precursor species compared to the second precursor species may be used." *Id.* at 5:55–57. For example, approximately equal amounts of first and

second precursor species can be used or approximately twice the number of moles of one precursor species can be used relative to another. *Id.* at 5:63–6:4.

In addition, the Specification explains that "[t]he conversion of the precursor composition to the material of the nanoparticles can be conducted in any suitable solvent" but "it is important to ensure that when the cluster compound and precursor composition are introduced in to the solvent the temperature of the solvent is sufficiently high to ensure satisfactory dissolution and mixing of the cluster compound and precursor composition." *Id.* at 6:28–35. The Specification discloses that after the precursor composition and cluster compound are dissolved in the solvent, the temperature of the solution is raise "to a temperature, or range of temperatures, which is/are sufficiently high to initiate nanoparticle growth" and the temperature of the solution can be maintained at that temperature or range of temperatures "for as long as required to form nanoparticles possessing the desired properties." *Id.* at 6:35–42.

D. Illustrative Claims

Petitioner challenges independent claims 1 and 25 and dependent claims 2–16 and 21–24 of the '423 patent. Independent claims 1 and 25, set forth below, are illustrative.

> 1. A method of producing nanoparticles comprising:
>
> effecting conversion of a nanoparticle precursor composition to a material of the nanoparticles, said precursor composition comprising a first precursor species containing a first ion to be incorporated into the nanoparticles and a separate second precursor species containing a second ion to be incorporated into the nanoparticles,
>
> wherein said conversion is effected in the presence of a molecular cluster compound different from the first precursor

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