Paper No. 79

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte SHUNPEI YAMAZAKI and YUJIRO NAGATA

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Appeal No. 1999-1466
Application No. 08/371,486

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HEARD: MAY 23, 2001

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Before HAIRSTON, GROSS, and BLANKENSHIP, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 101-135, which are all the claims remaining in the application.

We reverse.

BACKGROUND

The invention is directed to a thin film transistor. Claim 101 is reproduced below.

101. A thin film transistor comprising:

a substrate having an insulating surface;

a channel region formed on said insulating surface comprising an intrinsic non-single crystal semiconductor material;

a pair of source and drain regions with said channel region therebetween, said source and drain regions comprising a non-single crystal semiconductor material having an impurity conductivity type;

a gate insulating film comprising a nitride formed on said channel region so that the portion of the channel region in direct contact with the gate insulating film is said intrinsic non-single crystal semiconductor material;

a gate electrode formed on said gate insulating layer;

wherein said source, drain and channel regions are doped with a recombination center neutralizer selected from the group consisting of H, a halogen and a combination thereof, and said gate insulating film extends beyond said channel region to cover junctions between said channel region and said source and drain regions.

The examiner relies on the following references:

Weitzel et al. (Weitzel)	4,160,260	Jul. 3, 1979
Ovshinsky et al. (Ovshinsky)	4,485,389	Nov. 27, 1984

A. Madan et al. (Madan), Investigation Of The Density Of Localized States In a-Si Using The Field Effect Technique, Journal of Non-Crystalline Solids 20, pp. 239-257 (1976).

LeComber et al. (LeComber), Amorphous-Silicon Field-Effect Device and Possible Application, Electronics Letters Vol. 15 No. 6, pp. 179-181 (Mar. 15, 1979).

Matsumura et al. (Matsumura), a-Si FET IC integrated on a glass substrate (partial translation), National Convention Record, The Institute of Electronics and Communication Engineers of Japan, p. 2-287 (Mar. 1980).

Claims 101-135 stand rejected under 35 U.S.C. § 103 as being unpatentable over Matsumura, Weitzel, Ovshinsky, LeComber, and Madan.

We refer to the Final Rejection (Paper No. 63) and the Examiner's Answer (Paper No. 66) for a statement of the examiner's position and to the Brief (Paper No. 65) and the Reply Brief (Paper No. 67) for appellants' position with respect to the claims which stand rejected.

OPINION

According to the Answer, pages 3 and 4, Matsumura "shows the basic thin film transistor structure" that is claimed. However, the examiner relies upon additional references to show obviousness of the claimed subject matter as a whole. Matsumura is recognized as disclosing an SiO_2 film as a gate insulator. The rejection turns to LeComber (Figure 1) and Madan (Figure 1(b)) for suggestion of substituting a silicon nitride gate film for the silicon dioxide film disclosed by Matsumura.

Appellants contend that there is no suggestion in LeComber for the substitution that is contemplated by the rejection. Appellants add, on pages 8 and 12-13 of the Brief, that the LeComber device utilizes a Schottky junction, "that is, a semiconductor-oxide-metal

junction," while the base reference of Matsumura has junctions between two semiconductor materials having different conductivity types.

The examiner responds (Answer, page 4) that LeComber shows silicon nitride to be a useful gate insulator for a field-effect transistor, and it clearly would have been obvious to have practiced a silicon nitride gate insulator in other insulated gate field-effect transistor devices such as disclosed by Matsumura. The examiner's position (Answer, page 5) is that the LeComber device is not "entirely different" from that of Matsumura, because the device of LeComber is a thin film field-effect transistor.

The abstract of LeComber discusses the characteristics of an insulated-gate field-effect transistor made from amorphous silicon. The description of the structure shown in Figure 1, at pages 179 and 180 of LeComber, is limited to discussion of an IGFET. We find no suggestion that the silicon nitride film used in the IGFET is also recommended, or even suitable, for a device having the type of junctions in the Matsumura device.

We agree with appellants that the teaching of LeComber would not have been considered by the artisan as applicable to the type of device disclosed by Matsumura, and thus would not have suggested modification of the device. While the obviousness may be "clear" to the examiner, the references disclose different structures, and LeComber does not discuss the reference's teachings as applied to other environments. Nor has the examiner supplied evidence (i.e., explanatory or supporting references) in support of the

assertion, or provided a convincing rationale as to why LeComber, taken with Matsumura, would have rendered obvious the proposed modification.

Appellants further contend (Brief, page 9) that Madan is concerned with determining the density of localized states in amorphous silicon, and is not directed to a thin film transistor. As such, appellants argue that Madan would not have suggested applying a nitride film in a thin film transistor structure as claimed.

According to the examiner (Answer, pages 4-5), however, Madan shows field-effect devices in Figures 1(a) and 1(b). "In these figures F is the gate electrode or equivalently 'field electrode' and A_1 and A_2 are the source and drain regions, and there is a gate dielctric [sic; dielectric] of quartz or silicon nitride between the gate electrode and a-Si semiconductor channel region." (Answer, paragraph bridging pages 4 and 5.) The examiner's findings are specifically disputed by appellants on pages 2 and 3 of the Reply Brief. Appellants further argue in the Brief (page 9) and the Reply Brief (page 3) that Madan's reference to quartz (SiO_2) or silicon nitride in place of thin soda glass would not have suggested using silicon nitride in a device having the claimed junctions.

We find, consistent with appellants' arguments, that the description of Figures 1(a) and 1(b), on pages 241 and 242 of Madan, refers to "field electrode" F and to A_1, A_2 as "surface electrodes for current measurement." Absent additional evidence or a convincing rationale from the examiner as to why the disclosure of Madan would be applicable to the structures disclosed by Matsumura, including the source and drain regions with the

associated boundaries, we agree with appellants that the teachings of Madan would not have been seen as applicable to a thin film transistor device as disclosed by Matsumura.

Even if, as the rejection implies, Madan's disclosure of quartz and silicon nitride may have suggested the interchangeability of silicon dioxide and silicon nitride, any suggestion of interchangeability would not necessarily go beyond the specific application disclosed by Madan. Madan compares quartz and silicon nitride to thin soda glass used in earlier experiments (page 242). There is no express suggestion that quartz and silicon nitride may be used interchangeably in the semiconductor arts in general, nor express suggestion for use in the specific type of device disclosed by Matsumura. Since the evidence before us does not support the examiner's findings with respect to the disclosure of Madan, we agree with appellants that Madan would not have suggested substituting the silicon dioxide gate insulator of Matsumura with a gate insulator of silicon nitride.

The allocation of burdens requires that the USPTO produce the factual basis for its rejection of an application under 35 U.S.C. § § 102 and 103. In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984) (citing In re Warner, 379 F.2d 1011, 1016, 154 USPQ 173, 177 (CCPA 1967)). The one who bears the initial burden of presenting a prima facie case of unpatentability is the examiner. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). We are persuaded by appellants that the teachings of LeComber and Madan are deficient in providing a factual basis for the suggestion to substitute, in a device as disclosed by Matsumura, a silicon dioxide gate

insulator with a silicon nitride gate insulator. Accordingly, we do not sustain the section 103 rejection of claims 101-135. Since the references as applied fail to establish a prima facie case of obviousness, we find unnecessary the consideration of the rebuttal evidence referenced on page 9 of the Brief.

CONCLUSION

The rejection of claims 101-135 is reversed.

REVERSED

KENNETH W. HAIRSTON Administrative Patent Judge	)
ANITA PELLMAN GROSS Administrative Patent Judge	) BOARD OF PATENT) APPEALS) AND) INTERFERENCES
HOWARD B. BLANKENSHIP Administrative Patent Judge	)

GERALD J FERGUSON JR
SIXBEY FRIEDMAN LEEDOM & FERGUSON
SUITE 600
2010 CORPORATE RIDGE
MCLEAN , VA 22102