UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte SALMAN AKRAM

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Appeal 2007-2304
Application 10/209,004
Technology Center 2800

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Decided: June 29, 2007

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Before TERRY J. OWENS, JOSEPH F. RUGGIERO, and JOSEPH L. DIXON, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

The Appellant appeals from a rejection of claims 2 and 4-11, which are all of the pending claims.

THE INVENTION

The Appellant claims a method for forming an electrode having a nodular shape,[1] and claims methods for forming a capacitor, a semiconductor device, a memory array and a wafer that include the method for forming the electrode.

Claim 2, which claims the method for forming the electrode, is illustrative:

2. A method for forming an electrode for use in a capacitor comprising:

forming an insulating layer;

forming a contact in said insulating layer;

forming an electrode layer on said insulating layer and on said contact;

etching said electrode layer utilizing a dry etch; and

etching said electrode layer utilizing a wet etch to form an electrode having a nodular shape; wherein said capacitor containing said electrode therein exhibits reduced current leakage.[2]

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[1] The Appellant states: "As used herein to define the present invention, the term 'nodular shape' means a structure having a finite cross section which includes a curved or partially curved cross section, and a partially square or rectangular cross section having curved corners, partially curved corners or faceted corners and having a width equal to or greater than the width of the contact 64 or 114. The term 'nodular shape' does not incorporate either a square cross section or a rectangular cross section" (Spec. 15:20-25).

[2] The Appellant states: "By providing the first electrodes 72 and 116 with a nodular shape, the prior art problem of improper step coverage can be avoided. The nodular shaped electrodes 72 and 116 allow for an even coverage of the of the [sic] other layers of the capacitor, the layers of dielectric material and the layer of second electrode material, on the first electrodes 72 and 116. This even coverage reduces, if not eliminates, charge leakage from the corners 32 and 33 of the prior

THE REFERENCES

Sandhu	US 5,381,302	Jan. 10, 1995
Hosaka (as translated)	JP 62-115767	May 27, 1987

THE REJECTION

Claims 2 and 4-11 stand rejected under 35 U.S.C. § 103 as being unpatentable over Sandhu in view of Hosaka.

OPINION

We affirm the aforementioned rejection.

The Appellant indicates that the claims stand or fall in three groups: 1) claims 2, 4-6 and 10; 2) claims 7 and 9; and 3) claims 8 and 11 (Br. 8). We therefore limit our discussion to one claim in each group, i.e., claims 2, 7 and 8. *See In re Ochiai*, 71 F.3d 1565, 1566 n.2, 37 USPQ2d 1127, 1129 n.2 (Fed. Cir. 1995); 37 CFR § 41.37(c)(1)(vii)(2004).

Claims 2 and 7

Sandhu discloses a method for forming a storage node electrode of a capacitor in a dynamic random access memory (DRAM) device, comprising forming an insulating layer (40; figure 3), forming a contact (65) in the insulating layer (figure 5), forming an electrode layer (85) on the insulating layer and the

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art capacitor 10 shown in Fig. 1" (Spec. 22:18-23).

contact (figure 11A), and etching the electrode layer using a dry etch (col. 6, ll. 60-64).

Hosaka, after etching the lower electrode of a nonvolatile memory or DRAM using a dry etch, uses a wet etch to remove the surface roughness and distortions on the lower electrode and to round the corner portions of the lower electrode's side surface, thereby preventing degradation of the quality of an insulating film formed on the lower electrode and obtaining good electrical characteristics (Hosaka 3, 5).

The Appellant argues that neither Sandhu nor Hosaka addresses the problem of current leakage (Br. 9-10). Hosaka teaches that without the wet etch, corner portions of conductor 3 will not disappear and, consequently, the quality of thin insulating film 6 applied over the conductor degrades significantly (Hosaka 3). Because the degradation of thin insulating film quality referred to by Hosaka and the improper step coverage of dielectric (i.e., insulating) material referred to by the Appellant both are caused by corners on the electrode to which the insulating material is applied (Hosaka 3; Appellant's Spec. 3:15-17), it appears that both Hosaka and the Appellant are addressing the same problem – current leakage where the insulating layer has a thin portion at the corner of an electrode. Both Hosaka and the Appellant solve the problem the same way – using a wet etch to round off the corners to provide better coverage of the insulating layer (Hosaka 3; Appellant's Spec. 22:18-23).

Regardless, contrary to the Appellant's argument (Br. 10-11; Reply Br. 2), the Appellant's claims do not require forming a shaped electrode for the purpose of

reducing current leakage. The claims merely require that a capacitor having an electrode formed by the method has reduced current leakage. Because, like the Appellant's electrode, Hosaka's electrode has rounded corners formed by wet etching (Hosaka 3), it appears that like the Appellant's capacitor having a rounded-corner electrode, Hosaka's capacitor having such an electrode has reduced current leakage. Thus, even if Hosaka is not addressing the problem of current leakage, the combination of Sandhu and Hosaka meets the requirements of the Appellant's claims 1 and 7.

The Appellant argues that obviousness requires that the applied references suggest the desirability of their combination and provide a reasonable expectation of success in combining their teachings (Br. 10; Reply Br. 2). Obviousness does not require such a rigid application of the teaching-suggestion-motivation test. *See KSR Int'l. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1739, 82 USPQ2d 1385, 1395 (2007). Instead, inferences from the prior art and creative steps that a person of ordinary skill in the art would employ can be taken into account. *See KSR.*, 127 S.Ct. at 1741, 82 USPQ2d at 1396. One of ordinary skill in the art would have been led, through no more than ordinary creativity, to apply Hosaka's wet etch to Sandhu's electrode to provide the above-discussed benefits of the wet etch disclosed by Hosaka. *See KSR.*, 127 S.Ct. at 1742, 82 USPQ2d at 1397 ("A person of ordinary skill is also a person of ordinary creativity, not an automaton.").

For the above reasons we are not convinced of reversible error in the rejection of claims 2 and 7 and claims 4-6, 9 and 10 that stand or fall therewith.

Claim 8

Claim 8, in addition to requiring the above-discussed reduced current leakage, requires planarizing a contact to make it substantially coplanar with a surface of an insulating material.

Sandhu's prior art figure 1 shows such a structure (contact 3 substantially coplanar with the insulating material on each side of it). The Appellant argues that one of ordinary skill in the art would not have been motivated to use the prior art configuration disclosed by Sandhu when Sandhu teaches away from it (Br. 11). Sandhu teaches that he seeks to provide increased density, decreased contact resistance between an electrode and a barrier layer, and reduced degradation of the barrier layer compared to the prior art device (col. 2, lines 33-38), but he does not disclose that the prior art device is not functional. Hence, Sandhu and Hosaka would have led one of ordinary skill in the art, through no more than ordinary creativity, to use Hosaka's method when making the prior art device disclosed by Sandhu to improve the prior art device in the manner taught by Hosaka, i.e., to remove surface roughness and distortions in the lower electrode (1) and round the corner portions of the lower electrode's side surface to prevent degradation of the quality of the thin insulating film formed on the lower electrode and to obtain good electrical characteristics (Hosaka 3).

Regardless, the Appellant points out that the Appellant's contact (64; fig. 6B) is substantially coplanar with the surface of the insulating material (60) even though the contact has a barrier layer (66) thereon (Br. 5). Because the Appellant's

barrier layer does not render the contact and the insulating material non-coplanar, then Sandhu's barrier layers (67, 75; col. 5, ll. 29-67; fig. 13A) on the contact (65) do not render the contact and the insulating layer (40) non-coplanar. Thus, contrary to the Appellant's argument (Br. 11-12; Reply Br. 3), Sandhu's contact and insulating material are coplanar, as that term is used by the Appellant, in the final product (fig. 13A), not just in an intermediate step (fig. 5).

We therefore are not convinced of reversible error in the rejection of claim 8 and claim 11 that stands or falls therewith.

DECISION

The rejection of claims 2 and 4-11 under 35 U.S.C. § 103 as being unpatentable over Sandhu in view of Hosaka is affirmed.

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

AFFIRMED

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DINSMORE & SHOHL LLP
ONE DAYTON CENTRE, ONE SOUTH MAIN STREET
SUITE 1300
DAYTON OH 45402-2023