

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KANWAL K. RAINA

Appeal No. 2006-0374
Application No. 10/120,511

ON BRIEF

Before GARRIS, PAK and JEFFREY T. SMITH, Administrative Patent Judges.

GARRIS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal which involves claims 1, 3, 5, 7-11 and 24-27.

The subject matter on appeal relates to a method of treating at least one flat panel display current emitter which comprises exposing a native oxide-containing tip of a current emitter to a hydrogenation process and exposing the hydrogenation process-treated tip of the current emitter to a nitrogen infusion

process, wherein the hydrogenation process-treated and nitrogen-infusion tip has a reduced atomic concentration of silicon and oxygen relative to the atomic concentration of the native oxide-containing tip. Further details of this appealed subject matter are set forth in representative independent claim 1 which reads as follows:

1. A method of treating at least one flat panel display current emitter, said method comprising:

a) exposing a native oxide-containing tip of said at least one current emitter to a hydrogenation process comprising plasma enhanced chemical vapor deposition conducted in the presence of a silane gas in a reaction chamber, wherein said plasma enhanced chemical vapor deposition process is conducted with a silane gas flow rate of about 1000 sccm, an RF power of about 200-300 watts, a chamber pressure of about 1200 mtorr, and a deposition period of about 5 to 10 minutes; and

b) exposing said hydrogenation process-treated tip of the at least one current emitter to a nitrogen infusion process,

wherein said hydrogenation process-treated and nitrogen-infused tip has a reduced atomic concentration of silicon and oxygen relative to the atomic concentration of said native oxide-containing tip.

The references set forth below are relied upon by the examiner as evidence of obviousness:

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|---------------------------------|-----------|---------------|
| Maa | 4,411,734 | Oct. 25, 1983 |
| Shimbo | 4,624,737 | Nov. 25, 1986 |
| Doan et al. (Doan) | 5,186,670 | Feb. 16, 1993 |
| MacDonald et al. (MacDonald) | 5,199,917 | Apr. 6, 1993 |
| Neukermans | 5,658,710 | Aug. 19, 1997 |
| Miyamoto | 5,747,384 | May 5, 1998 |
| Cathey et al. (Cathey) | 5,853,492 | Dec. 29, 1998 |
| Iyer et al. (Iyer) | 5,917,213 | Jun. 29, 1999 |

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All the appealed claims are rejected under 35 U.S.C.

§ 103(a) as follows:

(a) claims 1, 9 and 10 are rejected over Neukermans in view of Cathey, Miyamoto and Maa;

(b) claims 3, 5 and 11 are rejected over the above-noted references and further in view of Shimbo;

(c) claims 1, 3, 5, 7 and 9-11 are rejected over Neukermans, Cathey, Miyamoto, Maa, Shimbo and Iyer;

(d) claim 8 is rejected over Neukermans, Cathey, Miyamoto, Maa, Shimbo, with or without Iyer, and further in view of Doan;

(e) finally, claims 24-27 are rejected over Neukermans in view of Cathey, Miyamoto and MacDonald.

We refer to the Brief and Reply Brief and to the Answer respectively for a complete discussion of the opposing viewpoints expressed by the appellant and by the examiner concerning the above-noted rejections.

OPINION

For the reasons which follow, we cannot sustain any of the rejections advanced on this appeal.

Concerning the rejection of claim 1 and indeed all of the rejections on appeal, the examiner expresses the following position concerning the Neukermans reference:

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Neukermans . . . teaches a method of treating an array of current emitters (col. 3, lines 21-37) comprising:

- a) exposing a native oxide-containing tip of said at least one (silicon) current emitter to a native oxide removal process to remove the native oxides (col. 3, lines 17-20); and
- b) exposing the native oxide-free tip of said at least one current emitter to a nitrogen infusion process to form a treated current emission surface of said tip (col. 5, lines 31-51) [Answer, page 6].

With further regard to this reference, the examiner acknowledges that "Neukermans . . . does not explicitly teach [, inter alia,] that the emitters are used in a flat display panel" (Answer, page 6) but concludes that:

[I]t would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the method of Neukermans . . . to have produced an array of field emitter tips for a flat panel display field emission device because Neukermans . . . teaches that its method is suitable for producing field emissive silicon tips, and Cathey . . . teaches that flat panel displays are a conventional use for an array of field emissive silicon tips [Answer, pages 6-7].

Although each of the rejections formulated by the examiner includes numerous other findings of fact and conclusions of law, we need not discuss these other findings and conclusions in order to resolve the subject appeal. This is because the examiner's afore-quoted findings and concomitantly the conclusion of law based thereon include fatal error. Specifically, the examiner has erroneously determined that Neukermans' method of treating an

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array of current emitters, which is disclosed at lines 21-37 in column 3, includes the step of "exposing the native oxide-free tip of said at least one current emitter to a nitrogen infusion process to form a treated current emission surface of said tip (col. 5, lines 31-51)" (Answer, page 6).

The Neukermans reference is directed to the formation of superhard, durable and inert microstructures such as tips for atomic force microscopy and field emission, membranes, hinges, actuators and sensors wherein the microstructures are reacted with a hydrocarbon or an ammonia gas in order to convert surface layers of the silicon microstructure to, respectively, SiC (which is useful for its conductive properties) or Si₃N₄ (which is useful for its insulative properties). See the abstract of Neukermans. While the examiner is correct that lines 21-37 in column 3 of this reference teach an embodiment wherein the microstructures are formed as an array of tips for field emission purposes, it is significant that these tips are exposed to a hydrocarbon gas in order to form a silicon carbide surface layer (see lines 26-32 in column 3), thereby yielding "electrically conductive tips [which] have an advantage when used in field emission" (see lines 33-34 in column 3). Nowhere does patentee describe this array of tips as being exposed to a nitrogen infusion process in accordance with the examiner's previously

quoted finding. Rather, as just explained, the tips of patentee's array are exposed to a hydrocarbon gas in order to form a silicon carbide surface layer having electrically conductive properties useful for field emission purposes.

It is true that Neukermans discloses in lines 31-51 of column 5 an embodiment wherein his microstructures are exposed to nitrogen in the form of ammonia gas in order to form a Si_3N_4 layer. However, this embodiment is completely unrelated to the column 3 teaching directed to an array of tips for field emission purposes. Indeed, this column 3 teaching is incompatible with the column 5 embodiment. This is because Neukermans expressly teaches that his Si_3N_4 layer is useful for its insulative properties (again, see the abstract) and that this silicon nitride layer is formed "when electric insulation is paramount" (column 5, lines 65-66). Thus, forming an insulating silicon nitride layer on the tips of patentee's field emission array embodiment in column 3 would be counterproductive to the electrically conductive purpose served by the tips of this array.

In light of the foregoing, it is apparent that Neukermans' column 3 method of treating an array of current emitters, even if modified in each of the numerous ways proposed by the examiner in view of the other applied references, would fail to include the appealed claim 1 step of "exposing said hydrogenation process-

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treated tip of the at least one current emitter to a nitrogen infusion process" as well as the corresponding step of the other method claims on appeal. We hereby reverse, therefore, each of the § 103 rejections advanced by the examiner on this appeal.

The decision of the examiner is reversed.

REVERSED

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| BRADLEY R. GARRIS |) | |
| Administrative Patent Judge |) | |
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| CHUNG K. PAK |) | BOARD OF PATENT |
| Administrative Patent Judge |) | APPEALS AND |
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| JEFFREY T. SMITH |) | |
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