UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SHIGEKI OYAMA, MINORU NOGUCHI, and TAKESHI FUJINO

Appeal 2008-3682
Application 09/946,560
Technology Center 1700

Decided: December 16, 2008

Before CHARLES F. WARREN, ROMULO H. DELMENDO, and JEFFREY T. SMITH, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

Statement of the Case

Appellants appeal under 35 U.S.C. § 134(a) from a final rejection of all pending claims 1-17. (Appeal Brief filed July 30, 2007, hereinafter "App. Br."; Final Office Action entered December 18, 2006). We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM the Examiner's decision to reject all the appealed claims.

Appellants state the claimed invention "provide[s] an activated carbon for an electrode of an electric double-layer capacitor including a plurality of crystallites having a graphite structure . . . in which the interlaminar distance d_{002} of the plurality of crystallites is in a range of $0.388 \leq d_{002} \leq 0.420$ nm." (Spec. ¶ 0005).

Claims 1, 4, 5, 10, and 14 read as follows:

> 1. An activated carbon for an electrode of an electric double-layer capacitor including a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, wherein the interlaminar distance d_{002} of the plurality of crystallites is in a range of $0.388 \leq d_{002} \leq 0.420$ nm; wherein said activated carbon is in the form of a powder.
>
> 4. A method for preparing the activated carbon of claim 1, comprising:
>
> a step of forming a fiber by conducting spinning using the graphitizing carbon as the starting material,
>
> a step of subjecting the fiber to an infusibilizing treatment at a heating temperature T_1 set in a range of $200°C \leq T_1 \leq 400°C$ for a heating time t_1 set in a range of 0.5 hour $< t_1 \leq 10$ hours in an atmospheric current, a step of subjecting the infusibilized fiber to a carbonizing treatment at a heating temperature set in a range of $600°C \leq T_2 \leq 900°C$ for a heating time t_2 set in a range of 0.5 hour $\leq t_2 \leq 10$ hours in an inert gas current to provide a fibrous carbonized material,
>
> a step of subjecting the fibrous carbonized material to a pulverizing treatment to provide a powdered carbonized material,
>
> a step of subjecting the powdered carbonized material to an alkali activating treatment at a heating temperature T_3 set in a range of $500°C \leq T_3 \leq 1{,}000°C$ for a heating time t_3 set in a range of 0.5 hour $\leq t_3 \leq 10$ hours in an inert gas atmosphere.

5. The method of claim 4 wherein the step of subjecting the powdered carbonized material to an alkali activating treatment is followed by an acid-washing, a water-washing, a filtration and a drying.

10. An activated carbon for an electrode of an electric double-layer capacitor including a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, wherein the activated carbon is obtained by subjecting an infusibilized fiber to a carbonizing treatment at a heating temperature set in a range of 600°C $\leq T_2 \leq$ 750°C to provide a fibrous carbonized material, subjecting the fibrous carbonized material to a pulverizing treatment to provide a powdered carbonized material, mixing the powdered carbonized material with KOH, and then subjecting the powdered carbonized material to an alkali activating treatment at a heating temperature T_3 set in a range of 700°C $\leq T_3 \leq$ 800°C for a heating time t_3 set in a range of 0.5 hour $\leq t_3 \leq$ 5 hours, whereby the activated carbon has an interlaminar distance d_{002} of the plurality of crystallites is in a range of 0.388 $\leq d_{002} \leq$ 0.420 nm; wherein said activated carbon is in the form of a powder.

14. The activated carbon of claim 10 wherein the powdered carbonized material has an average particle size of 20 μm.

(App. Br., Claims Appendix, 36-38).

The prior art references relied upon by the Examiner to reject the claims on appeal are:

Audley	4,946,663	Aug. 7, 1990
Sato	5,877,935	Mar. 2, 1999
Maeda	6,118,650	Sep. 12, 2000
Peng	6,251,822	Jun. 26, 2001
Ohsaki	6,475,461	Nov. 5, 2002
Hijiriyama [1]	JP 1996-51045	Feb. 20, 1996

[1] In this decision, we refer to the translation of Hijiriyama that was prepared by the U.S. Patent Office by Schreiber Translations, Inc. (PTO 07-1872,

CERVINKA, ET AL., *A Contribution of Radial Electron Density Distribution Measurements to the Study of PTFE-Carbon*, 19 CARBON 413-419 (1981).

The following rejections are before us for review:

i. claims 1-3 and 7-14 under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious in view of Sato;

ii. claims 1-3 and 7-13 under 35 U.S.C. § 102(e) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Maeda;

iii. claims 1-4, 6-13 and 15-17 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Maeda and Peng;

iv. claim 5 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Maeda, Peng, and Audley;

v. claim 14 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Maeda, Peng, and Sato;

vi. claims 1-4 and 6-17 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Sato and Maeda or the combined teachings of Sato, Maeda, and Peng;

vii. claim 5 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Sato, Maeda, and Audley or the combined teachings of Sato, Maeda, Peng, and Audley;

viii. claims 1, 7-10, and 13-14 under 35 U.S.C. § 102(e) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Ohsaki;

January 2002). The Examiner refers to this reference as JP 8-51045 and Appellants refer to this reference as Japanese Patent No. 8-51045 and alternatively as JP '045. (Ans. 11; App. Br. 13, l. 8).

ix. claims 1-3 and 7-14 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ohsaki and Maeda or the combined teachings of Ohsaki and Sato;

x. claims 1-3 and 7-14 under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Hijiriyama in view of evidence in the form of the Cervinka article.

We affirm rejections i-ix, but reverse rejection x.

In their Appeal Brief, Appellants submit arguments addressing the claims together with respect to rejections i-iii, vi, and viii-ix. Accordingly, we select claim 1 as representative to decide each of these rejections, and confine our discussion to this claim. Appellants' failure to argue claims separately in the Appeal Brief is taken as a waiver that the patentability of any claim must be considered separately. 37 C.F.R. § 41.37(c)(1)(vii).

With respect to rejections i, ii, viii, and x, the Examiner found that Sato, Maeda, Ohsaki, and Hijiriyama each teaches every limitation of claim 1 either explicitly or inherently. (Ans. 2, l. 18 to 4, l. 21; 10, ll. 12-19; 11, ll. 4-14). In particular, the Examiner found that the disclosures of Sato and Maeda provide a reasonable basis to infer that the prior art activated carbon materials disclosed in these references have the claimed interlaminar distance between crystallites of a graphite structure as recited in claim 1. (Ans. 2, l. 18 to 4, l. 21; Claim 1). In addition, the Examiner found Ohsaki explicitly discloses the claimed interlaminar distance between crystallites of a graphite structure. (Ans. 10, ll. 12-19). Also, the Examiner found Hijiriyama inherently discloses the claimed interlaminar distance between crystallites in view of evidence disclosed in Cervinka. (Ans. 11, ll. 4-14).

With respect to rejections i-iii, vi, viii, ix, and x, the Examiner also determined that the claimed subject matter of claim 1 would have been obvious to one of ordinary skill in the art in view of combined teachings of various combinations of Maeda, Peng, Sato, and Ohsaki. (Ans. 4, l. 22 to 6, l. 8; 7, l. 13 to 9, l. 22; 10, l. 20 to 11, l. 3).

With regard to rejections iv, v, and vii, the Examiner determined that the claimed subject matter of dependent claims 5 and 14 would have been obvious to one of ordinary skill in the art in view of the combined teachings of various combinations of references (namely, Maeda, Peng, Sato, and Audley). (Ans. 6, l. 9 to 7, l. 12; 10, ll. 1-11).

Also, the Examiner found that Appellants' relied upon evidence of unexpected results (in the form of Specification data) is insufficient. (Ans. 11, ll. 16-20).

In contrast, Appellants assert that each of Sato, Maeda, Ohsaki, and Hijiriyama does not disclose crystallites having a graphite structure obtained by a starting material of a graphitizing carbon wherein the interlaminar distance d_{002} of the crystallites is in the range of 0.388 to 0.420 nm, as recited in claim 1. (App. Br. 18, ll. 19-23; 21, ll. 5-9; Claim 1). Furthermore, Appellants assert that Peng, Audley, and Cervinka also fail to disclose these claimed limitations. (Claim 1; App. Br. 24, ll. 14-18; 26, ll. 2-6; 33, ll. 15-19). In addition, Appellants assert that test data disclosed in the Specification show that the claimed characteristics in the appealed claims are not inherent in the prior art and demonstrate unexpected results. (Reply Br. 12, ll. 1-5).

Issues

Thus, the issues arising from the contentions of the Examiner and Appellants are:

Have Appellants shown reversible error in the Examiner's finding that there is a reasonable basis to infer that the prior art activated carbons in Sato, Maeda, Ohsaki, and Hijiriyama have the same properties as Appellants' claimed activated carbon?

If not, have Appellants demonstrated that the relied upon evidence is sufficient to satisfy Appellants' burden to show that the prior art activated carbon does not inherently have the claimed interlaminar spacing?

Findings of Fact

1. Appellants' Specification does not provide a definition for "powder." (Spec. ¶¶ 0001-0040).
2. In the context of Appellants' invention, the ordinary meaning of "powder" is "[a]ny solid, dry material of extremely small particle size ranging down to colloidal dimensions, prepared either by comminuting larger units (mechanical grinding), combustion (carbon black, lampblack), or precipitation via a chemical reaction (calcium carbonate, etc.)." (*Hawley's Condensed Chemical Dictionary*, 13th Ed. (1997)).
3. Appellants' Specification states:

> It is an object of the present invention to provide an activated carbon of the above-described type for an electrode, wherein the electrostatic capacity density per unit volume can be increased to 30 F/cc or more.
>
> To achieve the above-described object, according to the present invention, there is provided an activated

> carbon for an electrode of an electric double-layer capacitor including a plurality of crystallites having a graphite structure in an amorphous carbon, in which the interlaminar distance d_{002} of the plurality of crystallites is in a range of $0.388 \leq d_{002} \leq 0.420$ nm. [¶ 0004-0005].

4. The Specification does not define a "graphitizing" carbon but discloses:

> Examples of the starting material of graphitizing carbon, which may be used in addition to a mesophase pitch, include coke, petroleum pitch, a polyvinyl chloride, a polyimide, PAN and the like. [¶ 0018].

5. The Specification discloses:

> In embodiments, this process [of producing activated carbon for the electrode] includes[: 1)] a step of forming a fiber by conducting spinning using a mesophase pitch which is a starting material of graphitizing carbon, [2] a step of subjecting the fibrous material to an infusibilizing treatment at a heating temperature T set in a range of $200°C \leq T \leq 400°C$ for a heating time t set in a range of 0.5 hour $\leq t \leq 10$ hours in an atmospheric current, [3] a step of subjecting the infusibilized fiber to a carbonizing treatment at a heating temperature T set in a range of $600°C \leq T \leq 900°C$ for a heating time t set in a range of 0.5 hour $\leq t \leq 10$ hours in an inert gas current to provide a fibrous carbonized material, [4] a step of subjecting the fibrous carbonized material to a pulverizing treatment to provide a powdered carbonized material, [5] a step of subjecting the powdered carbonized material to an alkali activating treatment at a heating temperature T set in a range of $500°C \leq T \leq 1{,}000°C$ for a heating time t set in a range of 0.5 hour $\leq t \leq 10$ hours in an inert gas atmosphere, followed by [6] an acid-washing, a water-washing, a filtration and a drying, thereby providing activated carbon. [¶ 0017].

6. The Specification discloses an example of producing an activated carbon using nitrogen gas as the inert gas in the carbonizing and activating steps. (¶¶ 0021, 0023).

7. The Specification discloses test data (Example 1) showing interlaminar distances obtained by processing mesophase pitch graphitizing carbon by: i) spinning; ii) infusibilizing at 320°C in atmospheric current for 1 hour; iii) carbonizing at 650°C in nitrogen gas current for 1 hour; iv) pulverizing the carbonized material, v) activating with potassium hydroxide (KOH) at 700°C in nitrogen gas current for 5 hours; and vi) acid-washing, water-washing, filtering, and drying. (¶¶ 0021-0023; Table 1; Example 1).

8. The Specification also discloses Examples 2-5 and Comparative Examples 1-4, which "were produced under the same atmosphere conditions as in the production of the Example 1, except that the temperature and the time in the production of the powdered carbonized material and/or the temperature and the time in the alkali activating treatment were changed." (¶ 0024; Table 1).

9. The test data compare interlaminar distances resulting from various carbonizing temperatures of 650, 700, and 750°C (Examples 1-5) against carbonizing temperatures of 770 and 800°C (Comparative Examples 1-4) at an alkali activating temperature of either 700°C or 800°C. (Table 1).

10. The test data show that carbonizing mesophase pitch at temperatures of 650°C, 700°C or 750°C for 1 hour, with alkali treatment temperature of either 700°C or 800°C at 5 hours, resulted in activated carbon with crystallites having interlaminar distances ranging from

0.388 to 0.416 nm, which in turn, resulted in electrostatic capacity densities ranging from 37.2 to 41.5 F/g (i.e., 31.6 to 33.6 F/cc) in an electric double-layer capacitor made with the produced activated carbon. (Tables 1 and 2; Spec. ¶¶ 0031-0036).

11. The test data also show that carbonizing mesophase pitch at temperatures from 770 to 800°C for 1 hour, with alkali activating temperatures of either 700°C or 800°C for 5 hours, resulted in interlaminar distances ranging from 0.360 to 0.375 nm, which in turn, resulted in electrostatic capacity densities ranging from 17.7 to 29.8 F/g (i.e., 16.6 to 25.6 F/cc) in an electric double-layer capacitor made with the produced activated carbon. (Tables 1 and 2; Spec. ¶¶ 0031-0036).

12. Appellants have not shown that the infusibilizing, spinning, acid-washing, water-washing, filtering, or drying step affects the interlaminar distance of the claimed activated carbon.

13. Appellants do not present test data, with respect to interlaminar spacing of crystallites, on activated carbon produced by the same methods disclosed in the prior art.

14. Sato discloses:

> [V]inyl chloride resin (PVC) exhibits two-stage weight loss of a first-stage weight loss beginning with about 250°C. and ending with about 350°C., and a second-stage weight loss beginning with about 420°C. and ending with about 500°C. when it is gradually heated from room temperature. [Col. 8, ll. 35-40].

15. Sato further discloses:

> [V]inyl chloride resin was heated from room temperature to 600°C. and held for 30 minutes at 600°C., thereby

> calcining the vinyl chloride resin into a carbonized product. [Col. 8, ll. 62-65].

16. Sato discloses "[t]he carbonized product thus obtained was then ground into particles having a particle size of 1-100 μm." (Col. 9, ll. 19-20).

17. Sato discloses:

> Potassium hydroxide was mixed in a proportion of 2 parts by weight per 1 part by weight of this carbonized product. The mixture was heated for 3 hours at 800°C. in a nitrogen gas stream to conduct the alkali activation, thereby obtaining active carbon (Example 1). [Col. 9, ll. 21-25].

18. Sato discloses that the active carbon of Sato's Examples 2 and 3 and Comparative Examples 1 and 2 were obtained using the same procedure as in Example 1 (e.g., same carbonization temperature of 600°C) except that the alkali activation treatment was varied. (Col. 9, ll. 41-44, 51-54, 62-67; col. 10, ll. 7-10).

19. Sato discloses that the alkali activation step was performed at 800°C, 860°C, and 900°C (Examples 1-3, respectively) or at 600°C and 750°C (Comparative Examples 1-2, respectively).

20. Maeda discloses examples of activated carbon (MACF 2 and 3) using mesophase pitch as the graphitizing carbon starting material and produced by: i) spinning to prepare pitch fibers; ii) infusibilizing from room temperature to 300°C at average heating rate of 4°C/min in air; iii) carbonizing at 700°C in nitrogen gas; iv) milling the carbonized fibers; v) activating with potassium hydroxide at 700°C in nitrogen gas; and vi) mixing with isopropyl and washing with water

until neutral; and obtaining capacitor capacities in an electric double layer capacitor of 42 F/g (MACF 2) and 45 F/g (MACF 3). (Col. 11, l. 59 to 12, l. 20; Table 1, Example 1, MACF 2 and 3).

21. Maeda discloses "the infusibilization treatment in air is desirably carried out under the conditions of an average heating rate of 1 to 15°C. /min, preferably 3 to 12°C. /min, and a temperature of 100 to 350°C., preferably about 150 to 300°C." (Col. 6, ll. 24-28).

22. At a heating rate of 3°C/min, Maeda's infusibilizing treatment would involve about 33 minutes within the temperature range from 200 to 300°C.

23. Maeda discloses milling the carbonized fibers to a mean particle diameter of 5 to 50 μm. (Col. 7, ll. 21-24).

24. Peng discloses a method of making activated carbon including "providing an oxidized pitch, carbonizing the pitch . . . and activating the pitch to produce activated carbon." (Col. 1, ll. 52-55).

25. Peng discloses petroleum pitch as a carbon source for making an activated carbon. (Col. 2, ll. 8-12).

26. Peng discloses:

> At some point before carbonization or activation, the pitch is oxidized to render it infusible. The oxidation can be done at about 200-300°C. in air for 1 to 5 hours. [Col. 2, ll. 35-37].

27. Peng discloses that carbonization to enrich the carbon content of the starting pitch is performed at 600-1000°C for 0.5 - 2 hours in nitrogen atmosphere. (Col. 6, ll. 17-22).

28. Peng states that standard activation methods can be used. (Col. 6, ll. 31-32).

29. Ohsaki discloses carbonaceous material specimens made from a carbonized charcoal (i.e., carbonized phenol resin) starting material that is chlorinated, dechlorinated and selectively activated , and then crushed to fit through 150 mesh. (Col. 12, ll. 15-24; col. 16, ll. 41-47; col. 49, l. 59 to 50 l. 15; col. 50, ll. 36-38; Table 17, Specimens 3-5).
30. Ohsaki states that: "A nongraphitizing carbon and a graphitizing carbon which has not been completely graphitized usually contain unorganized carbon." (Col. 2, ll. 1-3).
31. Ohsaki discloses: "Since the present invention makes use of the reaction of chlorine with unorganized carbon, it is necessary that the carbonized charcoal used in the present invention be non-graphitizing carbon and graphitizing carbon in which the degree of crystallinity is insufficient. (Col. 12, ll. 55-60).
32. Ohsaki discloses specimens of activated carbon obtained from carbonized charcoal and containing crystallites having an interlaminar distance (d_{002}) ranging from 0.406 to 0.417 nm. (Table 17, Specimens 3-5).
33. Ohsaki discloses: "Electrodes for electrical double layer capacitors are called polarizable electrodes, but those which have much larger electrostatic capacity are being demanded. . . . In particular, activated carbon which has been given an activation treatment is often used." (Col. 6, ll. 47-56).
34. Ohsaki discloses: "By means of using the carbonaceous material obtained by means of the manufacturing method for porous carbonaceous material of the present invention, an electrical double

layer capacitor is obtained in which capacitance is 70~90 F/cm^3." (Col. 12, ll. 3-7).

35. Hijiriyama discloses an example of producing a carbon material for an electrical double layer capacitor using phenol laminated paper substrate plates carbonized at 700°C in a nitrogen gas for 2 hours, activated with potassium hydroxide at 500°C in a nitrogen gas for 2 hours, washed, dried, and ground to 10-15 μm. (¶ 0036-0038).

36. Cervinka states that "carbon preparations prepared by pyrolysis of a phenolic resin and heat treated at different temperatures T, d002 = 0.388 nm (T=900°C) . . . were found." (Cervinka at 418; footnote omitted).

37. Cervinka states that "[g]rown-in defects and /or interstitial atoms are known to interfere with the regular stacking of graphitic sheets." (*Id.*)

Principles of Law

"[T]he PTO must give claims their broadest reasonable construction consistent with the specification. Therefore, we look to the specification to see if it provides a definition for claim terms, but otherwise apply a broad interpretation." *In re ICON Health and Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007) (Citation omitted).

Anticipation requires that a single prior art reference discloses, either expressly or under the principles of inherency, each and every element of the claimed invention. *In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986).

"[W]hen the PTO shows sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of

showing that they are not." *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990). *See also In re Best,* 562 F.2d 1252, 1255 (CCPA 1977).

Appellants cannot overcome a prima facie case of anticipation under 35 U.S.C. § 102 by a showing of unexpected results. *In re Malagari*, 499 F.2d 1297, 1302 (CCPA 1974).

"[E]vidence establishing lack of all novelty in the claimed invention necessarily evidences obviousness." *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982).

Analysis

i. Rejection of Claims 1-3 and 7-14 As Anticipated by, or Alternatively, As Obvious in View of Sato

Anticipation of Claim 1

Appellants assert that there is no evidence that the activated carbons of Sato inherently have the claimed interlaminar spacing. (Reply Br. 7, ll. 17-19). Furthermore, Appellants assert that the processes disclosed in Sato are not identical to processes disclosed by Appellants and the prior art processes do not inherently result in a product that has the characteristics of Appellants' claimed product. (App. Br. 19, l. 22 to 20, l. 2). Also, Appellants state that Sato does not disclose infusibilizing treatment, acid-washing, water-washing, filtration, and drying steps after alkali activation treatment. (App. Br. 18, l. 23 to 19, l. 2).

Appellants' assertions are unpersuasive. The Specification discloses that the claimed activated carbon is produced by starting with graphitizing carbon and processing by: i) spinning; ii) infusibilizing; iii) carbonizing at 600 to 900°C for 0.5 to 10 hours in inert gas (nitrogen); iv) pulverizing; v)

activating with alkali metal hydroxide (e.g., potassium hydroxide) at 500-1000°C for 0.5-10 hours in inert gas (nitrogen); and vi) acid washing, water washing, filtering, and drying. (FF 4-6). According to the Specification, polyvinyl chloride is an example of a graphitizing carbon starting material. (FF 4).

Sato discloses producing activated carbon using graphitizing carbon starting material of vinyl chloride resin (PVC) (FF 14). Furthermore, Sato discloses processing the PVC by: i) heating from room temp to 600°C; ii) carbonizing at 600°C for 30 minutes; iii) pulverizing; and iv) alkali activating with potassium hydroxide at 860°C for 4 hours in nitrogen gas. (FF 14-17). Additionally, although Sato does not explicitly disclose an infusibilizing step, Sato's process including heating the starting material to the carbonizing temperature is similar to Appellants' infusibilizing step as a pre-heating step before carbonizing. (FF 5, 14, 15).

Because the claimed product and the prior art are made from the same starting material (i.e., graphitizing carbon) and are produced by a substantially similar process, the Examiner had a sufficient basis to believe that the prior art product would reasonably appear to have the claimed characteristics of a plurality of crystallites having a graphite structure wherein the interlaminar distance d_{002} of the crystallites is in the range of 0.388 to 0.420 nm. The Examiner's basis for belief was well justified because claim 1 is broadly recited ("activated carbon . . . including a plurality of crystallites") to encompass materials in which the claimed interlaminar spacing is required for only two crystallites of the claimed activated carbon. (Claim 1). In view of these facts, the Examiner did not err by shifting the burden of proof to Appellants to show that the prior art

product does not inherently have the characteristics or properties of the claimed activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255.

Appellants assert that Sato's process is different from Appellants' disclosed process and "does not inherently result in production of the activated carbons of the present invention." (App. Br. 19, ll. 3-4). Specifically, Appellants contend that the carbonization temperatures used to prepare Sato's disclosed "Examples" and "Comparative Examples" result in different interlaminar distances (as implied by Sato's disclosed electrostatic capacity densities) relative to distances achieved by Appellants when using comparable temperatures with Appellants' methods. (App. Br. 19, ll. 4-21). Additionally, Appellants assert that *In re Best* and *In re Fitzgerald* "are inapposite to the situation in the present application." (Reply Br. 10, ll. 19-21). In particular, Appellants assert:

> Appellants here have presented evidence of unexpected properties in the form of test data demonstrating that the prior art products do not exhibit the claimed interlaminar spacing. Appellants have met their burden of proof in demonstrating that the functional features present in the claims are not inherent characteristics of the prior art. [Reply Br. 12, ll. 1-5].

Furthermore, Appellants assert that Sato does not disclose "the unexpected properties achieved by an activated carbon having the claimed interlaminar spacing." (App. Br. 20, ll. 2-4).

Appellants' arguments are unpersuasive. Contrary to Appellants' arguments, Sato discloses in Examples 1-3 and Comparative Examples 1-2 that the materials were prepared by carbonizing at 600°C, which is between the range of carbonization temperatures disclosed as suitable in the Specification. (FF 5, 15, and 18). Thus, there is no persuasive evidence on

the record showing that the prior art products do not inherently have the claimed interlaminar spacing. (FF 7-11, and 13). Appellants' test data merely compares interlaminar distances of activated carbon obtained by using mesophase pitch starting material carbonized at temperatures ranging from 650 to 750°C at activating temperatures of 700°C or 800°C against those carbonized at 770 or 800°C and activated at 700°C or 800°C. (FF 7-9; Table 1). Appellants' data suggest that preparing activated carbon in the disclosed method using carbonization temperatures of 770°C and 800°C for 1 hour with alkali activation at 700°C and 800°C for 5 hours does not result in the claimed interlaminar spacing, but that carbonization temperatures at 650°C, 700°C, and 750°C for 1 hour with alkali activation at 700°C or 800°C for 5 hours, in Appellants' disclosed process, does produce the claimed interlaminar distance (*i.e.*, 0.388 to 0.416 nm). (FF 10 and 11; Table 1). Thus, Appellants' data suggest that lower carbonization temperatures (650-750°C) will result in the claimed interlaminar distances, which is exactly the disclosure of Sato. Thus, Appellants' test data does not show the prior art process will not inherently result in the claimed interlaminar spacing.

Appellants' reliance on electrostatic capacity density data in Table 2 as showing unexpected results is also unpersuasive because Appellants have not established that the electrostatic capacity densities disclosed in Sato necessarily result in interlaminar distances outside the claimed range. Because Appellants have failed to demonstrate that the claimed invention differs from the prior art in terms of interlaminar distance, Appellants cannot overcome the rejection by a showing of unexpected results arising from this alleged difference. *In re Malagari*, 499 F.2d at 1302.

For these reasons, Appellants have not shown the Examiner erred in finding the claimed activated carbon anticipated by Sato.

Obviousness of Claim 1

Because we affirm the Examiner's rejection of claim 1 under 35 U.S.C. § 102 over Sato, we also affirm the rejection of claim 1 under 35 U.S.C. § 103. *See In re Fracalossi*, 681 F.2d at 794.

ii. Rejection of Claims 1-3 and 7-13 As Anticipated by, or Alternatively, As Obvious in View of Maeda

Anticipation of Claim 1

Appellants assert that there is no evidence that the activated carbons of Maeda inherently have the claimed interlayer spacing. (App. Br. 21, ll. 17-18; Reply Br. 7, ll. 17-19). Furthermore, Appellants state that Maeda discloses a different process from that used to make the claimed activated carbon. Specifically, Appellants state that Maeda's Example 2 used a carbonization temperature of 950°C and achieved an electrostatic capacity density of 34 F/g, but when Appellants use a carbonization temperature above 750°C in their method, "an interlaminar distance of less than 0.375 nm, and an electrostatic capacity density of 25.6 F/cc (equivalent to 29.8 F/g) or less" is achieved. (App. Br. 21, l. 18 to 22, l. 1). Appellants also state that Maeda's Reference Example 1 used a carbonization temperature of 600°C and obtained an electrostatic capacity of 21 F/g, while Appellants' carbonization temperature of 650°C "in conjunction with Appellants' methods for preparing active carbon results in an active carbon product that has an interlaminar distance that is from 0.407 to 0.416 nm, and an

electrostatic capacity density of 32.5 to 33.6 F/cc (equivalent to 41.2 to 41.5 F/g)." (App. Br. 22, ll. 4-13). Furthermore, Appellants state that Maeda does not disclose acid-washing, water-washing, filtration, and drying steps after alkali activation. (App. Br. 21, ll. 15-16).

Appellants' arguments are unpersuasive. As do Appellants, Maeda uses mesophase pitch as a graphitizing carbon starting material to prepare activated carbon. (FF 4 and 20). In addition to the examples discussed by Appellants, Maeda also discloses Example 1 of an activated carbon prepared by: i) spinning to prepare pitch fibers; ii) infusibilizing from room temperature to 300°C at average heating rate of 4°C/min in air; iii) carbonizing at 700°C in nitrogen gas; iv) milling the carbonized fibers; v) activating with potassium hydroxide at 700°C in nitrogen gas for 7 hours; and vi) mixing with isopropyl alcohol and washing with water until neutral. (FF 20-23; Maeda, Table 1). Fibers MACF-2 and MACF-3, produced by this process, are said to exhibit electrostatic capacity density values of 42 and 45 F/g respectively, which is comparable to values Appellants argue they obtain with their process. (FF 20; App. Br. 22, ll. 6-10). As discussed above, the Specification produces the inventive activated carbon by: 1) spinning mesophase pitch; 2) infusibilizing within a temperature range of 200 to 400°C for a time of 0.5 to 10 hours in air; 3) carbonizing within a temperature range of 600 to 900°C for a time of 0.5 to 10 hours in an inert gas (i.e., nitrogen); 4) pulverizing the carbonized material; 5) alkali activating (e.g., with potassium hydroxide) within a temperature range of 500 to 1000C for a time of 0.5 to 20 hours in an inert atmosphere (e.g., nitrogen); and 6) acid-washing, water-washing, filtering, and drying. (FF 5 and 6).

Similar to the first rejection, because the claimed product and the prior art are made from the same starting material (i.e., graphitizing carbon) and are produced by a substantially similar process, the Examiner had a sufficient basis to believe that the prior art product would reasonably appear to have the claimed characteristics of a plurality of crystallites having a graphite structure wherein the interlaminar distance d_{002} of the crystallites is in the range of 0.388 to 0.420 nm. Here also, the Examiner's basis for belief was well justified because broadly recited claim 1 encompasses materials in which the claimed interlaminar spacing is required for only two crystallites of the claimed activated carbon. (Claim 1). In view of these facts, the Examiner did not err by shifting the burden of proof to Appellants to show that the prior art product does not inherently have the characteristics or properties of the claimed activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255.

Appellants assert that Maeda does not disclose making an active carbon powder, but makes active carbon fibers instead. (App. Br. 21, ll. 9-11).

This argument is unpersuasive. In interpreting the meaning of claim terms, we first look to the Specification to determine whether Appellants have established a definition for the claim terms in question. Here, we do not find any definition in Appellants' Specification for "powder." (FF 1). Accordingly, we give the claim term its broadest reasonable construction. *In re ICON Health and Fitness, Inc.*, 496 F.3d at 1379. The broadest reasonable interpretation of "powder" is "a solid substance in the form of tiny loose particles." (powder *supra*; FF 2). Here, one skilled in the relevant art would understand Maeda's milled carbonized fibers with a mean

diameter ranging from 5 to 50 μm to be a "powder." (FF 23). Appellants have not offered any evidence that compels a contrary interpretation.

Appellants assert that Maeda does not disclose the "unexpected properties achieved by an activated carbon having the claimed interlaminar spacing." (App. Br. 22, ll. 18-20). Additionally, Appellants assert that *in re Best* and *in re Fitzgerald* "are inapposite to the situation in the present application." (Reply Br. 10, ll. 19-21). Specifically, Appellants assert:

> Appellants here have presented evidence of unexpected properties in the form of test data demonstrating that the prior art products do not exhibit the claimed interlaminar spacing. Appellants have met their burden of proof in demonstrating that the functional features present in the claims are not inherent characteristics of the prior art. [Reply Br. 12, ll. 1-5].

Appellants' arguments are unpersuasive because there is no persuasive evidence on the record showing that the prior art products do not inherently have the claimed interlaminar spacing. (FF 7-11, and 13).

As discussed above, Appellants' test data merely compares interlaminar distances of activated carbon obtained with mesophase pitch starting material and using carbonizing temperatures ranging from 650 to 800°C and activating temperatures of 700°C or 800°C within Appellants' disclosed process for producing activated carbon. (FF 7-11; Table 1). Appellants' test data suggest that Appellants' disclosed process obtains the claimed interlaminar distances with lower carbonization temperatures (650-750°C), but not with higher carbonization temperatures (770-800°C). (FF 11; Table 1)

As discussed above, Maeda discloses a 700°C carbonizing temperature and 700°C activation temperature. (FF 20). Appellants' test data suggest that this temperature would result in the claimed interlaminar

distance. (FF 10; claim 1). Accordingly, Appellants' test data does not show the prior art process will not inherently result in the claimed interlaminar spacing.

Appellants' reliance on electrostatic capacity density data in Table 2 as showing unexpected results is also unpersuasive because Appellants have not established that the electrostatic capacity densities disclosed in Sato necessarily result in interlaminar distances outside the claimed range.

Because Appellants have failed to demonstrate that the claimed invention differs from the prior art in terms of interlaminar distance, Appellants cannot overcome the rejection by a showing of unexpected results arising from this alleged difference. *In re Malagari*, 499 F.2d at 1302.

For these reasons, Appellants have not shown the Examiner erred in finding the claimed activated carbon anticipated by Maeda.

Obviousness of Claim 1

Because we affirm the Examiner's rejection of claim 1 under 35 U.S.C. § 102 over Maeda, we also affirm the rejection of claim 1 under 35 U.S.C. § 103. *See In re Fracalossi*, 681 F.2d at 794.

iii. Rejection of Claims 1-4, 6-13 and 15-17 As Obvious in View of Maeda and Peng

Appellants argue: "Like Maeda, Peng fails to disclose or suggest the activated carbons having a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material." (App. Br. 23, l. 23 to 24, l. 1). Furthermore, Appellants assert that Peng

teaches away from this feature. (App. Br. 24, ll. 1-8). Additionally, Appellants argue:

> Peng fails to remedy the deficiencies of Maeda, as set forth above, as it also fails to disclose or suggest an activated carbon including a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, where the interlaminar distance of the plurality of crystallites is in the range of 0.388 to 0.420 nm, or, alternatively, where the interlaminar distance is greater than 0.388 nm. [App. Br. 24, ll. 14-18]

Appellants' arguments are unpersuasive. As discussed above, Maeda discloses the same graphitizing carbon starting material (mesophase pitch) and substantially identical process, as disclosed in the Specification. (FF 20-23). In view of these facts, the Examiner had a reasonable basis to shift the burden of proof to Appellants to show that the claimed product differs from that of the prior art. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255. Appellants have not met this burden.

For the reasons discussed above, we uphold the Examiner's rejection over the combined teachings of Maeda and Peng.

iv. Rejection of Claim 5 As Obvious in View of Maeda, Peng, and Audley

Appellants do not argue that the combined teachings of Maeda, Peng, and Audley fail to teach "the step of subjecting the powdered carbonized material to an alkali activating treatment is followed by an acid-washing, a water-washing, a filtration and a drying." (Claim 5). Rather, Appellants argue:

> [T]he combination of Maeda, Peng, and Audley does not disclose or suggest the claimed activated carbons, or the claimed methods of making them, wherein the activated

> carbons have a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, where an interlaminar distance between the plurality of crystallites is in the range of 0.388 to 0.420 nm. [App. Br. 26, ll. 8-13].

Appellants' arguments are unpersuasive. As discussed above, Maeda discloses the same starting material and the substantially identical process as disclosed in the Specification to achieve the claimed activated carbon. (FF 20-23). The Examiner properly shifted the burden to Appellants to show that the prior art does not have the characteristics and properties of the claimed activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255. Appellants have not satisfied their burden.

Appellants also state "that one skilled in the art would not find any suggestion or motivation to combine Maeda, Peng, and Audley to arrive at the presently claimed inventions." (App. Br. 26, ll. 14-18). However, Appellants' conclusory statements do not show that the Examiner erred in determining the claimed subject matter obvious in view of the prior art.

v. Rejection of claim 14 as obvious in View of Maeda, Peng, and Sato

Appellants do not argue the combined teachings of Maeda, Peng, and Sato fail to disclose "the powdered carbonized material has an average particle size of 20 μm." (Claim 14). Rather, Appellants argue:

> [T]he combination of Maeda, Peng, and Sato does not disclose or suggest the claimed activated carbons, or the claimed methods of making them, wherein the activated carbons have a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, where an interlaminar distance between the plurality of crystallites is in the range of 0.388 to 0.420 nm. [App. Br. 27, ll. 6-11].

Appellants' arguments are unpersuasive. As discussed above, both Sato and Maeda disclose producing the claimed activated carbon starting with graphitizing carbon and using a substantially identical process as disclosed in Appellants' Specification. (FF 4-6, 14-17, and 20-23). In view of these facts, the Examiner properly shifted the burden to Appellants to show that the prior art does not have the characteristics and properties of the claimed activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255. Appellants do not direct us to persuasive evidence that the prior art product does not inherently have the characteristics and properties of the claimed activated carbon.

Appellants also argue "that one skilled in the art would not find any suggestion or motivation to combine Maeda, Peng, and Sato to arrive at the presently claimed inventions." (App. Br. 27, ll. 12-16). Here also, Appellants' conclusory statements do not show that the Examiner erred in determining the claimed subject matter obvious in view of the prior art.

vi. Rejection of claims 1-4 and 6-17 as obvious in View of Sato and Maeda or Sato, Maeda, and Peng

Appellants argue that the combined teachings of Sato and Maeda do not disclose the claimed activated carbons including crystallites with a graphitic structure obtained by using graphitizing carbon and having an interlaminar distance between the crystallites in the range of 0.388 to 0.420 nm. (App. Br. 27, l. 21 to 28, l. 2). Furthermore, Appellants assert that Peng teaches away from the claimed activated carbon. (App. Br. 28, ll. 4-9). In addition, Appellants argue that there is no motivation to combine the teachings of Sato, Maeda, and Peng. (App. Br. 28, ll. 10-15).

Appellants' arguments are unpersuasive. As discussed above with respect to rejections i and ii, Maeda and Sato each provides a sound basis that the prior art activated carbons would reasonably appear to have the same properties or characteristics as the claimed activated carbon. (FF 4-6, 14-17, and 20-23). Therefore, the Examiner properly shifted the burden to Appellants to show that the prior art activated carbon does not inherently have the characteristics of the claimed activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255. However, Appellants have not satisfied their burden. Therefore, Appellants have failed to show error.

vii. Rejection of claim 5 as obvious in View of Sato, Maeda, and Audley or Sato, Maeda, Peng, and Audley

Appellants argue that the combined teachings of Sato, Maeda, and Peng do not disclose the claimed activated carbons including crystallites with a graphitic structure obtained by using graphitizing carbon and having an interlaminar distance between the crystallites in the range of 0.388 to 0.420 nm. (App. Br. 28, l. 21 to 29, l. 2). Furthermore, Appellants assert that Audley does not provide the missing limitations. (App. Br. 29, ll. 3-4). In addition, Appellants argue there is no motivation to combine the teachings of Sato, Maeda, Peng and Audley. (App. Br. 29, ll. 10-14).

As discussed above with regard to rejections i and ii, Maeda and Sato each provides a sound basis that the prior art activated carbons would reasonably appear to have the same properties or characteristics as the claimed activated carbon. (FF 4-6, 14-17, and 20-23). Therefore, the Examiner properly shifted the burden to Appellants to show that the prior art activated carbons do not inherently have the characteristics of the claimed

activated carbon. *In re Spada*, 911 F.2d at 708; *In re Best*, 562 F.2d at 1255. However, Appellants have not satisfied their burden. Therefore, Appellants have not shown that the Examiner erred in determining the claimed subject matter obvious in view of the prior art.

viii. Rejection of Claims 1, 7-10, 13, and 14 As Anticipated by, or Alternatively, As Obvious in View of Ohsaki

Anticipation of Claim 1

Appellants assert:

> Ohsaki is directed to using materials which are not graphitizing carbon as a starting material to produce a carbonaceous material that may be used to form an electric double layer capacitor. Appellants submit that the starting materials described by Ohsaki are difficult to graphitize, *e.g.*, coconut shell, phenol resin, furan resin, and the like. [App. Br. 29, 17-21].

Appellants' assertion that Ohsaki does not disclose graphitizing carbon starting material is unpersuasive. Giving the term "graphitizing" its broadest reasonable interpretation, in light of the Specification, the term includes all graphitizing carbon, whether easy or difficult to graphitize, or whether partially or completely graphitized. *In re ICON Health and Fitness, Inc.*, 496 F.3d at 1379. Appellants have not defined "graphitizing" otherwise. (FF 4). Ohsaki discloses that the carbonized charcoal starting material should be "graphitizing carbon" in which the degree of crystallinity is insufficient, as well as non-graphitizing carbon. (FF 31). Thus, Ohsaki explicitly discloses "graphitizing carbon" starting material.

Appellants assert:

> Ohsaki fails to disclose or suggest an activated carbon including a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a starting material, where the interlaminar distance of the plurality of crystallites is in the range of 0.388 to 0.420 nm, or, alternatively, where the interlaminar distance is greater than 0.388 nm, as required by the present claims. [App. Br. 30, ll. 4-8].

Appellants' assertions are unfounded. Ohsaki discloses specimens of an activated carbon powder, produced from a carbonized charcoal (i.e., carbonized phenol resin) having a graphite structure with a plurality of crystallites having an interlaminar distance of 0.409 nm (Specimen 3), 0.406 nm (Specimen 4), and 0.417 nm (Specimen 5). (Table 17; FF 29 and 32). Furthermore, Ohsaki teaches using the prior art activated carbon in an electric double-layer capacitor. (FF 33 and 34).

For these reasons, Appellants failed to show the Examiner erred in finding the claimed subject matter anticipated by Ohsaki.

<u>Obviousness of Claim 1</u>

Because we affirm the Examiner's rejection of claim 1 under 35 U.S.C. § 102 over Ohsaki, we also affirm the rejection of claim 1 under 35 U.S.C. § 103. *See In re Fracalossi*, 681 F.2d at 794.

ix. Rejection of claims 1-3 and 7-14 as obvious in View of Ohsaki and Maeda or Ohsaki and Sato

Appellants assert:

> Ohsaki does not disclose or suggest the claimed activated carbons, or the claimed methods of making them, wherein the activated carbons have a plurality of crystallites having a graphite structure obtained by using a graphitizing carbon as a

> starting material, where an interlaminar distance between the plurality of crystallites is in the range of 0.388 to 0.420 nm. [App. Br. 31, ll. 12-16].

Moreover, Appellants state "that one skilled in the art would not find any suggestion or motivation to combine Ohsaki, Maeda, and Sato in order to arrive at the presently claimed inventions." (App. Br. 31, ll. 22-24).

Appellants' arguments are unpersuasive. As discussed above, Appellants have not shown error in the Examiner's findings that each of Ohsaki, Maeda, and Sato anticipates the claimed subject matter. Therefore, Appellants have not shown that the Examiner erred in concluding obviousness. *In re Fracalossi*, 681 F.2d at 794.

x. Rejection of Claims 1-3 and 7-14 As Anticipated by, or Alternatively, As Obvious in View of Hijiriyama in View of Evidence Disclosed by Cervinka

Anticipation of Claim 1

The Examiner states that Hijiriyama "teach[es] forming active carbon powder of 10-15 microns from phenolic resin." (Ans. 11, ll. 7-8). Furthermore, the Examiner asserts that evidence disclosed in Cervinka shows:

> [A] d002 of .388 is expected; the higher the temperature, the more graphitic (ie, closer to .337) the value becomes. Thus, the 700 degrees carbonization of the reference [i.e., Hijiriyama] would be expected to yield a d002 value higher than .388. [Ans. 11, ll. 9-11].

Appellants argue:

> The Examiner alleges . . . that Cervinka discloses that higher carbonization temperatures result in lower d_{002} values, and implies that Cervinka supports the inherency positions advanced in the summaries of the appealed rejections.

> However, this is a gross oversimplification of the teachings of Cervinka. It is clear from the cited passage of Cervinka that multiple factors can affect d_{002} values, including at least the choice of starting material, hybridization state of carbon atoms, reaction conditions, and presence of grown-in defects/interstitial atoms, as well as reaction temperature . . . although Cervinka does not disclose how one skilled in the would control those factors in order to arrive at the presently-claimed invention. [Reply Br. 13, ll. 15-24].

Appellants' arguments are persuasive. Hijiriyama does not expressly disclose the claimed interlaminar distance. Furthermore, the Examiner has not shown that the claimed interlaminar distance is inherent, particularly in light of Cervinka's discussion of defects that affect the regular stacking of graphitic sheets (i.e., the interlaminar distance d_{002}). (FF 37). For these reasons, Hijiriyama, in view of evidence discussed in Cervinka, does not explicitly or inherently disclose the claimed invention.

Obviousness of Claim 1

The Examiner alternately rejects the claimed subject matter as obvious in view of Hijiriyama and Cervinka, but has not directed us to any evidence or reasoning why it would have been obvious to one of ordinary skill in the art to modify the teachings of Hijiriyama to obtain the claimed interlaminar distance. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). Therefore, the Examiner erred in concluding that the claimed subject matter would have been obvious in view of Hijiriyama and Cervinka.

Conclusion

Appellants have not shown reversible error in the Examiner's finding that there is a reasonable basis to infer that the prior art activated carbons have the same properties as Appellants' claimed activated carbon.

Appellants' evidence (submitted as test data disclosed in the Specification) is insufficient to show that the prior art activated carbon does not inherently have the claimed interlaminar spacing .

Order

We affirm rejections i-ix and reverse rejection x. Accordingly, the decision of the Examiner rejecting claims 1-17 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

ack

cc:

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