

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MASAMICHI AZUMA and CARLOS A. PAZ DE ARAUJO

Appeal No. 1999-0418
Application No. 08/517,036

HEARD: March 20, 2001

Before THOMAS, KRASS, and BARRY, Administrative Patent Judges.
BARRY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the rejection of claims 1-11. We reverse.

BACKGROUND

The invention at issue in this appeal relates to thin film metal-ferroelectric-insulator-semiconductor (MFS or MFIS) devices. Ferroelectric materials can be used as a gate insulator of metal oxide semiconductor field effect transistor (MOSFET) devices. When so used, the spontaneous polarization

serves to modulate the gate channel conduction. The channel conduction state can, for example, be used as an indicator of a memory storage state.

Silicon substrates are the most commonly used types of substrates for these applications. Unfortunately, the ferroelectric polarization phenomenon is reduced or even dissipated when the ferroelectric materials are deposited directly on the silicon surface.

The appellants' MIS device includes a semiconducting substrate, a silicon nitride buffer layer, a ferroelectric metal oxide layer, and a noble metal top electrode. The use of a layered superlattice material for the ferroelectric metal oxide layer a polarization state to be retained for weeks without continuous short-term refreshment.

Claim 1, which is representative for our purposes, follows:

1. A ferroelectric device for use in integrated circuits, comprising:

a semi-conducting substrate;
a buffer layer formed atop said substrate;
a ferroelectric metal oxide layered superlattice material formed atop said buffer layer; and
a top electrode,
there being no other electrode between said semi-conducting substrate and said top electrode.

The references relied on in rejecting the claims follow:

Rohrer et al. (Rohrer) 24, 1987	4,707,987	Nov.
Yamazaki 1991	5,021,839	June 4,
Agostinelli et al. (Agostinelli) 1993	5,241,191	Aug. 31, (filed Dec. 31, 1991)
Paz de Araujo et al. (Paz) 1996	5,519,234	May 21, (filed Nov. 18, 1993)
Argos et al. (Argos), European Patent Application 0 540 993 A1, May 12, 1993		
Arnett, <u>Ferroelectric FET Device</u> , IBM Technical Disclosure Bulletin, Feb. 1973, at 2825		

Claims 1, 4, 6, 7, and 10 stand rejected under 35 U.S.C. § 103(a) as obvious over Arnett in view of Argos and Paz. Claims 2, 8, 9, and 11 stand rejected under § 103(a) as obvious over Arnett in view of Argos and Paz further in view of Rohrer. Claim 3 stands rejected under § 103(a) as obvious over Arnett in view of Argos and Paz further in view of Yamazaki. Claim 5 stands rejected under § 103(a) as obvious over Arnett in view of Argos and Paz further in view of Agostinelli. Rather than repeat the arguments of the appellants or examiner in toto, we refer the reader to the briefs and answer for the respective details thereof.

OPINION

In deciding this appeal, we considered the subject matter on appeal and the rejection advanced by the examiner. Furthermore, we duly considered the arguments and evidence of the appellants and examiner. After considering the record, we are persuaded that the examiner erred in rejecting claims 1-11. Accordingly, we reverse.

We begin by noting the following principles from

In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993).

In rejecting claims under 35 U.S.C. Section 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).... "A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 782, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993) (quoting In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976)).

With these principles in mind, we consider the examiner's rejection and appellants' argument.

The examiner alleges, "to provide the device of Arnett with a ferroelectric layer from a ferroelectric metal oxide layered superlattice material ... as taught by ... Paz de Araujo et al. would have been obvious to one of ordinary skill in this art because ... Paz de Araujo et al. disclose ferroelectric metal oxide layered superlattice materials ... to be highly compatible with conventional integrated circuit materials and processes" (Examiner's Answer at 6.) The appellants argue, "[w]here high capacitance is an advantage to

be obtained from the ferroelectric material, those skilled in the art would be led away from the claimed invention if ferroelectric layered superlattice materials have a lower dielectric constant and a correspondingly lower capacitance." (Reply Br. at 4.)

"Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor." Para-Ordnance Mfg., 73 F.3d at 1087, 37 USPQ2d at 1239 (citing W.L. Gore & Assocs., Inc., 721 F.2d at 1551, 1553, 220 USPQ at 311, 312-13 (Fed. Cir. 1983)). "It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992) (citing In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984)). "[T]o establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant." In re Kotzab,

217 F.3d 1365, 1370, 55 USPQ2d 1313, 1316 (Fed. Cir. 2000)
(citing In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637
(Fed. Cir. 1998) and In re Gordon, 733 F.2d 900, 902, 221 USPQ
1125, 1127 (Fed. Cir. 1984)).

Here, the examiner fails to identify a sufficient suggestion to combine the layered superlattice material of Paz with the memory cell of Arnett. Rather than the claimed ferroelectric metal oxide layered superlattice material, Arnett teaches a layer of barium titanate (BaTiO_3). Specifically, "there is deposited a ferroelectric material 18 such as 1000 angstroms of barrium titnate [sic., barium titanate]" P. 2825.

For it memory cell to operate properly, moreover, Arnett emphasizes that the ferroelectric material must have a large capacitance. Specifically, "[t]he ferroelectric material 18 is used to provide a high-capacitance material between the gate electrode 19 and the trap material 17." P. 2825. More specifically, "[c]harging and discharging of the trap material 17 is accomplished at low voltages and at high speeds, by

virtue of the large capacitance of the ferroelectric layer 18." Id. Capacitance is directly proportional to the "dielectric constant" or "relative permittivity" of a material. Because the dielectric constant of barium nitrate "lies in the range of 2000-4500,"

A. J. Moulson and J. M. Herbert, Electroceramics 244 (1990)(copy attached), Arnett requires a material with such a dielectric constant in the range of 2000-4500.

Although Paz discloses layered superlattice materials, the materials lack a large dielectric constant. The reference teaches materials having dielectric constants no greater than 166. Specifically, "[t]he $\text{BaBi}_2\text{Ta}_2\text{O}_9$ was not a switching ferroelectric, but was a paraelectric with a dielectric constant of 166 at 1 megahertz." Col. 30, ll. 60-61. Paz's dielectric constant of 166 is twelve times smaller than the Arnett's minimum requirement of 2000.

Because Paz's dielectric constant of is twelve times smaller than Arnett's minimum requirement, we are not persuaded that Paz's layered superlattice material would have

been desirable in Arnett's memory cell such that teachings from the prior art would have suggested the combination. The addition of Argos, Rohrer, Yamazaki, and Agostinelli does not cure the defect. Therefore, we reverse the rejection of claims 1, 4, 6, 7, and 10 as obvious over Arnett in view of Argos and Paz; the rejection of claims 2, 8, 9, and 11 as obvious over Arnett in view of Argos and Paz further in view of Rohrer; the rejection of claim as obvious over Arnett in view of Argos and Paz further in view of Yamazaki; and the rejection of claim 5 as obvious over Arnett in view of Argos and Paz further in view of Agostinelli.

CONCLUSION

In summary, the rejection of claims 1-11 under 35 U.S.C. § 103(a) is reversed.

REVERSED

JAMES D. THOMAS)	
Administrative Patent Judge)	
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)	
)	
)	BOARD OF PATENT
ERROL A. KRASS)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
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LANCE LEONARD BARRY)	
Administrative Patent Judge)	

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APPEAL NO. 1999-0418 - JUDGE

APPLICATION NO. 08/517,036

APJ BARRY - 2 copies

APJ KRASS

APJ THOMAS

DECISION: **REV'D**

Prepared By: APJ BARRY

DRAFT SUBMITTED: 11 Jan 02

FINAL TYPED:

Team 3:

I typed all of this opinion.

Please check spelling, cites, and quotes.

Do NOT change matters of form or style.

Please attach copy of A. J. Moulson and J. M. Herbert, Electroceramics 244 (1990).