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Paper 57
Entered: September 25, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SK INNOVATION CO., LTD.,
Petitioner,

v.

CELGARD, LLC,
Patent Owner.

Case IPR2014-00680
Patent 6,432,586 B1

Before FRANCISCO C. PRATS, DONNA M. PRAISS, and CHRISTOPHER L. CRUMBLEY, Administrative Patent Judges.

PRATS, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Statement of the Case

SK Innovation Co., Ltd. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting *inter partes* review of claims 1–12, all of the claims, of U.S. Patent No. 6,432,586 B1 (Ex. 1001, "the '586 patent"). Celgard, LLC, ("Patent Owner") filed a Preliminary Response. Paper 8 ("Prelim. Resp.").

We instituted trial only as to claims 7–11, for obviousness under 35 § 103(a) over Tsukamoto,[1] Lundquist,[2] and Tojo.[3] Paper 11, 23–24 ("Decision to Institute," or "Dec.").[4]

After trial was instituted, Patent Owner filed a Response (Paper 32; "PO Resp."), and Petitioner filed a Reply (Paper 39, "Reply").

Both parties filed Motions to Exclude Evidence. Paper 43 ("Pet. Mot. to Exclude") and Paper 46 ("PO Mot. to Exclude").

Both parties filed Oppositions to the Motions to Exclude Evidence. Paper 48 ("Pet. Opp."); Paper 49 ("PO Opp."). Both parties filed Replies to the Oppositions to the Motions to Exclude Evidence. Paper 52 ("Pet. Reply Opp."); Paper 54 ("PO Reply Opp.").

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[1] JP H11-283674 (published October 15, 1999) (Ex. 1031) (as translated, Ex. 1032).

[2] U.S. Patent No. 4,650,730 (issued Mar. 17, 1987) (Ex. 1008).

[3] JP H11-80395 (published Mar. 26, 1999) (Ex. 1006) (as translated, Ex. 1007).

[4] The application which issued as the '586 patent was filed on April 10, 2000. Ex. 1001, cover page. Accordingly, the version of § 103 in effect before the Leahy-Smith America Invents Act ("AIA") applies to the claims of the '586 patent. *See* AIA, Public Law 112-29, § 3, 125 Stat. 288.

Petitioner supported its Petition with a Declaration by Craig B. Arnold, Ph.D. Ex. 1004 ("Arnold Decl.").

In support of its Response, Patent Owner relied on Declarations by Ralph E. White, Ph.D., P.E., (Ex. 2002 ("White Decl.")) and William J. Paulus (Ex. 2915 ("Paulus Decl.")).

Oral Hearing was held on June 29, 2015, and the Hearing Transcript has been entered in the record. Paper 56 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a).

"In an inter partes review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence." 35 U.S.C. § 316(e).

We conclude that Petitioner has proved by a preponderance of the evidence that claims 7–11 of the '586 patent are unpatentable, based on the obviousness ground on which trial was instituted.

Petitioner's Motion to Exclude Evidence is granted-in-part, denied-in-part, and dismissed-in-part as moot. Patent Owner's Motion to Exclude Evidence is denied.

A. Related Proceedings

Concurrently with the Petition under consideration herein, Petitioner filed a petition advancing additional challenges to the claims of the '586 patent. Pet. 4; *SK Innov. Co., Ltd. v. Celgard, LLC*, Case IPR2014-00679, Paper 2 (May 9, 2014). The claims of the '586 patent were challenged also by Mitsubishi Plastics, Inc. and LG Chem Ltd. in IPR2014-00524 and IPR2014-00692, respectively. Pet. 4. IPR2014-00524 was recently terminated after settlement between the parties.

Previously, the '586 patent was subject to an *inter partes* review, IPR2013-00637, which was terminated after petitioner Sumitomo settled the related litigation, as noted below. *Id.* at 3–4. Claims 1–6 and 11 of the '586 patent have also been challenged in *Ube Maxell Co. v. Celgard, LLC*, Case IPR2015-01511, Paper 1 (June 25, 2015).

The '586 patent has been asserted in the U.S. District Court for the Western District of North Carolina in *Celgard, LLC v. SK Innovation Co., Ltd.*, Case No. 3:13-cv-00254; *Celgard, LLC v. LG Chem, Ltd.*, Case No. 3:13-cv-00043; and *Celgard, LLC v. Sumitomo Chemical Co., Ltd.*, Case No. 3:13-cv-00122. Pet. 3. The Sumitomo Chemical Co., Ltd. case has settled. Pet. 3.

B. The '586 patent

The '586 patent discloses that commercializing lithium-containing high-energy rechargeable batteries has been difficult, mainly because of "dendrite growth that occurs after repetitive charge-discharge cycling." Ex. 1001, 1:21–22. Specifically, "[w]hen lithium dendrites grow [from the lithium-containing anode] and penetrate the separator [between the electrodes], an internal short circuit of the battery occurs (any direct contact between anode and cathode is referred to as 'electronic' shorting, and contact made by dendrites is a type of electronic shorting)." *Id.* at 1:27–31. "Some shorting . . . may result in thermal runaway of the lithium battery, a serious safety problem for [a] lithium rechargeable battery." *Id.* at 1:31–35.

To address those issues, the '586 patent describes an improved electrode separator for a high-energy rechargeable lithium battery. *Id.* at 1:40–53. The separator includes two specific layers: "[1] at least one

ceramic composite layer and [2] at least one polymeric microporous layer." *Id.* at 1:46–47.

The '586 patent explains that the ceramic composite layer "is, at least, adapted for preventing electronic shorting (e.g. direct or physical contact of the anode and the cathode) and blocking dendrite growth." *Id.* at 2:54–57.

The '586 patent explains that the ceramic composite layer is composed of a mixture of two types of components: "[1] a matrix material having [2] inorganic particles dispersed therethrough." *Id.* at 3:9–10 (drawing reference numerals removed). The '586 patent explains that the "[c]eramic composite layer is nonporous (it being understood that some pores are likely to be formed once in contact with an electrolyte, but ion conductivity of [that] layer is primarily dependent upon choice of the matrix material and particles)." *Id.* at 3:10–14 (drawing reference numerals removed).

The '586 patent explains that the matrix component of the ceramic composite layer can be "any gel forming polymer suggested for use in lithium polymer batteries or in solid electrolyte batteries." *Id.* at 3:32–34. The '586 patent discloses that a variety of inorganic particles may be used in the ceramic composite layer, including, "for example, silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), calcium carbonate ($CaCO_3$), titanium dioxide (TiO_2), SiS_2, $SiPO_4$, and the like, or mixtures thereof. The preferred inorganic particle is SiO_2, Al_2O_3, and $CaCO_3$." *Id.* at 3:53–57.

Turning to the polymeric microporous layer of the '586 patent's separator, the patent explains that that layer "is, at least, adapted for blocking (or shutting down) ionic conductivity (or flow) between the anode and the cathode during the event of thermal runaway." *Id.* at 2:58–60.

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