

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 18

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KAZUHIRO NODA, KENICHI TAKAHASHI, KOICHI TANAKA and
HARUO WATANABE

Appeal No. 1996-2758
Application No. 08/103,792¹

ON BRIEF

Before JOHN D. SMITH, PAK and SPIEGEL, Administrative Patent Judges.

PAK, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal from the examiner's refusal to allow claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33 through 35, which are all of the claims remaining in the application. Subsequent to the final Office action dated

¹ Application for patent filed August 10, 1993.

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November 23, 1994, Paper No. 8, claims 1, 4, 8, 14, 20, 23 and 33 were amended, claims 6, 7, 9 through 13, 15, 17 through 19, 25, 26 and 28 through 32 were canceled, and claims 34 and 35 were added. See the Amendment After Final dated February 27, 1995, Paper No. 10.

Appellants have grouped the claims on appeal as follows
(Brief, page 4):

Group I - Claim 1 and its dependent claims;

Group II - Claim 20 and its dependent claims;

Group III - Claim 34; and

Group IV - Claim 35.

Therefore, for purposes of this appeal, the claims in each group will stand or fall together with the broadest claim therein, namely claims 1, 20, 34 and 35, in accordance with 37 CFR

§ 1.192(c)(7)and(c)(8)(iv) (1995). Claims 1, 20, 34 and 35 are reproduced below:

1. A non-aqueous electrolyte which comprises, in combination, an aluminum halide and a quaternary ammonium halide in a non-aqueous solvent,

wherein said non-aqueous solvent is an organic compound having a donor number of not larger than 5, and a molar ratio

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of said quaternary ammonium halide to said aluminum halide being not larger than 1:1.

20. A method for the electrodeposition of aluminum, comprising the step of subjecting a non-aqueous electrolyte comprising, in combination, an aluminum halide and a quaternary ammonium halide in a non-aqueous solvent to electrodeposition, thereby depositing aluminum on a cathode,

wherein said non-aqueous solvent is an organic compound having a donor number of not larger than 5, and a molar ratio of said quaternary ammonium halide to said aluminum halide being not larger than 1:1.

34. A non-aqueous electrolyte comprising an aluminum halide and a quaternary ammonium halide in a non-aqueous solvent selected from the group consisting of 1,2-dichlorobenzene, 1,3-dichlorobenzene and mixtures thereof.

35. A method for the electrodeposition of aluminum comprising the step of subjecting a non-aqueous electrolyte including an aluminum halide and a quaternary ammonium halide in a non-aqueous solvent selected from the group consisting of 1,2-dichlorobenzene, 1,3-dichlorobenzene and mixtures thereof [sic, to a cathode].

The sole prior art reference of record relied upon by the examiner is:

Horiba et al. (Horiba)	4,550,067	Oct. 29,
1985		

Claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33 through 35 stand rejected under 35 U.S.C. § 103 as unpatentable over the disclosure of Horiba.

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We have carefully reviewed the specification, claims and applied prior art, including all of the arguments advanced by the examiner and appellants in support of their respective positions. This review leads us to conclude that only the examiner's § 103 rejection of claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33 is well founded. Accordingly, we will sustain the examiner's § 103 rejection of claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33, but will not sustain the examiner's § 103 rejection of claims 34 and 35. Our reasons for this determination follow.

The claimed subject matter is directed to a non-aqueous electrolyte and its use in the electrodeposition of aluminum. See claims 1 and 20. The electrolyte comprises an aluminum halide and a quaternary ammonium halide in a non-aqueous solvent. The claimed molar ratio of a quaternary ammonium halide to an aluminum halide is not larger than 1:1. According to pages 9 and 10 of the specification, the dissolution of a quaternary ammonium halide and an aluminum halide in a non-aqueous solvent is affected by their molar ratio. Any non-aqueous solvent for dissolution of both the quaternary ammonium halide and the aluminum halide ordinarily

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used in known lithium electrochemical cells may be employed. See specification, page 10. However, appellants claim only those preferred non-aqueous solvents which have a certain functional property, i.e., a donor number not larger than 5. These preferred solvents include, *inter alia*, 1, 2-dichloroethane. See claims 1 and 20, in conjunction with specification, page 11. The specification states (page 6) that:

When the non-aqueous electrolyte of the invention is used [in a secondary cell], Al can be reversibly electrodedeposited from and dissolved in the non-aqueous electrolyte. Accordingly, it will be possible to fabricate a secondary cell which exhibits good charge and discharge characteristics and has a high energy density.

As evidence of obviousness, the examiner relies on the disclosure of Horiba. We find that Horiba discloses an electrolyte useful for a secondary battery cell. See column 1, lines 43-45. The electrolyte contains "a dopant consisting of an anion and a cation . . .". See column 1, lines 46-47. The electrode used in a secondary cell is "made of a material which is capable of being **reversibly** converted into highly conductive substance by doping anions or cations thereinto

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(emphasis added)." See column 1, lines 51-53. According to Horiba (column 2, lines 34-68):

Examples of the anions useful for the present invention include BF_4^- , AlCl_4^- , AsF_6^- , PF_6^- , SCN^- , SbF_6^- , NbF_6^- , and TaF_6^- . Examples of the cations used in combination therewith include alkali metal ions such as Li^+ , Na^+ and K^+ , **ammonium ions such as** $(\text{CH}_3)_4\text{N}^+$, $(\text{C}_2\text{H}_5)_4\text{N}^+$, $(\text{C}_3\text{H}_7)_4\text{N}^+$, $(\text{CH}_3)_3(\text{C}_4\text{H}_9)\text{N}^+$, $(\text{C}_2\text{H}_5)_3(\text{C}_6\text{H}_{13})\text{N}^+$, $(\text{C}_5\text{H}_{11})_4\text{N}^+$, $(\text{CH}_2)_5\text{N}^+$, $(\text{CH}_3)_2(\text{i-C}_5\text{H}_{11})\text{N}^+$, $(\text{n-C}_6\text{H}_{13})_4\text{N}^+$, $(\text{n-C}_8\text{H}_{17})_4\text{N}^+$, $(\text{n-C}_4\text{H}_9)_3\text{N}^+(\text{CH}_2\text{-C}_6\text{H}_5)$, $(\text{CH}_3)_2(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)\text{N}^+$, **etc.**, phosphonium ions such as $(\text{C}_6\text{H}_5)_4\text{-P}^+$, $(\text{CH}_3)(\text{C}_6\text{H}_5)_3\text{P}^+$, $(\text{CH}_3)_2(\text{C}_6\text{H}_5)_2\text{P}^+$, $(\text{C}_6\text{H}_5)_2\text{P}^+$, $(\text{CH}_3)_3(\text{C}_6\text{H}_5)\text{P}^+$, $(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)_3\text{P}^+$, $(\text{C}_2\text{H}_5)_2(\text{C}_6\text{H}_5)_2\text{P}^+$, $\text{HP}^+(\text{C}_6\text{H}_5)_3$, $(\text{C}_3\text{H}_7)(\text{C}_6\text{H}_5)_3\text{P}^+$, $(\text{CH}_2=\text{CHCH}_2)(\text{C}_6\text{H}_5)_3\text{P}^+$, $(\text{CH}_2)_3\text{P}^+(\text{C}_6\text{H}_4.\text{C}_6\text{H}_5)_2$, $(\text{CH}_2)_n\text{P}^+(\text{C}_6\text{H}_4.\text{C}_6\text{H}_4.\text{C}_6\text{H}_5)_2$ wherein n is 6, 10 or 12, and $(\text{CH}_3.\text{C}_6\text{H}_5)_m\text{P}^+(\text{C}_6\text{H}_5)_n$ wherein m+n is 4, n is 1, 2 or 3, and arsonium ions such as $(\text{CH}_3)(\text{C}_6\text{H}_5)_3\text{As}^+$, $(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)_3\text{As}^+$, $(\text{CH}_3.\text{C}_6\text{H}_5)\text{As}^+(\text{C}_6\text{H}_5)_3$, $(\text{C}_6\text{H}_5)_4\text{As}^+$, $(\text{CH}_3)_2(\text{CH}.\text{C}_6\text{H}_5)(\text{C}_6\text{H}_5)_3\text{As}^+$, $(\text{C}_6\text{H}_5.\text{C}_6\text{H}_4)(\text{C}_6\text{H}_5)_3\text{As}^+$, and $(\text{C}_6\text{H}_5.\text{CH}_2)(\text{C}_6\text{H}_5)_3\text{As}^+$. **Any organic solvent can be used for dissolving at least one kind of the anions and cations above** provided that it is inert for the electrodes and other materials, provided that electrolytic substance can be dissolved therein and an increased electric conductivity can be imparted thereto, and provided that it is not decomposed by the charging and discharging. Examples of organic solvents include acetonitrile, propylene carbonate, tetrahydro-furan, (-butyrolactone, 1,2-dimethoxyethane, dioxane, dichloroethane, **1,2-dichloroethane**, N,N,-dimethyl-formamide, dimethyl sulfoxide, dimethyl sulfite, ethylene carbonate, 1,3-dioxolane, nitromethane, formamide, methyl formate, and 2-methyltetrahydrofuran, of which at least one is used. (Emphasis added).

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Given that the limited electrolyte components described and exemplified in Horiba serve the same purpose as appellants' and specifically include those claimed, we agree with the examiner that it would have been obvious to arrive at the claimed electrolyte comprising an aluminum chloride anion, a quaternary ammonium cation and a solvent, such as 1, 2-dichloroethane. **See Merck & Co. v. Biocraft Labs.**, 874 F.2d 804, 807, 10 USPQ2d 1843, 1846 (Fed. Cir.), **cert. denied**, 493 U.S. 975 (1989); **In re Susi**, 440 F.2d 442, 444, 169 USPQ 423, 425 (CCPA 1971); **In re Petering**, 301 F.2d 676, 681, 133 USPQ 275, 280 (CCPA 1962). One of ordinary skill in the art would have had a reasonable expectation that the above-mentioned combination of an anion, a cation and a solvent would be useful as the electrolyte components for a secondary battery cell. **Merck & Co. Inc. v. Biocraft Laboratories Inc.**, 874 F.2d at 809, 10 USPQ2d at 1847; **In re O'Farrell**, 853 F.2d 894, 904, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988).

Appellants argue that Horiba does not suggest using an organic solvent that has a donor number of not larger than 5. See Brief, page 7. As indicated **supra**, however, Horiba

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teaches using any organic solvent, inclusive of those having a donor number of not larger than 5, which is useful for dissolving the anions and cations of an electrolyte and imparting an increased electric conductivity to an electrode. Horiba specifically exemplifies 1, 2-dichloroethane as one of the solvents employed, which, according to appellant, is an organic solvent having a donor number of not larger than 5. From our perspective, the above teachings would have led one of ordinary skill in the art to employ either 1, 2-dichloroethane, as well as other appropriate exemplified solvents, in the electrolyte described in Horiba with a reasonable expectation of dissolving both the anions and cations therein and improving its ability to increase the conductivity of an electrode used in a secondary battery cell. Note also that appellants have not demonstrated that the other solvents exemplified in Horiba do not have a donor number of not larger than 5. *See, e.g., In re Swinehart*, 439 F.2d 210, 212, 169 USPQ 226, 228 (CCPA 1971) (the burden is on appellants to show that the subject matter shown in the prior art does not necessarily possess the functionally defined limitations of their claimed subject matter).

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Appellants also argue that Horiba would not have suggested the claimed molar ratio of a quaternary ammonium ion to an aluminum halide. See Brief, page 8 and Reply Brief, page 7. We disagree. As indicated *supra*, Horiba teaches using an electrolyte containing amounts of a quaternary ammonium ion and an aluminum halide, which can be dissolved in an organic solvent, such as 1, 2-dichloroethane, and can be useful for improving the conductivity characteristic to an electrode used in a secondary battery cell. Implicit in this teaching is that the amounts of a quaternary ammonium ion and an aluminum halide employed must be sufficient to impart the desired dissolution and conductivity characteristics. In other words, Horiba establishes that the amounts of a quaternary ammonium ion and an aluminum halide ion employed are result effective parameters in the secondary battery cell art. Therefore, the determination of workable or even optimum values for these parameters would have been obvious to one of ordinary skill in the art. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-37 (Fed. Cir. 1990); *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980).

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Further, appellants argue that Horiba fails to teach or suggest electrodeposition of aluminum as required in claim 20. We do not agree. From our perspective, the broadest reasonable interpretation of "electrodeposition of aluminum" includes the doping of aluminum (deposition of aluminum into an electrode) taught by Horiba. *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997) (during prosecution of a patent application, claims therein are given the broadest reasonable interpretation in light of the specification). Even were we to conclude that "electrodeposition" does not include "doping" as suggested by appellants at pages 2 and 3 of their Reply Brief, our conclusion would not be altered. Since the same or similar electrode would be subject to the same electrolyte in a secondary battery cell under the same or similar conditions, we are of the view that "electrodeposition" of aluminum would necessarily follow in the process described in Horiba.

Moreover, we note appellants' arguments regarding the criticality of an organic solvent having a donor number of not greater than five and the impossibility of electrodeposition of aluminum in the process of Horiba. See, e.g., Brief, pages

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7, 8 and 9 and Reply Brief, page 6. However, appellants have not supplied any facts to support their arguments. **See In re De Blauwe**, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984)("Mere argument or conclusory statement in the specification does not suffice"); **In re Wood**, 582 F.2d 638, 642, 199 USPQ 137, 140 (CCPA 1978)("Mere lawyer's arguments and conclusory statements in the specification, unsupported by objective evidence, are insufficient. . ."). Accordingly, we are not persuaded by these arguments.

Thus, having considered all of the evidence and arguments advanced by the examiner and appellants in this record, we determine that the preponderance of evidence weighs in favor of obviousness of the subject matter defined by claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33 within the meaning of 35 U.S.C. § 103. Accordingly, we affirm the examiner's decision rejecting claims 1 through 5, 8, 14, 16, 20 through 24, 27 and 33 under 35 U.S.C. § 103 over the Horiba reference.

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However, claims 34 and 35 stand on a different footing. They are limited to using 1, 2-dichlorobenzene, 1, 3-dichlorobenzene or the mixtures thereof as the non-aqueous solvent for the claimed electrolyte. According to the examiner (Answer, pages 5 and 9):

The [sic, use of] 1,2-dichlorobenene or 1,3-dichlorobenzene as the organic solvents are also [sic, would have also been] obvious to the skilled artisan. . . . As stated supra the reference explicitly teaches that 1,2-dichloroethane is one of the solvents which are used. Thus, the skilled artisan would recognize that the dichloro solvents are equally useful. . . .

The claims are drawn to 1,2-dichlorobenzene and 1,3-dichlorobenzene, these are equivalent to the 1,2-dichloroethane.

However, the examiner's conclusory statements are unsupported by any factual evidence. No evidence is relied on to show equivalency between the claimed aromatic and the prior art alkyl compounds. Thus, we agree with appellants that the examiner has not satisfied his initial burden of establishing a *prima facie* case of obviousness regarding the subject matter of claims 34 and 35 within the meaning of 35 U.S.C. § 103. Accordingly, we reverse the examiner's decision rejecting claims 34 and 35 under 35 U.S.C. § 103.

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In view of the foregoing, the decision of the examiner is affirmed-in-part.

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

AFFIRMED-IN-PART

JOHN D. SMITH)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
CHUNG K. PAK)	APPEALS
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