The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 32

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MASAMICHI AZUMA,
MICHAEL C. SCOTT,
CARLOS A. PAZ DE ARAUJO,
and JOSEPH D. CUCHIARO

Appeal No. 1998-2309
Application No. 08/277,035

HEARD: October 10, 2001[1]

Before HAIRSTON, JERRY SMITH, and LEVY, Administrative Patent Judges.

LEVY, 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 14-18, 20 and 21[2]. Claims 1-13, and 19 have been canceled. Claim 22 has been allowed.

[1] Telephonic hearing.

[2] A communication from the examiner (Paper No. 28, mailed May 21, 2001) indicates that the amendment filed subsequent to the final rejection (Paper No. 17, filed April 30, 1997) has been entered.

BACKGROUND

Appellants' invention relates to a method of making an integrated circuit capacitor. An understanding of the invention can be derived from a reading of exemplary claim 14, which is reproduced as follows:

14. A method of making an integrated circuit capacitor, said method comprising the steps of:

forming a first metal electrode;

providing a liquid precursor comprising barium, strontium, and titanium together in a common solution;

depositing said precursor directly on said first metal electrode to form a thin film; and

annealing said thin film at a temperature ranging from 675°C to 850°C to form a perovskite layer of barium strontium titanate on said first metal electrode,

The prior art reference of record relied upon by the examiner in rejecting the appealed claims are:

Swartz et al. (Swartz)	5,198,269	Mar. 30, 1993 (filed Aug. 28, 1989)

Claims 14, 15, 17, 18, 20, and 21 stand rejected under 35 U.S.C. § 102(e) as anticipated by, or in the alternative, under 35 U.S.C. § 103 as being unpatentable over Swartz.

Claim 16 stands rejected under 35 U.S.C. § 103 as being unpatentable over Swartz.

Rather than reiterate the conflicting viewpoints advanced by the examiner and appellants regarding the above-noted rejections, we make reference to the examiner's answer (Paper No. 22, mailed October 23, 1997) for the examiner's complete reasoning in support of the rejections, and to appellants' brief (Paper No. 21, filed August 4, 1997) and reply brief (Paper No. 23, filed December 24, 1997) for appellants' arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have carefully considered the subject matter on appeal, the rejections advanced by the examiner, and the evidence of anticipation and obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision,

appellants' arguments set forth in the briefs along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer. Upon consideration of the record before us, we reverse, essentially for the reasons set forth by appellants.

We begin with the rejection of claims 14, 15, 17, 18, 20, and 21 under 35 U.S.C. § 102(e), or in the alternative under 35 U.S.C. § 103 based upon the teachings of Swartz.

Anticipation is a question of fact. In re King, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986). The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. Verdegaal Bros. Inc. v. Union Oil Co., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir.), cert. denied, 484 U.S. 827 (1987).

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to

support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467
(1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or
to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note

In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole. See id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

We begin with independent claim 14. The claim recites, inter alia, "providing a liquid precursor comprising barium, strontium, and titanium together in a common solution; depositing said precursor directly on said first metal electrode to form a thin film." The examiner's position (answer, page 4) is that:

> Swartz et al. Is [sic] considered to show all the steps of these claims with the exception [sic] Swartz et al uses a first layer of sol-gel perovskite precursor material before applying a second layer of sol-gel perovskite (col. 3, lines 53+). Swartz et al further recites [sic] because of the first layer, the second layer has better cystallinity densities and crystallizes at lower temperature and shorter times than if deposited directly on the substrate (col. 4, lines 1-6). The substrates may have electrodes (col. 7, lines 59+).

> The method of Swartz et al may be used to produce capacitors (col. 1, line 18). Thus, the claims are considered to be anticipated by or obvious over Swartz. The second layer may be strontium barium titanate. The precursor layer is heated to 300˚ and 600˚C (to pyrolyze the organic species) and annealed at temperatures of 500˚ and 800˚C (col. 6, line 39).

In addition, the examiner recognizes (answer, page 5) that "Swartz does recite the [sic] all precursors will not crystallize on all substrates and the intermediate layers make[s] preparing the crystallized layer possible on a wider variety of substrates (col. 7, line 42)," but maintains that:

> However, this is not seen to teach the crystallized layer will not form on substrates without the first layer. Swartz does recite the crystallized layer does form on some substrates without the intermediate layer. The recitation at col. 4, lines 2-6 is considered to show that Swartz et al did form the crystallized layer on a subtract [sic] without the intermediate layer or these observations could not have been made.

Appellants assert (brief, page 8) that the passage of column 4 referred to by the examiner is ambiguous and has been taken out of context. Appellants maintain (brief, page 9) that the examiner's interpretation of the passage of column 4 "conflicts with the entire theory, purpose and specifically reported experimental results within Swartz et al." Appellants conclude (reply brief, page 4) that:

> Swartz et al contradicts the hindsight theories and speculations of the Examiner who has modified Swartz et al. to produce perovskite BST by depositing a liquid BST precursor directly on a metal electrode. This contradiction exists because the passages in the whole Swartz et al. reference, as shown in the Appeal Brief, collectively suggest to those skilled in the art that a seed layer is required to produce perovskite structure in BST.

We find that Swartz is directed (col. 1, lines 11-15) "to a sol-gel method for producing crystalline thin films of perovskite compounds with better crystallinity and on a wider variety of substrates by deposition of an intermediate perovskite film (interlayer)." Utility is disclosed (col. 1, lines 15-18) to include dielectric material and thin-film capacitors. Swartz further discloses (col. 7, line 58 through col. 8, line 4) that the invention is applicable to a "wider variety of substrates" including substrates that are coated with electrode materials, and a "wider variety of ferroelectric thin-film materials" including $(Ba,SR)TiO_3$. The process disclosed by Swartz (col. 3, lines 44-52) includes:

> Providing a substrate; depositing a first layer of a sol-gel perovskite precursor material wherein the crystallization of this precursor material to the perovskite phase is substantially insensitive to the substrate; heat treatment of this first layer to crystallize it into the perovskite structure: depositing a second layer of a sol-gel perovskite

> precursor material wherein the crystallization is sensitive to the substrate; and heat-treating the deposited layers to form a perovskite thin film.

Swartz further discloses (col. 3, line 67 through col. 4, line 7) that:

> Due to the presence of the first layer, the second layer of sol-gel perovskite precursor material after heat treatment has better crystallinity when deposited on the first layer than if it would, have been deposited directly on the substrate and heat treated. Additionally, the second layer of sol-gel perovskite precursor material densifies and crystallizes into a perovskite structure at a lower temperature and/or with shorter times in the presence of the first layer.

From this disclosure of Swartz, we find that the sol-gel perovskite precursor material could be deposited directly on the substrate, but that lesser crystallinity would result, and that higher temperatures and/or heating time would be required. The issue arises as to whether this passage of Swartz refers to the depositing of a liquid BST precursor in a common solution, and depositing the precursor directly on an electrode, as required by the method of claim 14.

From the disclosure of Swartz that the substrate may be coated with electrode material, we find that Swartz discloses

the claimed electrode. As to whether Swartz teaches or suggests depositing a liquid barium strontium titanium (BST) precursor directly on the substrate, we find that the passage from column 4, lines 2-6 relied upon by the examiner is further described (col. 8, lines 5-9) where Swartz discloses that "[t]his invention will also have utility in improving the crystallinity and/or reducing the annealing times of ferroelectric thin films, even when the interlayer is not required for crystallization of the perovskite phase." Swartz further discloses (col. 8, lines 9-18) that sol-gel PZT thin films require higher temperatures for crystallization into the perovskite structure than do sol-gel derived from $PbTiO_3$. In the table beginning at the bottom of col. 8, a number of examples are given in which no interlayer (first layer that is substantially insensitive to the substrate) is provided. However, we observe that none of these examples includes BST (which is sensitive to the substrate) as the second layer. Thus, we agree with appellants (brief, page 9-10) that "Swartz et al. never once reports the perovskite-phase crystallization of a substrate-sensitive material in the absence of an intermediate seed layer [first layer or interlayer], except in

the case of PZT materials on aluminum or sapphire (see the table in column 9 at lines 3c, 9b, and 12b)."

Swartz further discloses (col. 19, lines 45-48) the use of (BST) in a thin-film capacitor. However, as disclosed by Swartz, the BST is disclosed as the second deposited layer, where the first layer is another perovskite whose crystallization is independent of the substrate. We find that Swartz additionally discloses (col. 8, lines 19-43) that ferroelectric films can be formed by first depositing an interlayer of one composition that is a constituent of the desired film, and then depositing the film with the composition adjusted to account for the composition of the interlayer. Specifically, a BST film is produced by first depositing a film of $SrTiO_3$ and then a film of $BaTiO_3$. After annealing, the resultant film is BST, which is directly on the substrate. However, method claim 14 recites the step of providing the barium, strontium, and titanium in a common solution as the liquid precursor. We agree with appellants (brief, pages 10 and 11) that Swartz discloses the deposition of two distinct layers followed by interdiffusion, which does not meet the claimed method step. Moreover, we note, that

Swartz discloses the resultant film to have utility in a pyroelectric detector (col. 8, line 43). We find no suggestion in Swartz of using the resultant film having varying Ba/Sr stoichiometry throughout the thickness of the film, in a thin film capacitor as claimed.

From all of the above, we find that Swartz does not anticipate claim 14. In addition, from the disclosure of Swartz, we find no suggestion, and no persuasive reasoning has been provided by the examiner, that would have suggested to an artisan the steps of "providing a liquid precursor comprising barium, strontium, and titanium together in a common solution, depositing said precursor directly on said first metal electrode to form a thin film" as recited in claim 14. In sum, we find that Swartz neither anticipates not renders obvious the method recited in claim 14. Independent claim 17 contains language identical to claim 14 with respect to providing and depositing the precursor.

With regard to independent claim 21, we find that the claim has language identical to claim 14 with respect to the providing and depositing of the liquid precursor, with the exception that claim 21 does not recite that the precursor is

deposited "directly" on the electrode. We agree with appellants (brief, page 14) that the recitation 'consisting essentially of' in the preamble of claim 21 "precludes the use of additional method steps that would fundamentally alter the claimed process."

We find that the embodiment of Swartz (col. 19, lines 9-48) that uses BST as the second layer does not anticipate or render obvious claim 21 because the first layer (interlayer) materially affects the process of manufacture. We additionally find that the embodiment of Swartz (col. 8, lines 19-32) that discloses the depositing of dual constituent layers that form the desired film during the annealing process, does not anticipate or render obvious the method step of providing a liquid precursor of barium strontium and titanium in a common solution, and depositing the precursor on the electrode, as required by claim 21.

Accordingly, the rejection of claims 14, 15, 17, 18, 20, and 21 under 35 U.S.C. § 102(e), or in the alternative, under 35 U.S.C. § 103 is reversed.

We turn next to the rejection of claim 16 under 35 U.S.C.

§ 103 as unpatentable over Swartz. The rejection of claim 16 under 35 U.S.C. § 103 is reversed for the same reasons as claim 14, from which claim 16 depends.

CONCLUSION

To summarize, the decision of the examiner to reject claims 14, 15, 17, 18, 20, and 21 under 35 U.S.C. § 102(e), or in the alternative, under 35 U.S.C. § 103 is reversed. The

decision of the examiner to reject claim 16 under 35 U.S.C. § 103 is reversed.

REVERSED

KENNETH W. HAIRSTON Administrative Patent Judge	)	
JERRY SMITH Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
STUART S. LEVY Administrative Patent Judge	)	

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