

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 24

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JEFFREY M. CALVERT, PEHR E. PEHRSSON
and MARTIN C. PECKERAR

Appeal No. 1996-1644
Application No. 07/933,147

ON BRIEF

Before KIMLIN, PAK, and OWENS, Administrative Patent Judges.
PAK, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1, 4 through 9, 15 and 16, which are all of the claims pending in the above-identified application.

According to appellants (Brief, page 4), "[the] claims stand or fall together." Therefore, for purposes of this appeal, we need only consider the propriety of the examiner's

Appeal No. 1996-1644
Application No. 07/933,147

rejections of claim 1, the broadest claim on appeal,
consistent with 37 CFR § 1.192(c)(7) (1995). Claim 1 is
reproduced below:

1. A process for modifying diamond surface, comprising the
steps of:

oxidizing the diamond surface in an oxygen containing
plasma induced by radio frequency radiation having a power
ranging from [sic, from] 25 to 200 Watts for a period of time
ranging between 10 seconds and 20 minutes, said step of
oxidizing producing an oxidized surface on said diamond
surface; and

attaching to the oxidized surface chemicals having both a
polar surface moiety that bonds with the oxidized surface and
moieties of a desired functionality which do not bond with the
oxidized surface but which are capable of bonding to a
material of interest.

As evidence of obviousness, the examiner relies on the
following prior art references:

Sato et al. (Sato) 1990	4,957,591	Sep. 18,
Cozzette et al. (Cozzette) 1991	5,063,081	Nov. 5,
		(Filed Aug. 15, 1990)
Suzuki et al. (Suzuki) 1992	5,137,785	Aug. 11,
		(Filed Mar. 8, 1990)
Mino et al. (Mino) 1993	5,270,080	Dec. 14,
		(Filed Feb. 4, 1992)

Appeal No. 1996-1644
Application No. 07/933,147

Ueno et al. (Ueno)¹
1984

0110258 A1

Jun. 13,

As evidence of nonobviousness, appellants rely on the following literature:

Pehrsson et al., "HREELS of Diamond Oxidation Chemistry," *Proc. of 2d NIQIM Int'l Symp. on Adv. Mater.*, (ISAM '95), Tskuba, Japan (March 6-10, 1995)(hereinafter referred to as "Exhibit 1" consistent with appellants' designation).

"Effect of the Preceding Heat Treatment on Hydrogen Chemisorption of Diamond Powders," *Carbon*, Vol. 19, pp. 232-34 (1981) (hereinafter referred to as "Exhibit 2" consistent with appellants' designation).

Matsumoto et al., "Thermal Desorption Spectra of Hydrogenated and Water Treated Diamond Powders," *Carbon*, Vol. 17, pp. 485-89 (1979)(hereinafter referred to as "Exhibit 3" consistent with appellants' designation).

Matsumoto et al., "Thermal Desorption Spectra of the Oxidized Surfaces of Diamond Powders," *Carbon*, Vol. 15, pp. 292-302 (1977)(hereinafter referred to as "Exhibit 4" consistent with appellants' designation).

Yamamoto et al., "Vapor-Phase Oxidation of Diamond Surfaces in O₂ Studies by Diffuse Reflectance of Fourier-transform Infrared and Temperature-Programed Desorption Spectroscopy," *J. Chem. Soc'y Faraday Trans.*, Vol. 89, No. 19, pp. 3635-40

¹The examiner refers to it as "Shinetsu" in her Answer.

Appeal No. 1996-1644
Application No. 07/933,147

(1993)(hereinafter referred to as "Exhibit 5" consistent with appellants' designation).

Bansal et al., "Kinetics of Chemisorption of Oxygen on Diamond," *Carbon*, Vol. 10, pp. 443-48 (1972)(hereinafter referred to as "Exhibit 6" consistent with appellants' designation).

Sappok et al., "Chemie Der Oberflache Des Diamanten-II. Bildung, Eigenschaften Und Struktur Der Oberflachenoxide," *Carbon*, Vol. 6, pp. 573-88 (1968)(hereinafter referred to as "Exhibit 7" consistent with appellants' designation).

Sappok et al., "Chemie Der Oberflache Des Diamanten-I. Benetzungswarmen, Elektronenspinresonanz Und Infrarotspektren Der Oberflachen-Hydride,-Halogenide Und-Oxide," *Carbon*, Vol. 6, pp. 283-95 (1968)(hereinafter referred to as "Exhibit 8" consistent with appellants' designation).

Shergold et al., "The Surface Chemistry of Diamond," *Int'l J. of Mineral Processing*, Vol. 9, pp. 219-33 (1982)(hereinafter referred to as "Exhibit 9" consistent with appellants' designation).

Struck et al., "Interaction of Hydrogen and Water with Diamond (100): Infrared Spectroscopy," *J. Vac. Sci. Technol. A*, Vol. 11, No. 4, pp. 1992-97 (July/August 1993) (hereinafter referred to as "Exhibit 10" consistent with appellants' designation).

Johnson et al., "Thermogravimetric Analysis of the Oxidation of CVD Diamond Films," *J. Mater. Res.*, Vol. 5, No. 11, pp. 2320-25 (1990)(hereinafter referred to as "Exhibit 11" consistent with appellants' designation).

Joshi et al., "Oxidation Kinetics of Diamond, Graphite, and Chemical Vapor Deposited Diamond Films by Thermal Gravimetry,"

Appeal No. 1996-1644
Application No. 07/933,147

J. Vac. Sci. Technol. A, Vol. 8, No. 3, pp. 2137-42 (May/June 1990)(hereinafter referred to as "Exhibit 12" consistent with appellants' designation).

Hansen et al., "The Hydrophobicity of Diamond Surfaces," *Ultrahard Materials Application Tech.*, Vol. 4, pp. 76-87 (ed. C. Barrett)(De Beers Indus. Diamond Div., London 1988)(hereinafter referred to as "Exhibit 13" consistent with appellants' designation).

The appealed claims stand rejected as follows:

- 1) Claims 1, 4 through 9, 15 and 16 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as their invention;
- 2) Claims 1, 4, 7, 15 and 16 under 35 U.S.C. § 103 as unpatentable over Mino alone or in view of Sato;
- 3) Claims 1, 4, 15 and 16 under 35 U.S.C. § 103 as unpatentable over Suzuki alone or in view of Sato; and
- 4) Claims 6 and 8 under 35 U.S.C. § 103 as unpatentable over either Mino or Suzuki, optionally in view of Sato and further in view of Cozzette or Ueno.

We have carefully reviewed the claims, specification and applied prior art, including all of the arguments and evidence advanced by both the examiner and appellants in support of their respective positions. This review leads us to conclude

Appeal No. 1996-1644
Application No. 07/933,147

that only the examiner's § 103 rejections are well founded. Accordingly, we will sustain only the examiner's § 103 rejections for substantially those reasons set forth in the Answer. We reverse the examiner's § 112, second paragraph, rejection for those reasons set forth by appellants in their Brief² and Reply Brief. We add the following for emphasis and completeness.

INDEFINITENESS

The purpose of the second paragraph of Section 112 is to basically insure, with a **reasonable** degree of particularity, an **adequate** notification of the metes and bounds of what is being claimed. See *In re Hammack*, 427 F.2d 1378, 1382, 166 USPQ 204, 208 (CCPA 1970). As the court stated in *In re Moore*, 439 F.2d 1232, 1235, 169 USPQ 236, 238 (CCPA 1971), the determination of whether the claims of an application satisfy the requirements of the second paragraph of Section 112 is merely to determine whether the claims do, in fact, set out and circumscribe a particular area with a **reasonable** degree of precision and particularity. It is here where the definiteness of language

²Our reference to the Brief is to the Supplemental Brief dated October 27, 1997.

Appeal No. 1996-1644
Application No. 07/933,147

employed must be analyzed-not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. [Emphasis ours; footnote omitted.]

Here, the examiner criticizes the claims on appeal for using incorrect grammar, employing the words "desired" and "of interest", and lacking antecedent basis. See Answer, page 2. The examiner's criticism, however, has not taken into consideration the teachings of the specification. See the Answer and the Supplemental Answer in their entirety. When these improper grammar, words and antecedent basis referred to by the examiner are read in light of the teachings of the specification, they do not render the claimed subject matter indefinite. Although we share the examiner's view that the claims could have been written better grammatically or otherwise, we do not believe that it can seriously be contended that the artisan would not have understood the scope of the claims. This view is further buttressed by the examiner's own comments at page 3 of the Answer.

Appeal No. 1996-1644
Application No. 07/933,147

In view of the foregoing, we reverse the examiner's decision rejecting all of the appealed claims under 35 U.S.C. § 112, second paragraph.

OBVIOUSNESS

The novel aspect of the claimed subject matter lies in oxidizing the surface of a diamond with a RF oxygen plasma to improve coating adhesion. See, e.g., specification, pages 6-8. According to appellants (Brief, pages 3 and 4):

Skilled practitioners recognize that certain chemical functional groups, when attached to a surface, will impart certain properties to that surface. These properties (such as wettability, reactivity, amenability to binding to a catalyst, chemical or biological recognition, to name a few) will be desired by skilled practitioners for many applications. Thus, a skilled practitioner who desires a diamond surface with a given property will, using this invention, oxidize a diamond surface according to the process of the invention, and graft a chemical containing a functional group for imparting this property onto the diamond surface, via a chemisorption reaction.

As evidence of obviousness of the claimed subject matter under 35 U.S.C. § 103, the examiner primarily relies on either Mino or Suzuki alone or in view of Sato. The examiner also relies on Cozzette or Ueno for obviousness of the subject matter of dependent claims 6 and 8.

Appeal No. 1996-1644
Application No. 07/933,147

Appellants do not dispute that "it would have been obvious to one of ordinary skill in the art to use [the] compounds [recited in claims 6 and 8] as taught by Cozzette or [Ueno] as [the] specific coating materials in [the process] of the primary references [e.g., Mino or Suzuki]..." Compare the Answer, page 10 with the Brief, pages 15 and 16. Appellants only argue that there are no suggestion and reasonable expectation of success to arrive at the claimed subject matter as represented by independent claim 1. See the Brief, pages 5-15 and the Reply Brief in its entirety.

As our reviewing court stated in *In re Dow Chem. Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988):

The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that ... [the claimed] process should be carried out and would have a reasonable likelihood of success... (Citations omitted). Both such a suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure.

We find that Mino discloses a method of forming an organic film on the surface of glass, plastic, metals and jewels (a diamond). See column 5, lines 5-15 and column 7, lines 29-36. To chemically bond the organic coating on the

Appeal No. 1996-1644
Application No. 07/933,147

substrate, the surface of the substrate needs to contain active hydrogen groups, such as -OH, -COOH, -NH₂ and =NH groups. See column 5, lines 23-28. When substrates with less surface hydrophilic groups, for example plastic substrates, are used, they must be subjected to an oxygen plasma or corona (different plasma) treatment to increase the surface hydrophilic groups. See column 5, lines 34-44. The examiner finds, and appellants do not dispute, that diamond surfaces, like plastic substrates, are known to be not hydrophilic. Compare the bridging paragraph of pages 5 and 6 of the Answer with the Brief and the Reply Brief in their entirety; and also note the specification, page 6, lines 1-6. The examiner also finds, and appellants do not dispute, that "the taught oxygen plasma or corona treatment are [sic., is] old and well known for functionalizing surfaces, especially carbon containing [sic., surfaces] by adding oxygen groups to improve coating adhesion." Compare the Answer, page 4 with the Brief and the Reply Brief in their entirety.

Similarly, we find that Suzuki also discloses treating a substrate having an outer surface layer containing carbon in the form of amorphous carbon, graphite or diamond-like carbon

Appeal No. 1996-1644
Application No. 07/933,147

produced by such methods as sputtering or plasma CVD with oxidizing plasma and coating the resulting substrate with an organic amine compound to form a compact monomolecular adsorption layer. See column 7, lines 3-15, together with column 6, lines 47-52 and the abstract. The diamond-like carbon of Suzuki is synthesized by a plasma assisted chemical vapor deposition (plasma CVD) technique which, according to Sato, is known to produce synthetic diamonds. Compare Sato, abstract with Suzuki, column 6, lines 47-52.

The examiner recognizes that both Mino and Suzuki do not specifically mention using a R.F. oxygen plasma at 25-200 watts and for periods of 10 sec. to 20 min for oxidizing the surface of a diamond. See the Answer, pages 5 and 7. However, the examiner finds, and appellants do not dispute, that a R.F. oxygen plasma is a conventional or standard oxygen plasma technique for "the taught results of making a surface hydrophilic." Compare the Answer, page 5, with the Brief and the Reply Brief in their entirety. The examiner also finds, and appellants do not dispute, that the properties of the claimed powder are significantly affected by variation of various treatment parameters, including the treatment time and

Appeal No. 1996-1644
Application No. 07/933,147

other factors which affect the plasma. Compare the Answer, page 5, with the Brief and the Reply Brief in their entirety. In other words, the examiner finds, and appellants do not dispute, that both the claimed R.F. oxygen plasma operating condition (defined by watts) and the claimed R.F. oxygen plasma treating time are known result effective variables.

Given the above teachings, we agree with the examiner that there is an ample suggestion to use a conventional oxygen plasma method, such as a R.F. oxygen plasma, under optimum conditions, e.g., the desired oxygen plasma operating time and R.F. plasma operating power (watts), to oxidize a natural diamond surface or synthesized diamond surface to render it more hydrophilic, prior to coating it with an organic amine or other organic compounds having desired functionalities. One of ordinary skill in the art would have had a reasonable expectation of successfully improving adhesion between the diamond surface and the organic amine or the other organic compounds via R.F. plasma oxidation. This is especially compelling in this situation since Sato, as found by the examiner at page 6 of the Answer, also teaches

Appeal No. 1996-1644
Application No. 07/933,147

the use of both high frequency and microwave, both of which are part of the radio frequency (R.F.) range, to plasma treat diamond with gases such as oxygen (abstract), where oxygen is taught to be chemiabsorbed on the surface so that the surface exhibits a hydrophilic nature (col. 4, lines 8-29) with parameters, such as power density being noted as important in the effect of the plasma.

Appellants take the position that those skilled in the art would not have employed a R.F. oxygen plasma to oxidize diamond surfaces prior to reacting them with organic functional compounds since there would have been no reasonable expectation of success for making diamond surfaces sufficiently oxidized for such a purpose with the R.F. oxygen plasma. See Brief, pages 9-10. In support of this position, appellants rely on the thirteen exhibits. See Brief, pages 9-13. However, none of these exhibits demonstrates that one of ordinary skill in the art would not have had a reasonable expectation of success in oxidizing diamond surfaces. Exhibit 1, for example, does not indicate that the surface of a diamond cannot be oxidized. Even were we to accept appellants' argument, this exhibit, at best, indicates that (Brief, pages 9 and 10):

Appeal No. 1996-1644
Application No. 07/933,147

It is not possible, based on these studies, to reach any conclusion regarding the oxidation of any particular diamond face.

The remaining exhibits indicate that the surface of a diamond can be oxidized as acknowledged by appellants at pages 10 through 13 of the Brief. Exhibit 6, for example, states that "the entire surface of diamond is capable of chemisorbing oxygen". See page 447. Exhibit 8 also states that "[d]iamond with chemisorbed oxygen is hydrophilic...Complete coverage with [oxygen] is possible." See page 283. Although they may not specify the density of oxygen functional groups on the surface of a diamond as alleged by appellants, the fact remains that the diamond surface can be oxidized to exhibit at least some hydrophilic nature. These exhibits support, rather than contradict, the prior art teachings relied upon by the examiner, which indicate that the diamond surface can be oxidized with conventional plasma oxidation techniques, such as R.F. plasma oxidation.

In view of the forgoing, we determine that the claimed subject matter as a whole would have been obvious to one of ordinary skill in the art in view of the applied prior art.

Appeal No. 1996-1644
Application No. 07/933,147

Hence, we affirm the examiner's decision rejecting claims 1, 4, 6 through 8, 15 and 16 under 35 U.S.C. § 103.

As a final point, we note that the examiner inadvertently fails to include claim 5 in the above § 103 rejections³. For the reasons stated herein, we determine that the above § 103 rejections are also applicable to the subject matter of claim 5. Since we are extending the above § 103 rejections to claim 5 for the first time, we will treat this extension as setting forth new grounds of rejection.

In addition to affirming the examiner's rejection of one or more claims, this decision contains a new ground of rejection pursuant to 37 CFR § 1.196(b) (amended effective Dec. 1, 1997, by final rule notice, 62 Fed. Reg. 53131, 53197 (Oct.

³ Claim 6, which has been rejected by the examiner, includes all of the limitations of claim 5 since claim 6 is dependent on claim 5. Claim 6 specifies amine compounds embraced by the generic amine compounds recited in claim 5. As indicated *supra*, the examiner states, and appellants do not dispute, that the specific amine compounds recited in claim 6 are taught by Cozzette or Ueno. As also indicated *supra*, we observe that Suzuki also teaches amine compounds which are embraced by claim 5. Further, we note that appellants acknowledge that the selection of a particular functional group, which is inclusive of the claimed amine compound, is well within the ambit of one of ordinary skill in the art. See Brief, pages 3-4.

Appeal No. 1996-1644
Application No. 07/933,147

10, 1997), 1203 Off. Gaz. Pat. Office 63, 122 (Oct. 21, 1997)). 37 CFR

§ 1.196(b) provides, "A new ground of rejection shall not be considered final for purposes of judicial review."

Regarding any affirmed rejection, 37 CFR § 1.197(b) provides:

(b) Appellants may file a single request for rehearing within two months from the date of the original decision

37 CFR § 1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of proceedings (37 CFR § 1.197(c)) as to the rejected claims:

(1) Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner. . . .

(2) Request that the application be reheard under § 1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

Should the appellants elect to prosecute further before the Primary Examiner pursuant to 37 CFR § 1.196(b)(1), in order to preserve the right to seek review under 35 U.S.C. §§

Appeal No. 1996-1644
Application No. 07/933,147

141 or 145 with respect to the affirmed rejection, the effective date of the affirmance is deferred until conclusion of the prosecution before the examiner unless, as a mere incident to the limited prosecution, the affirmed rejection is overcome.

If the appellants elect prosecution before the examiner and this does not result in allowance of the application, abandonment or a second appeal, this case should be returned to the Board of Patent Appeals and Interferences for final action on the affirmed rejection, including any timely request for rehearing thereof.

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

Appeal No. 1996-1644
Application No. 07/933,147

Affirmed-in-Part/s 196(b)

EDWARD C. KIMLIN)	
Administrative Patent Judge)	
)	
)	
)	
)	BOARD OF PATENT
CHUNG K. PAK)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
)	
)	
)	
TERRY J. OWENS)	
Administrative Patent Judge)	

CKP:lp

Appeal No. 1996-1644
Application No. 07/933,147

ASSOCIATE COUNSEL (PATENTS)
CODE 3008.2
NAVAL RESEARCH LAB.
WASH. DC 20375-5320

Leticia

Appeal No. 1996-1644
Application No. 07/933,147

APJ PAK

APJ OWENS

APJ KIMLIN

DECISION: AFFIRMED IN PART,
196(b)

Send Reference(s): Yes No
or Translation (s)

Panel Change: Yes No

Index Sheet-2901 Rejection(s):

Prepared: March 26, 2002

Draft Final

3 MEM. CONF. Y N

OB/HD GAU

PALM / ACTS 2 / BOOK
DISK (FOIA) / REPORT