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Paper 12
Entered: July 27, 2017

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ONED MATERIAL LLC,
Petitioner,

v.

NEXEON LIMITED,
Patent Owner.

Case IPR2017-00961
Patent 8,940,437 B2

Before BRIAN P. MURPHY, JON B. TORNQUIST, and CHRISTOPHER M. KAISER, *Administrative Patent Judges.*

TORNQUIST, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

OneD Material LLC ("Petitioner") filed a Petition (Paper 4, "Pet.") requesting *inter partes* review of claims 18–23 of U.S. Patent No. 8,940,437 B2 (Ex. 1001, "the '437 patent"). Nexeon Limited ("Patent Owner") filed a Preliminary Response to the Petition (Paper 11, "Prelim. Resp.").

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314; 37 C.F.R. § 42.4(a). 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 the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition."

After considering the Petition and the Preliminary Response, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to claims 18–23 of the '437 patent. Accordingly, we do not institute *inter partes* review.

A. Related Proceedings

The parties indicate that the '437 patent and U.S. Patent No. 8,597,831 ("the '831 patent") are at issue in *Nexeon Limited v. EaglePicher Technologies, LLC and OneD Material LLC.*, Case No. 1:15-cv-00995-RGA (D. Del.). Pet. 2; Paper 6, 2. The parties further note that the '831 patent is at issue in IPR2016–01528. Pet. 2; Paper 6, 2.

B. The '437 Patent

The '437 patent discloses pillared silicon particles and a method of fabricating the same. Ex. 1001, Abstract. The '437 patent notes that in conventional lithium–ion rechargeable battery cells, graphite is used as an anode. *Id.* at 1:33–36. When the battery containing the graphite anode is

charged, lithium reacts with the graphite to form LiC_6, which "has a maximum capacity of 372 mAh/g." *Id.* at 1:55–60. In contrast to conventional graphitic anodes, a silicon anode will react with lithium to form $Li_{21}Si_5$, which has a maximum capacity of 4,200 mAh/g. *Id.* at 1:63–2:5. Silicon anodes swell considerably during the charge/discharge cycle, however, causing the anodes to crack or disintegrate. *Id.* at 2:6–10, 2:18–26, 2:32–41.

The '437 patent explains that one approach known in the art to overcome the problem of volumetric swelling was the use of nano-scale silicon powders. *Id.* at 2:11–52. Although these powders are not destroyed during the expansion process, the individual powder particles become isolated from one another and from the copper current collector during the charge/discharge cycle, again resulting in limited sustained capacity. *Id.* According to the '437 patent, these problems have "prevented silicon particles from becoming a commercially viable replacement for graphite in lithium rechargeable batteries." *Id.* at 2:48–52.

Another approach for overcoming volumetric expansion in silicon anodes is the use of a silicon electrode fabricated with a regular or irregular array of silicon pillars. *Id.* at 3:21–34. These silicon pillars are able to absorb the volumetric expansion/contraction associated with the charge and discharge cycles, but the pillars are produced on a high purity, single-crystal silicon wafer, which is expensive. *Id.* at 3:24–34.

To overcome the volumetric expansion problems of prior art silicon powders, and to reduce the cost of silicon anodes, the '437 patent discloses a method of forming silicon pillars on the surface of silicon powders. *Id.* at 3:35–56. These pillared particles may be arranged in a composite structure

(particles, polymer binder, and a conductive additive) or may be directly bonded to the current collector. *Id.* at 4:35–51. According to the '437 patent, "[t]he structure of the particles overcomes the problems of charge/discharge capacity loss." *Id.* at Abstract.

C. Illustrative Claims

Claims 18 and 20 are illustrative of the challenged claims and are reproduced below:

> 18. A plurality of discrete particles wherein each particle comprises silicon and includes a particle core and a plurality of silicon-comprising pillars fabricated on the particle core and extending outwardly therefrom from a first end to a second end, wherein each pillar in the plurality of pillars is attached to the core at the first end of the pillar, and the second end of each pillar is an unattached free end, wherein in each particle, the fraction of the surface area of the particle core occupied by the pillars is in the range of 0.10 to 0.50.

Ex. 1001, 10:20–28.

> 20. A composite electrode for a lithium-ion battery comprising a plurality of discrete particles as claimed in claim 18 and further comprising at least one of a conductive additive and a binder.

Id. at 10:32–35.

D. The Asserted Grounds of Unpatentability

Petitioner contends claims 18–23 of the '437 patent are unpatentable based on the following grounds (Pet. 14–43):[1]

[1] Petitioner also relies on a declaration from Dr. Kurt W. Kolasinski (Ex. 1051).

References	Basis	Claims Challenged
Farrell,[2] Peng,[3] and Green,[4] in view of the knowledge of a person of ordinary skill in the art, as evidenced by Kolasinski[5] and Kasavajjula[6].	§ 103	18–23
Farrell, Peng, Green, and Kasavajjula, in view of the knowledge of a person of ordinary skill in the art, as evidenced by Kolasinski.	§ 103	20 and 23

Petitioner contends that Farrell and Kasavajjula are prior art to the '437 patent under 35 U.S.C. §102(a) and Green, Peng, and Kolasinski are prior art under § 102(b). Pet. 4–5 (asserting that Peng was published online on August 18, 2005). Patent Owner does not challenge the prior art status of any of the asserted references in the Preliminary Response.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, "[a] claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the

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[2] WO 2007/037787, filed May 5, 2006 and published April 5, 2007 (Ex. 1004).
[3] Peng, K., et al., *Aligned Single–Crystalline Si Nanowire Arrays for Photovoltaic Applications*, 1 SMALL Vol. 11, 2005, pp. 1062–1067 (Ex. 1005).
[4] U.S. Patent Pub. No. 2006/0097691, published May 11, 2006 (Ex. 1006)
[5] Kolasinski, K., *Silicon Nanostructures from Electroless Electrochemical Etching*, 9 CURRENT OPINION IN SOLID STATE AND MATERIALS SCIENCE, 2005, pp. 73–83 (Ex. 1007).
[6] Kasavajjula, U., et. al., *Nano– and Bulk–Silicon–Based Insertion Anodes for Lithium–Ion Secondary Cells*, 163 JOURNAL OF POWER SOURCES, 2007, pp. 1003–1039 (Ex. 1008).

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