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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte WEINA LI, MICHAEL L. PERRY,
RACHID ZAFFOU, and CHRISTOPER C. SHOVLIN

Appeal 2019-000494
Application 14/653,280
Technology Center 1700

Before JEFFREY T. SMITH, N. WHITNEY WILSON, and
BRIAN D. RANGE, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeals under 35 U.S.C. § 134(a) from the Examiner's January 25, 2018 decision finally rejecting claims 1–18 and 22–24 (“Final Act.”). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We affirm.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies United Technologies Corporation as the real party in interest (Appeal Br. 1).

CLAIMED SUBJECT MATTER

Appellant's disclosure relates to a method of treating a carbon electrode that includes a surface with a plurality of chemically different carbon oxides (Spec. ¶ 3). The surface is treated with a reducing agent to reduce at least a portion of the oxides to a target carbon oxide (*id.*). The reducing agent can be selected from the group consisting of diborane (B_2H_6), metalorganic agents, $LiBH_3$, and combinations thereof (Spec. ¶ 20). Details of the claimed method are set forth in representative claim 1, which is reproduced below from the Claims Appendix to the Appeal Brief:

1. A method of treating a carbon electrode, the method comprising:
 - providing a carbon-based electrode including a surface that has a plurality of chemically different carbon oxides; and
 - treating the surface with a reducing agent to reduce at least a portion of the plurality of chemically different carbon oxides to a target carbon oxide, wherein the reducing agent is selected from the group consisting of diborane (B_2H_6), metalorganic agents, $LiBH_3$, and combinations thereof.

REJECTIONS

1. Claims 1–6, 8–11, and 13–18 are rejected under 35 U.S.C. § 103(a) as unpatentable over Zhong² in view of Filer.³

² Zhong et al., "Effect of carbon nanotube surface functional groups on oxygen reduction in alkaline solution," *Journal of Power Sources*, Vol. 225, pp. 192–199, published October 23, 2012.

³ Filer, US 2011/0306084 A1, published December 15, 2011.

2. Claims 1–6, 8–11, and 13–18 are rejected under 35 U.S.C. § 103(a) as unpatentable over Ramesh⁴ in view of Filer.

3. Claim 12 over Zhong in view of Filer, or Ramesh in view of Filer, and further in view of Adzic.⁵

4. Claim 22 over Zhong in view of Filer, or Ramesh in view of Filer, and further in view of Jiang.⁶

5. Claims 7, 8, and 17 over Zhong in view of Filer, or Ramesh in view of Filer, and further in view of Shin.⁷

6. Claims 23 and 24 over Zhong in view of Filer, or Ramesh in view of Filer, and further in view of Hashimoto.⁸

DISCUSSION

Appellant argues all of the claims together. Accordingly, we limit our discussion to the rejection of claim 1. Moreover, the arguments made in support of the patentability of claim 1 are the same with regards to Rejection 1 (Zhong in view of Filer) and Rejection 2 (Ramesh in view of

⁴ Ramesh et al., “Chemically functionalised exfoliated graphite: a new bulk modified, renewable surface electrode,” *Chemical Communications*, **1999** 2221–2222, published 1999.

⁵ Adzic et al., US 2006/0177728 A1, published August 10, 2006.

⁶ Jiang et al., US 2011/0014550 A1, published January 20, 2011.

⁷ Shin et al., “Efficient Reduction of Graphite Oxide by Sodium Borohydride and Its Effect on Electrical Conductance” *Adv. Funct. Mater.*, Vol. 19, pp. 1987–1992, published April 20, 2009.

⁸ Hashimoto et al., US 2013/0230744 A1, published September 5, 2013.

Filer), in that they focus on the teachings of Filer. Accordingly, we will address all of the rejections together.

The Examiner finds that each of Zhong and Ramesh disclose each element of claim 1, except that neither discloses the use of the specific reducing agents recited therein, in particular diborane (Final Act. 2–3, 5). Appellant does not challenge these findings (see, Appeal Br. 3–5, and Reply Br. 1–2). The Examiner further finds that Filer is in the same field of endeavor, a finding which is also unchallenged by Appellant, and discloses the use of reducing agents such as diborane, lithium aluminum hydride, and sodium borohydride as reducing agents for reducing carboxylic acid on carbon materials (Final Act. 3, 5, citing Filer ¶¶ 20–25)). The Examiner determines that it would have been obvious to use diborane in either Zhong’s or Ramesh’s process in order to reduce the functional groups on the carbon materials in those references as taught by Filer because “[s]imple substitution of one known reducing agent for another would produce the predictable results of reducing the carbon oxide groups on the carbon material” and “Filer teaches diborane, lithium aluminum hydride and sodium borohydride as functionally equivalent reducing agent[s] for this purpose” (Final Act. 3–4, 5–6).

Appellant argues that Filer “does not teach mere use of diborane to reduce carboxylic acid on carbon materials as is desired in Zhong or Ramesh,” but instead “teaches use of reducing agents that can be adapted in order to form [] tritium containing side chains on a carbon form” (Appeal Br. 3, citing Filer ¶¶ 24, 26, and 34). According to Appellant, although both Zhong and Ramesh are interested in reducing carbon oxide groups on carbon nanotubes or graphite particles, “neither have any interest in producing

tritiated groups as in Filer” (Appeal Br. 3). Appellant further argues that neither Zhong nor Ramesh would seek to produce a tritium containing material – for example, because tritium is radioactive - and, therefore, would not be combined with Filer’s teachings (Appeal Br. 3–4).

Appellant’s arguments are not persuasive. Filer specifically states that:

A reducing agent is any reducing agent capable of reducing a carboxylic acid when used under appropriate conditions. Such reducing agents are commonly referred to as strong reducing agents. Examples of reducing agents include those that react as nucleophiles, but a reducing agent may act as an electrophile such as diborane. Illustrative reducing agents include diborane (B₂H₆)...

(Filer, ¶ 25, emphasis added). Thus, Filer is plainly teaching that diborane is a reducing agent capable of reducing a carboxylic acid (for example to a hydroxyl group). Filer goes on to discuss how the reducing agents described in Paragraph 25 may be “tritiated as a proton donor for the association of a tritium with a planar carbon form” (*id.*).

Nevertheless, the Examiner reasonably found that Filer teaches that diborane can be used as reducing agent for reducing carboxylic acid groups, regardless of whether it is tritiated (Ans. 14). Accordingly, the Examiner properly concluded that it would have been obvious to substitute the known reducing agent diborane in either Ramesh’s process or Zhong’s process for the reducing agents disclosed therein. “[T]he simple substitution of one known element for another” generally will be obvious unless the substitution would have been beyond the level of ordinary skill in the art or the results of the substitution would not have been predictable by one of ordinary skill in the art. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-417 (2007).

In this instance, while Filer teaches, and indeed is directed to, the use of tritiated reducing agents, Filer also discloses that diborane is a known reducing agent for reactions like those disclosed in Zhong and Ramesh. Accordingly, the substitution of diborane into those processes would have been obvious.

Accordingly, we conclude that, based on the preponderance of the evidence of record, Appellant has not demonstrated reversible error in the rejections.

CONCLUSION

In summary:

Claims Rejected	Basis	Affirmed	Reversed
1-6, 8-11, and 13-18	§ 103 Zhong and Filer	1-6, 8-11, and 13-18	
1-6, 8-11, and 13-18	§ 103 Ramesh and Filer	1-6, 8-11, and 13-18	
12	§ 103 Zhong, Filer and Adzic	12	
12	§ 103 Ramesh, Filer and Adzic	12	
22	§ 103 Zhong, Filer and Jiang	22	
22	§ 103 Ramesh, Filer and Adzic	22	
7, 8, 17	§ 103 Zhong, Filer and Shin	7, 8, 17	
7, 8, 17	§ 103 Ramesh, Filer and Shin	7, 8, 17	
23, 25	§ 103 Zhong, Filer and Hashimoto	23, 25	
23, 25	§ 103 Ramesh, Filer and Hashimoto	23, 25	
Overall Outcome		1-18 and 22-24	

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

AFFIRMED