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opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.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. 13

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JAMES E. JASKIE

Appeal No. 95-3093
Application 08/011,595[1]

ON BRIEF

Before THOMAS, HAIRSTON, and BARRETT, Administrative Patent Judges.

BARRETT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the final rejection of claims 1-12, all the claims pending in the application.

The claimed invention is directed to an electron emitter formed with a layer of predetermined structure, such as diamond

[1] Application for patent filed February 1, 1993, entitled "Enhanced Electron Emitter."

or diamond-like carbon, with an "electrically active defect" in the structure at an emission site. The "electrically active defect" is formed by a crystal defect, such as a screw dislocation, 60° dislocation, or an edge type dislocation.

Claims 1 and 7, the two independent claims, are reproduced below.

> 1. An electron emitter formed with a layer of material having a predetermined structure with an electrically active defect in the structure at an emission site.
>
> 7. A field emission device including a supporting substrate having a layer of material including one of diamond and diamond-like carbon formed on a surface thereof, the layer of material having a diamond bond structure with an electrically active defect defining an electron emitter.

THE REFERENCES

The examiner relies on the following U.S. patents:

Huisman et al. (Huisman)	5,008,590	April 16, 1991
Jaskie et al. (Jaskie)	5,141,460	August 25, 1992

THE REJECTION

Claims 1-3 and 6-9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Jaskie. The examiner states (Examiner's Answer, pages 2-3):

> It would have been obvious to consider the diamond structure as having an electrically active defect defining an electron emitter (510) since the diamond coating formation is irregular (see column 4, lines 18-23). The irregular diamond coating formation will cause an electrical active defect since electrons are emitted from the electron emitter with diamond coating and the diamond coating thicknesses are important feature to the emission device. If the diamond

> coating of the emitter and the layer (501) is not smooth, the rate of electron emission will be changed (see figures 5C-5D and column 4, lines 3-15).

Claims 4, 5, and 10-12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Jaskie and Huisman. The examiner concludes that it would have been obvious to hydrogenate the surface of Jaskie in view of Huisman which discloses a semiconductor body or layers made of "hydrogenated amorphous silicon (α-Si:H)" (column 2, lines 50-51; column 6, line 12).

OPINION

We sustain the rejection of claims 1-3 and 6-9, and reverse the rejection of claims 4, 5, and 10-12.

Claims 1-3 and 6-9

Initially, although the rejection is based on obviousness under 35 U.S.C. § 103, the examiner does not propose any modifications or changes to Jaskie. The examiner's statement that "[i]t would have been obvious to consider the diamond structure as having an electrically active defect defining an electron emitter" states that one of ordinary skill would recognize that Jaskie inherently contains "electrically active defects." If a structure, function, or characteristic is inherent, the limitation is anticipated. However, there is no error in basing a rejection on § 103 when the actual ground is anticipation under § 102. In re Fracalossi, 681 F.2d 792, 794, 215 USPQ 569, 571 (CCPA 1982).

The issue is whether the diamond coating in Jaskie has an "electrically active defect." Appellant states that this is a coined term (Brief, page 8) and should be given the meaning defined in the specification. In this case, it is necessary to refer to the specification to determine what structure is meant by the term "electrically active defect." An electrically active defect is a special kind of defect "which locally enhances electron emission" (specification, page 12, lines 22-23). "Specifically, the defect is formed of the same basic material with a different structure" (specification, page 12, lines 23-25). The specification states that "[t]here are several types of crystal defects that can occur in diamond and which will produce the useful properties of the present invention" (specification, page 5, lines 31-33). Three types of simple dislocations, the screw dislocation, the 60° dislocation, and the edge type dislocation, "are useful as electrically active defects" (specification, page 6, lines 19-20). Another example is a thin film of graphitic structure (specification, page 8, lines 26-32). Defects of the type described in the specification are presumed to be "electrically active defects."

Jaskie does not expressly disclose that the diamond coating contains an "electrically active defect," which is not surprising since appellant states that this is a coined term. Jaskie does not discuss dislocations or a thin film of graphitic structure;

if it did, it would be considered an express teaching of the structure of an "electrically active defect." The examiner's position is that "electrically active defects" are inherent in the structure of the diamond coating crystallite. The burden is on the examiner to provide reasons why a characteristic is inherent before the burden shifts to the applicant to prove that the subject matter does not possess the characteristic relied on. In re Best, 562 F.2d 1252, 1254-55, 195 USPQ 430, 433 (CCPA 1977).

The examiner essentially finds that the diamond structure in Jaskie inherently has "electrically active defects" "since the diamond coating formation is irregular (see column 4, lines 18-23)" (Examiner's Answer, page 3). The referenced portion of Jaskie states that "it is an important feature of coating formation that irregularities in coating thickness and coverage be minimized" (column 4, lines 19-21). The "irregularities" are irregularities in coating thickness and coverage. While irregularities in coating thickness and coverage certainly might be considered "defects" from a manufacturing point of view, we are in agreement with appellant that these are "nothing similar to the 'electrically active defects' disclosed" (Brief, page 5) and, therefore, there is no apparent basis to find that this kind of irregular structure is an "electrically active defect." The examiner does not convincingly explain why irregularities in coating thickness and coverage are

"electrically active"; that is, how the electrical properties are affected by nonuniform thickness and coverage.

Although the examiner has not persuasively argued that "electrically active defects" are caused by irregularities in coating thickness and coverage, we nevertheless agree with the examiner's basic finding that the diamond structure in Jaskie inherently has "electrically active defects." All real crystals have defects in the arrangement of atoms, including line defects or dislocations. As evidence of this fact we cite the article "Crystal Defects," McGraw-Hill Encyclopedia of Science & Technology (7th ed., McGraw-Hill, Inc., 1992), pages 579-586, at page 582 ("To extend the earlier argument about the difficulty in preparing perfect crystals, it should be anticipated that most crystals will contain dislocations in ample numbers and that special care would have to be taken to prepare a dislocation-free crystal. The latter is in most cases impractical (although in fact some electronic materials are dislocation-free).") (copy attached).[2] It is further known that dislocations have electrical effects, F.R.N. Nabarro, Theory of Crystal Dislocations, (Dover Publications, Inc. 1987), Chapter IX (copy

[2] McGraw-Hill is cited as evidence that dislocations are inherently present in real crystals. Because McGraw-Hill merely proves a fact about an inherent characteristic, which would have been known to a person of ordinary skill in the crystal art, we do not consider our citation of the standard reference work to raise a new ground of rejection. See In re Boon, 439 F.2d 724, 727-28, 169 USPQ 231, 234 (CCPA 1971).

attached), and, in particular, that the dislocations in diamond are electrically active, J. Bruley and P.E. Batson, A Study of the Electronic Structure Near Individual Dislocations in Diamond by Energy-Loss Spectroscopy, Mat. Res. Soc'y Symp. Proc., Vol. 162, page 255 (of record). We find no difference between the subject matter of claims 1, 2, and 7 and a diamond crystal layer as in Jaskie having inherent dislocation imperfections. Because the diamond coating crystallite in Jaskie inherently contains dislocations of the type disclosed in the specification it contains "electrically active defects." We also find that the growth method in Jaskie uses numerous carbon nucleation sites (column 2, lines 45-52), which will inherently produce dislocations as evidenced by the description in appellant's disclosure (specification, page 11, line 35, to page 12, line 9).

With respect to claims 3 and 9, the limitation of "defects generally periodically positioned in the layer" is considered to be inherent in Jaskie because defects are generally randomly located and randomly located defects are considered to be more or less uniformly spaced. Furthermore, the defects in Jaskie are considered inherently periodic because appellant has disclosed no special method of producing periodic defects. With respect to claim 6, the limitation that the defects are "at an angle to a surface of the layer of material in the range of approximately 45° to 90° with the surface" is considered inherent because

appellant discloses no special method for producing defects with this range of angles. With respect to claim 8, the limitation that the "electrically active defect is a graphite-like change in the diamond bond structure," is considered an inherent structure in prior art diamond coatings such as Jaskie because appellant discloses no special method of providing such a structure.

Because claim 1-3 and 6-9 appear to read on ordinary diamond coating layers with defects that are expected to be inherently present in all diamond crystals, we sustain the rejection of claims 1-3 and 6-9 over Jaskie.

Appellant's arguments are nonpersuasive because they are limited to the express disclosure of Jaskie and do not address the inherent characteristics of the diamond coating. Appellant is co-patentee of the Jaskie patent and he is in the best position to state why the diamond structure in Jaskie does not inherently co..tain "electrically active defects," as claimed, and why the claims are not met by defects that occur naturally in all diamond structures. While appellant's argument that Jaskie suggests making the diamond coating defect-free (Brief, page 9) may be true, this does negate the fact that the coating would still inherently contain defects of the type disclosed to be "electrically active defects."

Claims 4, 5, and 10-12

Claims 4 and 10 recite that "the surface is hydrogenated." The purpose of hydrogenating the surface is to make the lattice structure formed by the carbon atoms appear to be the same at the surface as in the bulk to make the material a better electron emitter. Huisman discloses a semiconductor body or layers made of "hydrogenated amorphous silicon (α-Si:H)" (column 2, lines 50-51; column 6, line 12). Thus, Huisman does not disclose a hydrogenated surface, but a solid alloy film. Also, amorphous Si:H films contain no crystallites and do not have a predetermined structure. The examiner does not explain why one of ordinary skill in the art, viewing Huisman, would have been motivated to hydrogenate the surface in Jaskie and we find the motivation or suggestion to be lacking. Moreover, the rejection over Jaskie is based on inherency of "electrically active defects," and it is difficult to see why one skilled in the art would have been motivated to hydrogenate the surface to improve the performance of inherent characteristics without some express motivation in the art. We conclude that the examiner has failed to establish a prima facie case of obviousness with respect to claims 4 and 10, and thus reverse the rejection of claims 4 and 10 and claims 5, 11, and 12 which depend therefrom.

CONCLUSION

The rejection of claims 1-3 and 6-9 is affirmed.

The rejection of claims 4, 5, and 10-12 is reversed.

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

JAMES D. THOMAS
Administrative Patent Judge)

KENNETH W. HAIRSTON
Administrative Patent Judge) BOARD OF PATENT APPEALS AND INTERFERENCES

LEE E. BARRETT
Administrative Patent Judge)

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Vincent B. Ingrassia
MOTOROLA, INC.
Intellectual Property Department
P.O. Box 10219, Suite R3108
Scottsdate, AZ 85271-0219