

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

IOXUS, INC.,
Petitioner,

v.

CAP-XX, LTD.,
Patent Owner.

IPR2019-01178
Patent 6,920,034 B2

Before KRISTINA M. KALAN, JENNIFER MEYER CHAGNON, and
AVELYN M. ROSS, *Administrative Patent Judges*.

CHAGNON, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

Ioxus, Inc. (“Petitioner”) filed a Petition for *inter partes* review of claims 1–7, 9, 12–18, 21–29, 32–37, 40–45, 48–58, 61, and 62 (“the challenged claims”) of U.S. Patent No. 6,920,034 B2 (Ex. 1001, “the ’034 patent”). Paper 2 (“Pet.”). CAP-XX, Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”).

The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314, which provides that an *inter partes* review may be instituted only upon a showing that “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2012). After considering the Petition, the Preliminary Response, and the evidence of record, we conclude that the information presented does not establish a reasonable likelihood that Petitioner will prevail in challenging the patentability of the challenged claims. We, therefore, decline to institute an *inter partes* review of the ’034 patent.

A. Related Proceedings

The parties identify *CAP-XX, Ltd. v Ioxus, Inc.*, Case No. 1-18-cv-00849 (D. Del.) and *CAP-XX, Ltd. v Cornell-Dubilier Electronics, Inc.*, Case No. 1-18-cv-00353 (D. Del.) as related matters. Pet. 1; Paper 4, 2. Petitioner also filed a petition for *inter partes* review of certain claims of U.S. Patent 7,382,600 B2, which is a continuation application of the ’034 patent. *See Ioxus, Inc. v. CAP-XX, Ltd.*, IPR2019-01179, Paper 1; Pet. 1–2; Paper 4, 2.

B. The '034 Patent

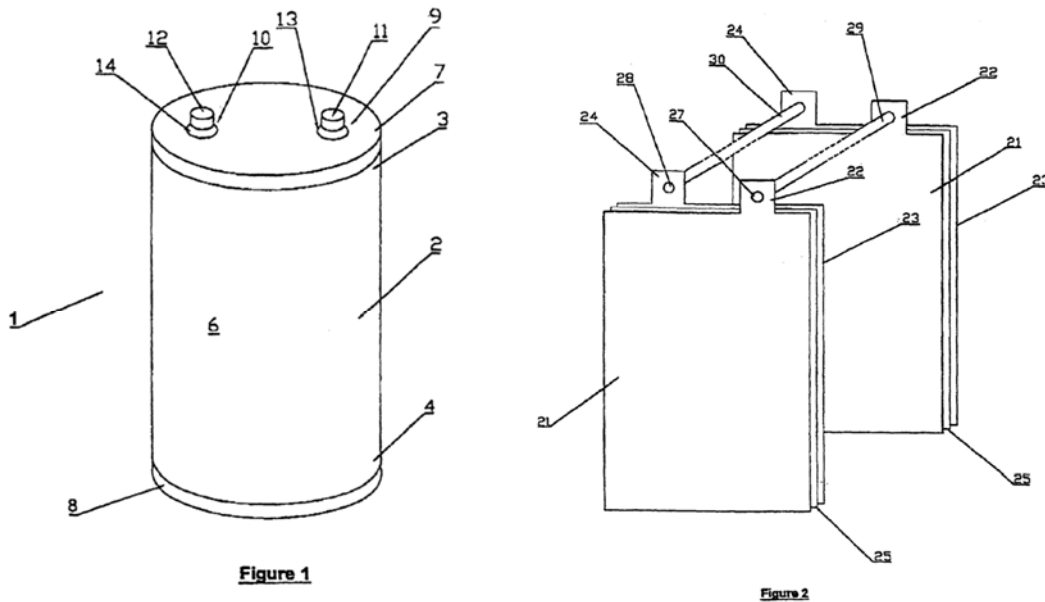
The '034 patent is titled “Charge Storage Device,” was filed on August 7, 2003¹, and issued July 19, 2005. Ex. 1001, codes (22), (45), (54). The '034 patent relates to charge storage devices, and the invention is “primarily for use with . . . electrochemical charge storage devices such as supercapacitors.” *Id.* at 1:11–15. According to Petitioner’s expert, the '034 patent describes “a well-known type of charge storage device called an electric double layer capacitor or ‘EDLC’.” Ex. 1002 ¶ 27.

According to the '034 patent, “[i]t is known to mass produce supercapacitors that have specific operational characteristics that fall within well defined ranges,” but this highlights a lack of flexibility with mass production. Ex. 1001, 1:21–25. The '034 patent notes that “[k]nown supercapacitors generally find application in power supplies such as uninterruptible power supplies for computers or backup power supplies for volatile memory. Accordingly, it has been common to optimise these supercapacitors for high energy density, low self-discharge rates, and low cost.” *Id.* at 1:31–36. The '034 patent continues, recognizing that “[m]ore recently it has been thought that supercapacitors are theoretically applicable to high power pulsed applications. . . . However, the success of these supercapacitors has been limited by factors such as a high equivalent series resistance, among others.” *Id.* at 1:37–46. The '034 patent attempts

¹ The '034 patent claims priority, through a series of other applications, to U.S. provisional application No. 60/110,930, which was filed on December 5, 1998. Ex. 1001, codes (60), (63). The specific priority date of the challenged claims is not at issue in this proceeding, and we need not make any determination in this regard.

“to overcome or substantially ameliorate one or more of the disadvantages of the prior art, or at least to provide a useful alternative.” *Id.* at 2:4–6.

Figures 1 and 2 of the '034 patent are reproduced below.



Figures 1 and 2, above, show a perspective view of a charge storage device according to the '034 patent and a schematic view of an electrode configuration disposed therein, respectively. Ex. 1001, 15:31–34. Supercapacitor 1 is packaged in cylindrical housing 2. *Id.* at 17:41–42. Supercapacitor 1 includes a plurality of first sheet electrodes 21 (having respective first tabs 22 extending therefrom) and a plurality of second sheet electrodes 23 (having respective second tabs 24 extending therefrom), with a plurality of porous sheet separators 25 disposed between the adjacent electrodes. *Id.* at 17:60–67. Terminals 11, 12 extend from within housing 2, where they are electrically connected to respective sets of electrodes 21, 22 via tabs 22, 24. *Id.* at 17:49–55, 18:2–5. The '034 patent describes that “[t]he invention . . . is particularly advantageous in that the modular unit of capacitance—one electrode 21, one electrode 23 and an intermediate

separator 25—is easily mass produced and combined with a plurality of like units to provide the necessary capacitance for a particular application,” thereby allowing “a supercapacitor having specific performance characteristics . . . to be produced easily and in small numbers at a unit cost not dissimilar to that of a large run.” *Id.* at 18:10–17. In other words, “various parameters of the supercapacitor [can be] easily tailored to meet the specific requirements of any particular application. That is, the invention is particularly suited to scaling.” *Id.* at 26:67–27:3.

The '034 patent further describes gravimetric and volumetric Figures of Merit (“FOM”), which “provide a different characterisation of storage devices which is more in keeping with the frequency dependent nature of pulse power and other such applications to which the devices are being applied.” *Id.* at 17:8–11. The Miller publication,² which is incorporated by reference into the '034 patent (*id.* at 16:63–17:3), notes that “[p]rior characterization standards have been limited in scope and are inadequate to properly characterize the pulse power performance of an [electrochemical capacitor].” Ex. 1008, 4.³ According to Miller, the FOM can be used to “compar[e] the pulse power performance of different technologies and products” and electrochemical capacitors “with the same FOM should be equally suited to meet the electrical performance requirements in a given pulsed power application.” *Id.* at 5. The '034 patent and Miller describe the calculation of these FOMs in detail, but for purposes of this Decision, it is

² John R. Miller, *Pulse Power Performance of Electrochemical Capacitors: Technical Status of Present Commercial Devices*, proceedings from the 8th International Seminar on Double Layer Capacitors and Similar Energy Storage Devices, Dec. 7–9, 1998 (Ex. 1008, “Miller”).

³ Citations to Miller are to the original pagination thereof.

sufficient to note that the gravimetric and volumetric FOMs of a charge storage device are calculated based on various characteristics of the charge storage device. These characteristics include, for example, “the frequency f_0 at which the impedance of the storage device reaches a -45° phase angle,” “a characteristic response time T_0 for the storage device,” “value of the imaginary part of the impedance Z ” at f_0 ,” “the rated voltage of the device” V , and the mass or volume of the device, respectively. *See* Ex. 1001, 16:43–62, 17:4–7; Ex. 1008, 4–6.

C. Illustrative Claims

Challenged claims 1, 13, 23, 34, 42, and 51 are independent, and claims 2–7, 9, 12, 14–18, 21, 22, 24–29, 32, 33, 35–37, 40, 41, 43–45, 48–50, 52–58, 61, and 62 are dependent. Claims 1 and 13 are illustrative, and are reproduced below.

1. A charge storage device comprising:
 - a charge storage cell including:
 - (a) a first electrode;
 - (b) a second electrode being opposed to and spaced apart from the first electrode; and
 - (c) a porous separator disposed between the electrodes;
 - a sealed package for containing the cell and an electrolyte in which the cell is immersed; and
 - at least two terminals extending from the package to allow external electrical connection to the cell, wherein the volumetric FOM (Figure of Merit) of the device is greater than about

3.2 Watts/cm³⁴ and the maximum operating voltage of the cell is less than about 4 Volts.

Ex. 1001, 31:28–40.

13. A charge storage device including:

a charge storage cell including:

(a) a first electrode having a first layer including a carbon having a surface area greater than 400 m²/gram;

(b) a second electrode having a second layer including a carbon having a surface area greater than 400 m²/gram; and

(c) a porous separator disposed between the electrodes;

a sealed package for containing the cell and an organic electrolyte in which the cell is immersed, wherein the first and second layers are opposed and spaced apart; and

at least two terminals that extend from the package to allow external electrical connection to the cell, wherein the volumetric FOM (Figure of Merit) of the device is greater than about 1.1 Watts/cm³ and the maximum operating voltage of the cell is less than about 4 Volts.

Id. at 31:63–32:14.

⁴ This notation of Watts/cm³ appears to be a typographical error, and we presume this should be Watts/cm³, as used throughout the Specification of the '034 patent (*see, e.g.*, Ex. 1001, 3:43–44).

D. Prior Art and Asserted Grounds

Petitioner asserts that the challenged claims would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	References
1–7, 9, 12, 23–29, 32–37, 40, 41, 51–58, 61, 62	103(a) ⁵	Niu ⁶ , Shimada ⁷
13–17, 21, 22, 42–45, 48–50	103(a)	Yoshida ⁸ , Applicant Admitted Prior Art ⁹
18	103(a)	Yoshida, Applicant Admitted Prior Art, Muranaka ¹⁰

⁵ Because the application leading to the '034 patent was filed before March 16, 2013, patentability is governed by the version of 35 U.S.C. §§ 102 and 103 preceding the Leahy-Smith America Invents Act (“AIA”), Pub L. No. 112-29, 125 Stat. 284 (2011).

⁶ Chunming Niu et al., *High power electrochemical capacitors based on carbon nanotube electrodes*, Appl. Phys. Lett. 70 (11), 1480–82, 17 March 1997 (Ex. 1004, “Niu”).

⁷ Shimada et al., U.S. Patent No. 4,439,810, issued Mar. 27, 1984 (Ex. 1005, “Shimada”).

⁸ Yoshida et al., U.S. Patent No. 5,150,283, issued Sept. 22, 1992 (Ex. 1006, “Yoshida”).

⁹ Petitioner contends that data identified in Figure 17 of the '034 patent as “prior art” and “any corresponding text and/or figures describing the details of that data from Figure 17” is Applicant Admitted Prior Art (“AAPA”). Pet. 52. Petitioner further contends that “the Miller paper can be used here as part of the AAPA or at least evidence of the AAPA.” *Id.* at 61 (referring to Miller, Ex. 1008). Patent Owner disputes that the PowerStor device, described in Miller, is prior art. Prelim. Resp. 30–32. Because we determine Petitioner has not shown a reasonable likelihood of success on its asserted grounds based on the alleged AAPA, we need not make a determination as to the availability of this disclosure as a basis for *inter partes* review.

¹⁰ Muranaka et al., U.S. Patent No. 4,408,259, issued Oct. 4, 1983 (Ex. 1007, “Muranaka”).

Petitioner also relies on the Declaration of Marc Juzkow¹¹ (Ex. 1002) to support its positions.

II. ANALYSIS

A. *Legal Standards*

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103(a) if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

¹¹ Petitioner requested authorization to file a Reply to Patent Owner’s Preliminary Response to address Patent Owner’s arguments regarding the credibility of Dr. Juzkow’s testimony. *See* Ex. 3001. We denied Petitioner’s request. Paper 7, 2. For purposes of this Decision, we have given full weight to Dr. Juzkow’s testimony, notwithstanding any alleged credibility issues raised by Patent Owner.

(3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.¹² *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To show obviousness, it is not enough to merely show that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). “This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.” *KSR*, 550 U.S. at 418–419.

On the other hand, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418; *accord In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). However, Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Instead, Petitioner must articulate a reason why a person of ordinary skill in the art would have combined or modified the prior art references. *In re NuVasive, Inc.*, 842 F.3d 1376, 1382 (Fed. Cir. 2016); *see also Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1366 (Fed. Cir. 2017) (“In determining whether there would have been a motivation to combine prior art references to arrive at the claimed invention, it is insufficient to simply conclude the combination would have been obvious without identifying any reason why a person of skill in the art would

¹² The parties have not asserted or otherwise directed our attention to any objective evidence of non-obviousness.

have made the combination.”); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.”) (citing *InTouch Techs., Inc. v. VGO Commc’ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)).

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met its burden to establish a reasonable likelihood of success at trial.

B. Level of Ordinary Skill in the Art

Petitioner contends that a person having ordinary skill in the art would have had “a bachelor’s degree or the equivalent in electrical engineering or chemistry (or equivalent degree or experience) and at least two years of additional experience in the area of supercapacitors, or equivalent work experience.” Pet. 7. Patent Owner does not contest Petitioner’s definition of a person of ordinary skill in the art. *See generally* Prelim. Resp. For purposes of this Decision, we adopt and apply Petitioner’s proposed description of the person of ordinary skill in the art.

C. Claim Construction

The instant Petition was filed after November 13, 2018. *See* Paper 3. Therefore, for this *inter partes* review proceeding claim terms

shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such

claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.
37 C.F.R. § 42.100(b) (2019). Further, “[a]ny prior claim construction determination concerning a term of the claim in a civil action, or a proceeding before the International Trade Commission, that is timely made of record in the *inter partes* review proceeding will be considered.”¹³ *Id.*

Under the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–19 (Fed. Cir. 2005) (en banc), claim terms are given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history of record. *See Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365–66 (Fed. Cir. 2012).

Petitioner “does not at this time contend that any terms from the ’034 patent require express construction to apply the prior art to the claims” and instead asserts that all claims should be accorded their plain and ordinary meaning. Pet. 7. Patent Owner, however, argues that the term “figure of merit” or “FOM” was not known in the art at the time of filing and instead only became known through Miller (Ex. 1008). Prelim. Resp. 11–12. Patent Owner contends that “gravimetric figure of merit” should be construed in accordance with the following:

The gravimetric figure of merit for a storage device is determined by identifying the frequency f_0 at which the impedance of that device reaches a -45° phase angle. The reciprocal of f_0 then provides a characteristic response time T_0 for the storage device. The value of the imaginary part of the impedance Z'' at f_0 is used to calculate the energy E_0 as follows: $E_0 = \frac{1}{2}CV^2$, where $C = -1/(2\pi f_0 Z'')$ and V is the rated voltage of the device. The gravimetric figure of merit is then calculated as follows:

¹³ No such prior claim construction determination has been made of record.

gravimetric FOM = $E_0/(mT_0)$, where m is the mass of the storage device.

Id. at 12–13. Similarly, Patent Owner contends that “volumetric figure of merit” should be construed in the same manner, “except volumetric FOM = $E_0/(vT_0)$, where v is the volume of the storage device.” *Id.* at 13. Patent Owner further contends that “the mass and volume measurements would include all components of an operable charge storage device, including its terminals.” *Id.* (citing Ex. 1001, 16:58–17:7, 27:15–23).

After reviewing the parties’ arguments and evidence, we determine that we do not need to expressly construe any terms for purposes of this Decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’”)).

D. Summary of Asserted Prior Art

1. Niu

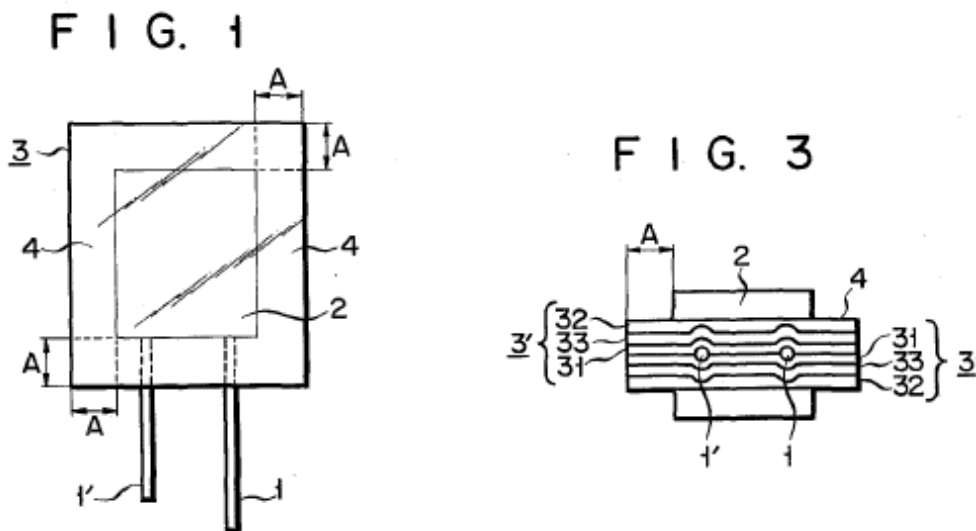
Niu relates to “high power electrochemical capacitors based on carbon nanotube electrodes.” Ex. 1004, 1480.¹⁴ Niu teaches a “single-cell test device . . . fabricated with two carbon nanotube electrodes having diameters of 0.5 in., thickness of 0.001 in., and separated by a 0.001 in. thick polymer separator (Celgard) using 38 wt % H₂S₀4 as the electrolyte.” *Id.* at 1481. Niu includes data regarding various electrical characteristics of the test device, including a “complex-plane plot of the impedance of th[e] capacitor”

¹⁴ Citations to Niu are to the original pagination thereof.

(Fig. 3(a)), a “Bode angle plot”¹⁵ (Fig. 3(b)) with specific data therefrom summarized in Table 1, and a “Ragone plot”¹⁶ (Fig. 4). *Id.* at 1481–82.

2. Shimada

Shimada teaches an electric capacitor “enclosed within a laminated film.” Ex. 1005, code (57). Figures 1 and 3 of Shimada are reproduced below.



Figures 1 and 3, above, show plan and front views, respectively, of electric capacitors according to embodiments of Shimada. *Id.* at 3:45–52. As seen in the figures, “laminated films 3 or 3’ are arranged on the upper and lower surfaces of a . . . capacitor element 2 to which external connecting terminals 1 and 1’ are mounted.” *Id.* at 4:18–21. Laminated film 3’ of the embodiment of Figure 3 comprises a plastic-metal laminated film having at least two plastic films 31, 32 with metal foil layer 33 interposed

¹⁵ The Bode angle plot plots Frequency (Hz) as a function of Angle (Deg.). Ex. 1004, Fig. 3(b).

¹⁶ The Ragone plot plots Power (W/kg) as a function of Energy (kJ/kg). Ex. 1004, Fig. 4.

therebetween. *Id.* at 4:21–26. The laminated films “are opposed to each other and the capacitor element 2 is interposed therebetween.” *Id.* at 4:34–36. Shimada describes that “the thickness of . . . an inner film 31 is set to be 70 to 200 μm ” and that this “thickness . . . must be 70 μm or more in order to prevent any initial defect such as short-circuiting between the terminals or leakage of the electrolyte.” *Id.* at 5:49–52, 6:39–43, Table 2.

3. *Yoshida*

Yoshida describes EDLCs “that use activated carbon in their polarizable electrodes.” Ex. 1006, 1:8–12. According to Yoshida, an EDLC “is a capacitor of large capacitance that uses activated carbon in its polarized electrodes and utilizes a phenomenon that electric charge is stored in an electric double layer formed between the activated carbon and an electrolyte.” *Id.* at 1:13–17. Yoshida’s asserted advantages of “withstand[ing] high voltage while holding low internal resistance” are achieved through the provision of:

an electric double layer capacitor which comprises a pair of polarizable electrodes, composed of electrically-conductive substrates coated with layers of a mixture of activated carbon with a water-soluble material-based binding agent, optionally including an agent for improving the electric conductivity of the layer, arranged so that the one faces with the other by being interposed with a separator, and an electrolyte.

Id. at 2:13–24.

Figure 1 of Yoshida is reproduced below.

FIG. 1

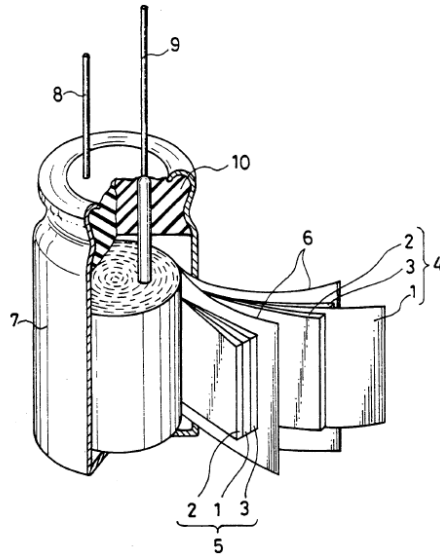


Figure 1, above, is a “perspective view, partly cut-out, of an example of a capacitor built in accordance with the present invention.” *Id.* at 3:46–48. Polarizable electrodes 4 and 5 are separated by separator 6. *Id.* at 4:15–22, 5:1–13. The coiled or wound electrode body 20 (shown in Figure 2) is impregnated with an electrolyte and housed in case 7 with lead wires 8 and 9 protruding from the casing. *Id.* In particular, Yoshida credits the ability of its device to balance high voltage with low internal resistance to the “activated carbon electrode structure including a composition of a low electric resistance which gives, a property of excellent electrically-contacting with the electrically-conductive substrates as well as property of good film-forming and self-supporting to the activated carbon layer.” *Id.* at 3:25–30.

4. *Alleged Applicant Admitted Prior Art*

Petitioner identifies the AAPA as the data found in Figure 17 (reproduced below) of the '034 patent that is labeled as “prior art,” and more particularly, “Prior Art 1.” Pet. 52–53.

	Capacitance F	Resistance milliohms	Voltage V	Mass g	Volume cc	Size mm x mm x mm	Response Time sec	FOM mass kW/kg	FOM Vol W/cc	Time constant sec	Pgrav max kW/kg	Pvol max W/cc	Thickne ss um
Prior Art 1			2.5	4.4	3.01	11.2 x 30.5	6.30E-01	2.06	3.02				
Prior Art 2			2.3	34.0	30.56	33.6 x 17.1 x 63	6.30E+00	0.98	1.10				
Prior Art 3			15.0	4800.0	1440.00	17 x 17 x 5	9.70E-02	0.98	3.20				
1 HF-7	0.00036	110.43	2.5	7.3	3.52	110 x 100 x 0.32	1.15E-04	0.98	2.00	3.98E-05	1.83	4.02	12
2 HF-9	0.00074	66.98	2.5	7.5	3.83	110 x 100 x 0.32	2.50E-04	0.99	2.04	6.44E-05	2.39	4.85	24
3 HF-3	0.00450	14.50	2.5	5.8	4.18	110 x 100 x 0.38	3.40E-04	5.91	6.20	6.53E-05	16.57	25.78	12
4 HF-11	0.00112	75.03	2.5	7.9	3.85	110 x 100 x 0.32	3.70E-04	0.99	2.03	8.40E-05	2.64	5.41	36
5 HF-5	0.00478	22.68	2.5	6.8	3.52	110 x 100 x 0.32	5.28E-04	3.44	6.88	1.08E-04	10.10	19.57	12
6 HF-13	0.00548	27.25	2.5	7.0	3.52	110 x 100 x 0.32	5.71E-04	3.33	6.88	1.49E-04	8.14	16.29	12
7 HF-16	0.00051	368.50	2.5	7.7	3.83	110 x 100 x 0.32	8.00E-04	0.19	0.40	1.83E-04	0.67	1.20	12
8 HF-17	0.00130	190.80	2.5	7.8	3.85	110 x 100 x 0.32	1.25E-03	0.34	0.88	2.48E-04	1.05	2.13	36
9 HF-18	0.03520	34.10	2.5	7.2	3.41	110 x 100 x 0.32	6.67E-03	1.97	4.13	1.20E-03	6.40	13.44	12
10 HF-2	0.03200	70.00	2.5	5.7	3.98	110 x 100 x 0.38	1.40E-02	1.03	1.48	2.24E-03	3.93	6.64	12
11 cap-XX	0.33000	17.80	2.5	12.0	9.01	85 x 53 x 2	3.70E-02	1.27	1.69	5.81E-03	7.40	9.85	12
12 cap-XXHiPo	0.54800	18.10	5.0	12.2	9.80	40 x 35 x 7	7.83E-02	5.83	7.28	9.92E-03	28.30	35.24	8
13 cap-XX,10	10.40000	4.50	2.5	17.0	12.50	50 x 50 x 5	1.50E-01	3.60	4.90	4.68E-02	20.42	27.78	12
14 cap-XX,30	29.70000	5.00	2.5	25.0	25.00	50 x 50 x 10	4.80E-01	2.71	2.71	1.49E-01	12.50	12.50	36
15 cap-XX,250	272.50000	1.00	2.5	295.0	365.30	190 x 110 x 18	1.00E+00	2.20	1.83	2.73E-01	6.30	4.40	36
16 DC-3	17.34000	11.30	2.5	7.0	15.13	91 x 95 x 1.75	1.92E+00	3.28	1.51	1.98E-01	19.73	9.14 60/100	
17 Wed	14.68000	14.00	2.5	8.2	15.13	91 x 95 x 1.75	1.92E+00	2.45	1.33	2.08E-01	13.61	7.38 30/70	

FIGURE 17

Figure 17, above, “is a table illustrating parameters of supercapacitors of the present invention as well as *some prior art supercapacitors.*” Ex. 1001, 16:1–3 (emphasis added). According to Petitioner, the data reported in “Prior Art 1” was derived from the PowerStor device discussed in Miller and incorporated by reference into the '034 patent. Pet. 53 (citing Ex. 1001, 16:63–17:3), 60–61 (same).

E. Asserted Obviousness in View of Niu and Shimada — Claims 1–7, 9, 12, 23–29, 32–37, 40, 41, 51–58, 61, and 62

Petitioner contends that claims 1–7, 9, 12, 23–29, 32–37, 40, 41, 51–58, 61, and 62 would have been obvious in view of Niu and Shimada. Pet. 7–50. Patent Owner disagrees. Prelim. Resp. 15–29.

1. Independent Claim 1

Claim 1 recites a charge storage device comprising, *inter alia*, a charge storage cell that includes a first electrode, a second electrode, and a porous separator; a sealed package containing the cell and an electrolyte; and at least two terminals allowing external electrical connection to the cell. Ex. 1001, 31:28–37. Claim 1 further requires the volumetric FOM of the device be greater than about 3.2 Watts/cm³ and the maximum operating voltage of the cell be less than about 4 Volts. *Id.* at 31:37–40.

Petitioner’s Proposed Combination

Petitioner’s obviousness theory relies on a “scaled up” version of Niu’s test cell, referenced in the Petition as “the modified cell.” Pet. 10; *see also id.* at 18–21 (describing the modified cell in more detail); Ex. 1002 ¶¶ 54, 77–91. According to Petitioner, the “charge storage cell” recited in claim 1 “describes a standard electric double-layer capacitor,” and the test device disclosed in Nui is such an EDLC. Pet. 15; *see also id.* at 14–18 (expanding on this contention); Ex. 1002 ¶¶ 61–76. Petitioner relies on the modified cell as teaching the structural elements of the charge storage cell recited in claim 1. *See* Pet. 14–18; Ex. 1002 ¶¶ 61–76. Petitioner further asserts that a person of ordinary skill in the art would have packaged this modified cell using a pouch similar to the one described in Shimada, and would have connected the external terminals to the modified cell within the

pouch. Pet. 11; *see also id.* at 22–25 (discussing the alleged obviousness of containing the modified cell in a pouch), 25–26 (discussing the alleged obviousness of allowing external connection to the capacitor); Ex. 1002 ¶¶ 57–58, 92–107. As discussed further in the following, Petitioner relies on various electrical properties of Nui’s test cell, as well as proposed dimensions of the modified cell as packaged in Shimada’s pouch, in alleging the volumetric FOM and maximum operating voltage of the modified device meet the values recited in claim 1. *See* Pet. 27–33; Ex. 1002 ¶¶ 108–24.

Dimensions of the Modified Cell

Petitioner contends that the proposed modifications to Nui’s test cell would have been obvious because “it was standard industry practice [at the time of the ’034 patent] to use smaller test cells” and then “‘scale up’ the test cell . . . for commercial purposes.” Pet. 19; *see* Ex. 1002 ¶¶ 77, 82. The Petition includes details about the proposed dimensions for Nui’s modified cell on which Petitioner relies as teaching the claimed “charge storage cell.” *See* Pet. 18–21; Ex. 1002 ¶¶ 77–91. Petitioner asserts, relying on Dr. Juzkow’s testimony, that the “particular electrode dimension [of the modified cell] was selected because it can fit within a credit card while still allowing enough room for other credit card components.” Pet. 20; Ex. 1002 ¶ 86. Lacking from the Petition and Dr. Juzkow’s testimony, however, is *any* explanation as to the significance of sizing the device to fit in a credit card or *why* a person of ordinary skill in the art would have been motivated to do so. *See Magnum Oil*, 829 F.3d at 1380 (Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.”); *NuVasive*, 842 F.3d at 1382 (Petitioner must articulate a

reason why a person of ordinary skill in the art would have modified the prior art references.).

Electrical Properties of the Modified Cell

As noted above, Petitioner relies on various electrical properties of Nui's test cell as teaching the claimed maximum operating voltage and in determining the volumetric FOM of the modified device. *See* Pet. 27–33; Ex. 1002 ¶¶ 108–24. Petitioner contends that, because “the data gathered for Nui's test cell was charted and tabled on a *per g* basis,” the “scaled up” device would have maintained the same exceptional electrical properties as the test device, except that certain dimensions, such as the length and width, of the components would have increased.” Pet. 10; *see also id.* at 19 (“It was well understood that the g, kg or cm² properties of a cell remains the same regardless of size, so a scaled-up cell (*i.e.*, a cell having length and width dimensions larger than its corresponding test cell, but otherwise using the same combination of materials) **would perform exactly the same** on a g, kg or cm² basis as its corresponding test cell.”); Ex. 1002 ¶¶ 54, 82. Patent Owner argues, however, that Petitioner “fail[s] to demonstrate that the Niu test cell and the modified devices would operate in the same manner and produce the same data.” Prelim. Resp. 18. We agree. Dr. Juzkow does not cite to any evidence or provide any factual basis to support his assertion that the electrical properties would remain the same. *See* Ex. 1002 ¶¶ 54, 113–24. Such conclusory expert testimony is inadequate to support an obviousness determination. *Cf. TQ Delta, LLC v. CISCO Sys., Inc.*, No. 2018-1766, 2019 WL 6222844, at *5–6 (Fed. Cir. Nov. 22, 2019) (discussing cases in which the Federal Circuit “ha[s] repeatedly recognized

that conclusory expert testimony is inadequate to support an obviousness determination on substantial evidence review”).

Dimensions of the Pouch

In Petitioner’s proposed combination, Niu’s modified cell is packaged using a pouch, as described in Shimada. Pet. 22–25; Ex. 1002 ¶¶ 92–107. In order to determine the volumetric FOM of the charge storage device, including any packaging, the volume of the device must be known. See Ex. 1001, 17:4–7 (defining the FOM_v). In this regard, Dr. Juzkow provides a chart detailing the thicknesses of the various elements of the proposed modified cell. See Ex. 1002 ¶ 119. In this chart, Dr. Juzkow details a 3-layer laminate having a total thickness of 90 μm for the pouch material, the laminate including an Al layer with a thickness of 25 μm, a PP layer with a thickness of 50 μm, and a Nylon layer with a thickness of 15 μm. *Id.*

According to Dr. Juzkow, the “dimensions and materials [of the pouch] were determined based on my personal knowledge and decades of work on EDLCs as well as what was disclosed in the prior art. For example, Shimada discloses that its laminated films, which form the pouch, have a thickness of 100 μm and are fabricated from various polymers and aluminum, which I have used here in my design.” Ex. 1002 ¶ 120 (citing Ex.1005,¹⁷ 4:26–67, 7:21–36). We note, however, that the cited portion of Shimada appears to disclose an “*ionomer film* of 100 μm thickness” — in other words, *one* of the three layers — rather than a 3-layer *laminated film* of that thickness. See Ex. 1004, 4:60–66.¹⁸

¹⁷ Dr. Juzkow cites to Ex. 1004, however we presume the citation was intended to be to Ex. 1005 (Shimada).

¹⁸ The text of this portion of Shimada appears to include a clerical error. However, in context, it appears it should read as: “The laminated film of

Shimada, instead, specifically teaches that the thickness of the inner film of the 3-layer laminate should be within the range of 70 to 200 μm . Ex. 1005, 5:50–52 (also defining the “inner film” as “the plastic film opposing the capacitor element,” i.e., element 31 in Fig. 3 of Shimada). According to Shimada,

it has been found that if the thickness of the inner film is kept within the range of 70 to 200 μm , the[] problems of separation of the sealed portion, leakage of the electrolyte and/or impregnating agent, short-circuiting between the external connecting terminals, and evaporation of the electrolyte or introduction of the cleaning agent through the section of the inner film may be effectively prevented, whereby the life time of the capacitor is significantly improved.

Id. at 2:33–42. In fact, Shimada teaches that “the thickness of the inner film *must be 70 μm or more* in order to prevent any initial defect such as short-circuiting between the terminals or leakage of the electrolyte and/or impregnating agent.” *Id.* at 6:39–43 (emphasis added), Table 2. We agree with Patent Owner that Petitioner does not specify which of the layers in Dr. Juzkow’s proposed pouch material is the inner film. *See* Prelim. Resp. 28. In any case, *not one* of the proposed layers has a thickness of “70 μm or more,” as required by Shimada. *See* Ex. 1002 ¶ 119; Prelim. Resp. 28. Neither the Petition nor Dr. Juzkow’s testimony addresses this express disclosure of Shimada. *See generally* Pet. Nor do they address why one of ordinary skill in the art would have been motivated to use a pouch

each sample was a plastic-metal laminated film which consisted of a polyethylene terephthalate film of 12 μm thickness, an aluminum foil layer of 20 μm thickness, ~~of 100 μm thickness. Two laminated~~ and an ionomer film of 100 μm thickness.” In any case, the text does not clearly state that the 3-layer laminated film has a total thickness of 100 μm , as indicated in Dr. Juzkow’s testimony.

having layer thicknesses outside of this preferred range taught by Shimada. *See Magnum Oil*, 829 F.3d at 1380 (Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.”); *NuVasive*, 842 F.3d at 1382 (Petitioner must articulate a reason why a person of ordinary skill in the art would have modified the prior art references.).

Petitioner’s proposed combination relies on these dimensions provided in Dr. Juzkow’s testimony in order to meet the recited volumetric FOM limitation of claim 1. Without explanation as to the reasons for selecting these proposed dimensions, Petitioner appears to rely on nothing more than impermissible hindsight to arrive at the claimed invention. *See W.L. Gore & Assocs. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983) (“To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.”).

Arguments Regarding a Presumption of Obviousness

Petitioner also argues that the challenged claims are “presumed obvious” because each “recite[s] a range of values that overlaps with a range disclosed by the prior art.” Pet. 12; *see also id.* at 12–14 (expanding on this contention). Beyond general assertions, however, Petitioner does not point to any specific disclosure in the prior art that overlaps the claimed range. *See id.* at 12–14. We do not find Petitioner’s unsupported attorney argument to be persuasive. To the extent Petitioner relies on the specific disclosures

of the prior art cited elsewhere in the Petition, these arguments are not persuasive for the reasons previously discussed.

Conclusion as to Claim 1

For at least these reasons, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 1 would have been obvious in view of Nui and Shimada.

2. *Independent Claims 23, 34, and 51*

Claims 23, 34, and 51 recite charge storage devices similar to that recited in claim 1. *See* Ex. 1001, 32:35–47, 33:1–13, 34:11–24. Where claim 1 recites a volumetric FOM of the device of greater than about 3.2 Watts/cm³, however, claims 23, 34, and 51 recite a gravimetric power maximum of greater than about 12.5 Watts/gram, a volumetric power maximum of greater than about 35 Watts/cm³, and a gravimetric FOM of greater than about 2.1 Watts/gram, respectively. *Id.*

Petitioner's obviousness theory as to each of these claims relies on the same "scaled up" version of Niu's test cell as combined with Shimada. Pet. 39–42, 45–47, 48–50. As discussed above with respect to claim 1, we are not persuaded that Petitioner has shown sufficiently why a person of ordinary skill in the art would have modified Niu in the manner asserted in the Petition. In particular, Petitioner's explanation is lacking as to *why* a person of ordinary skill in the art would have been motivated to select the particular dimensions of the modified cell or of the Shimada pouch materials in the proposed combination.

Further still, regarding claim 51, Petitioner relies on the mass of the modified cell and the various electrical properties of Nui's test cell in determining the gravimetric FOM of the modified device. *Id.* at 41–42.

Similarly, regarding claims 23 and 34, Petitioner relies on electrical properties of Nui's test cell to determine the gravimetric power maximum and volumetric power maximum of the modified device. *Id.* at 45–47, 49–50. As discussed above with respect to claim 1, Dr. Juzkow's testimony is lacking sufficient factual basis or evidentiary support for the assertion that the modified cell necessarily would have the same electrical properties as Nui's test cell.

For at least these reasons, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of success in showing that claims 23, 34, and 51 would have been obvious in view of Nui and Shimada.

3. *Dependent Claims 2–7, 9, 12, 24–29, 32, 33, 35–37, 40, 41, 52–58, 61, and 62*

Claims 2–7, 9, 12, 24–29, 32, 33, 35–37, 40, 41, 52–58, 61, and 62 each depend from one of claims 1, 23, 34, and 51 and, therefore, include all of the limitations of their respective independent claims. *See generally* Ex. 1001, 31:28–34:50. In view of our determination that Petitioner fails to demonstrate a reasonable likelihood of success in showing that independent claims 1, 23, 34, and 51 would have been obvious in view of Nui and Shimada, we reach the same determination for dependent claims 2–7, 9, 12, 24–29, 32, 33, 35–37, 40, 41, 52–58, 61, and 62.

F. *Asserted Obviousness in View of Yoshida and Applicant Admitted Prior Art (and Muranaka) — Claims 13–18, 21, 22, 42–45, and 48–50*

Petitioner contends that claims 13–17, 21, 22, 42–45, and 48–50 would have been obvious in view of Yoshida and AAPA, and that claim 18

would have been obvious in view of Yoshida, AAPA, and Muranaka.
Pet. 7–50. Patent Owner disagrees. Prelim. Resp. 30–36.

1. Independent Claim 13

Claim 13 recites a charge storage device comprising, *inter alia*, a charge storage cell that includes a first electrode, a second electrode, and a porous separator; a sealed package containing the cell and an organic electrolyte; and at least two terminals allowing external electrical connection to the cell. Ex. 1001, 31:63–32:11. Claim 13 further requires the volumetric FOM of the device be greater than about 1.1 Watts/cm³ and the maximum operating voltage of the cell be less than about 4 Volts. *Id.* at 32:12–14.

Petitioner’s Proposed Combination

Petitioner’s obviousness theory relies on Yoshida’s “general description of a cylindrical EDLC,” depicted in Figure 1, as teaching all of the structural elements of claim 13. Pet. 51; *see also id.* at 54–60 (expanding on this contention); Ex. 1002 ¶¶ 178, 185–97. Regarding the claimed “maximum operating voltage,” Petitioner contends that “Yoshida discloses that its supercapacitors were tested using a voltage of 1.8 V, which is its operating voltage.” Pet. 63. Petitioner relies on the AAPA as teaching the recited volumetric FOM value of claim 13. *See* Pet. 60–63; Ex. 1002 ¶¶ 198–205. The AAPA describes an EDLC with a volumetric FOM of 3.02 Watts/cm³. Ex. 1001, Fig. 17 (“Prior Art 1”); *see* Pet. 60–61; Ex. 1002 ¶¶ 198–99.

Reasons to Combine

Petitioner argues that one skilled in the art—knowing that the PowerStor device and Yoshida “use[] the same cylinder-type supercapacitor”—would have combined the AAPA with Yoshida “so that

Yoshida’s supercapacitor has a volumetric FOM of 3.0 (or 3.02).” Pet. 62; Ex. 1002 ¶ 202. Petitioner continues, arguing that a person of ordinary skill in the art “would have understood how to modify Yoshida’s device to obtain the 3.0 FOM_v value” and that “reducing the length and width dimensions of its electrodes (and correspondingly reducing the size of the separator and packaging), would increase the overall volumetric FOM of the supercapacitor . . . without changing the functionality or other electrical characteristics of the capacitor.” Pet. 62; Ex. 1002 ¶ 203.

Patent Owner contends that Petitioner’s reason for combining Yoshida and the PowerStor device—that is, their common characteristics—does not provide an adequate motivation to combine. Prelim. Resp. 35. Patent Owner further argues Petitioner’s assertion that a person skilled in the art would have known to modify the physical dimensions of Yoshida to achieve the FOM limitations of claim 13 are without support. *Id.* In particular, Patent Owner argues that Petitioner’s argument is supported only by the testimony of Dr. Juzkow, who “merely restates the argument made by Petitioner without pointing to any portion of Yoshida that would demonstrate that any device disclosed therein would satisfy the claimed FOM limitation.” *Id.* (citing Ex. 1002 ¶¶ 200–03).

On this record, we agree that Petitioner has not offered sufficient argument or supporting evidence that a person skilled in the art would have had reason to combine the teachings of Yoshida and AAPA. Petitioner first argues that the PowerStor device uses the same cylinder-type supercapacitor as that is described in Yoshida and “[i]t would have therefore been obvious to a [person of ordinary skill in the art] to combine the ‘Prior Art 1’ AAPA with Yoshida so that Yoshida’s supercapacitor has a volumetric FOM of 3.0

(or 3.02).” Pet. 62; *see also* Ex. 1002 ¶ 202 (“Because Yoshida has the same EDLC shape and wound-cell configuration as the PowerStor supercapacitor . . . it would have been obvious to a [person of ordinary skill in the art] to combine the data for that supercapacitor . . . with the general cylindrical EDLC disclosures in Yoshida to obtain the 3.0 FOM_v value.”). Petitioner’s reasoning, while relevant to showing that the references *could* have been combined, i.e., that they may be analogous, nevertheless falls short of establishing *what would have prompted* the ordinarily skilled artisan to make the proffered combination to yield a supercapacitor having volumetric FOM of 3.0. *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010); *see also In re Kahn*, 441 F.3d 977, 987–88 (Fed. Cir. 2006) (noting that the inquiry as to whether a person of ordinary skill in the art would have sought to combine the references “picks up where the analogous art test leaves off”).

Petitioner’s further argument that “there were no standard electrode shapes/sizes/dimensions at the time of the ’034 patent” and, therefore, “[i]t would have been a simple matter of the [person of ordinary skill in the art] playing around with the dimensions of Yoshida’s device to get to the 3.0 FOM_v” fares no better. Pet. 62–63; Ex. 1002 ¶ 204. As our reviewing court has explained, “obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc.*, 805 F.3d at 1703 (citations omitted). That the person of ordinary skill in the art *would have known how* to achieve a volumetric FOM of 3.0 does not explain *why* modifying Yoshida to achieve a volumetric FOM of 3.0 is desirable in the first instance. The prior art may

show a supercapacitor having a gravimetric FOM as claimed, but without more, this fails to provide the requisite reason for a skilled artisan to modify Yoshida's device to include the claimed gravimetric FOM. *KSR*, 550 U.S. at 418–419. Accordingly, Petitioner's assertions here are “insufficient to show persuasively that a relevant artisan would have recognized some deficiency in one reference or had some other reason to motivate looking to the other and combining them.” *Microsoft Corp. v. Enfish, LLC*, 662 F. App'x 981, 990 (Fed. Cir. 2016) (unpublished); *see also id.* (“[T]he Board correctly concluded that Microsoft did not articulate a sufficient motivation to combine,” where “Microsoft gave no reason for the motivation of a person of ordinary skill to combine [two references] except that the references were directed to the same art or same techniques.”). Thus, Petitioner fails to show why a person of ordinary skill in the art would have been motivated to combine the teachings of Yoshida and AAPA as proposed.

Arguments Regarding a Presumption of Obviousness

Here, Petitioner refers back to its previous arguments regarding the challenged claims being “presumptively obvious.” *See, e.g.*, Pet. 63. These arguments are not persuasive for the reasons previously discussed.

Conclusion as to Claim 13

For at least these reasons, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 13 would have been obvious in view of Yoshida and AAPA.

2. *Independent Claim 42*

Claim 42 recites a charge storage device similar to that recited in claim 13. *See Ex. 1001*, 33:29–46. Where claim 13 recites a volumetric

FOM of the device of greater than about 1.1 Watts/cm³, however, claim 42 recites a gravimetric power maximum of greater than about 4.8 Watts/gram. *Id.*

Petitioner's obviousness theory as to claim 42 relies on the same combination of Yoshida and AAPA discussed above with respect to claim 13. *See* Pet. 66–70. In particular, Petitioner relies on attributes of the PowerStor supercapacitor to teach the claimed gravimetric power maximum, arguing that a person of ordinary skill in the art would have understood that “by simply adjusting the weight of the supercapacitor (which would increase its gravimetric power maximum),” Yoshida’s supercapacitor could be modified to have a gravimetric power maximum of at least 5.9 W/g (the same as the PowerStor product). *Id.* at 68; Ex. 1002 ¶¶ 161, 213–15. As discussed above with respect to claim 13, we are not persuaded that Petitioner has shown sufficiently why a person of ordinary skill in the art would have modified Yoshida in the manner asserted in the Petition. For at least this reason, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 42 would have been obvious in view of Yoshida and AAPA.

3. *Dependent Claims 14–18, 21, 22, 43–45, and 48–50*

Claims 14–18, 21, 22, 43–45, and 48–50 each depend from one of claims 13 and 42, therefore, include all of the limitations of their respective independent claims. *See generally* Ex. 1001, 31:28–34:50. In view of our determination that Petitioner fails to demonstrate a reasonable likelihood of success in showing that independent claims 13 and 42 would have been

obvious in view of Yoshida and AAPA, we reach the same determination for dependent claims 14–18,¹⁹ 21, 22, 43–45, and 48–50.

III. CONCLUSION

After considering the evidence and the arguments presented in the Petition and Preliminary Response, we determine that the record does not demonstrate a reasonable likelihood that Petitioner will prevail with respect to any claim challenged in the Petition. We, therefore, do not institute an *inter partes* review.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied* as to all challenged claims, and no trial is instituted.

¹⁹ Petitioner asserts that claim 18 would have been obvious in view of Yoshida, AAPA, and Muranaka. Pet. 64–65. Petitioner relies on Muranaka for its teaching of a “cylindrical EDLC having multiple cells connected in parallel,” and does not assert that Muranaka addresses the deficiencies identified with respect to the proposed combination of Yoshida and AAPA as to independent claim 13. *See id.*; Ex. 1002 ¶¶ 207–08.

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FOR PETITIONER:

Erik Milch
Jennifer Volk-Fortier
COOLEY LLP
emilch@cooley.com
jvolkfortier@cooley.com

FOR PATENT OWNER:

Chris Perque
Jason Mueller
ADAMS AND REESE, LLP
chris.perque@arlaw.com
jason.mueller@arlaw.com