

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SAM YANG and DAN GEALY

Appeal 2008-3699
Application 10/281,954
Technology Center 2800

Decided: September 24, 2008

Before THOMAS A. WALTZ, PETER F. KRATZ, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

WALTZ, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants seek review under 35 U.S.C. § 134 from the Examiner's rejections of pending claims 69, 71-76, 78, 79, 81, 83-86, 88-90, 92-94 and 97-98 in the Final Office Action, dated September 22, 2006. This Board has

jurisdiction under 35 U.S.C. § 6(b). For the reasons discussed below, the rejections of the Examiner are AFFIRMED.

The invention of this application is directed to a processor device having a capacitor. Claim 69 is illustrative and reproduced below:

69. A processor system comprising:
a processor; and
a memory device coupled to said processor, at least one of said memory device and said processor comprises a capacitor structure, wherein said capacitor structure comprises:
a bottom conducting layer, wherein said bottom conducting layer is part of a bottom electrode;
an annealed dielectric layer formed over said bottom conducting layer, wherein said annealed dielectric layer is annealed with a first annealing process; and
a top electrode consisting of a single oxidized gas annealed top conducting layer formed over said annealed dielectric layer, wherein said annealed top conducting layer is annealed with a second annealing process different from said first annealing process.

The Examiner relies on the following prior art as evidence of unpatentability:

Emesh	5,452,178	Sep. 19, 1995
Forbes	5,963,469	Oct. 5, 1999
Alers	6,303,426 B1	Oct. 16, 2001
Iizuka	6,338,996 B1	Jan. 15, 2002
Narwankar	6,475,854 B2	Nov. 5, 2002

The following rejections are presented for review:

1. Claims 69-71, 76, 78, 79, 83, 84, 86, 88, 89, 97, and 98 stand rejected under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka.

2. Claims 73, 74, and 85 stand rejected under 35 U.S.C. § 103(a) as being obvious over Forbes in view of Iizuka and further in view of Emesh.

3. Claims 75 and 81 stand rejected under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka and further in view of Alers.

4. Claim 94 stands under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka and further in view of Narwankar.

FINDINGS OF FACT (FF)

As related to the discussions and issues raised herein, the following findings of fact (FF) are made:

1. Iizuka teaches a method for producing a highly dielectric thin film capacitor formed by layering first a noble metal lower electrode, then a dielectric film, and subsequently a noble metal upper electrode. Col. 2, ll. 25-30.

2. In a second embodiment, Iizuka teaches that, after formation, the layered capacitor is annealed in a gas mixture of oxygen, 5% or lower, and nitrogen under 1 atmosphere pressure and 300-400° C temperature. Col. 4, ll. 56-60.

3. Iizuka teaches that annealing a capacitor in an oxygen atmosphere causes a rearrangement of the boundary between the electrode and dielectric layer (BST thin film) to improve the crystallization of the boundary between the electrode and the dielectric layer. This reduces the leak current at room temperature and suppresses the leak current increase during high temperature operation. Col. 5, l. 49 to Col. 6, l. 6.

4. Emesh discloses a capacitor having an electrode, an overlying dielectric layer, col. 6, l. 26 – col. 7, l. 1, and a second overlying electrode, col. 7, l. 21-23. The first electrode may be fabricated of a suitable conductive metal, alloy or conductive metal oxide. Col. 7, ll. 1-3. The second electrode may be a suitable noble metal, metal alloy or conductive metal oxide. Col. 9, ll. 40-42.

5. Alers teaches a capacitor having a lower electrode layer 66 comprising a metal nitride, overlaid by a dielectric layer 70. Col. 3, ll. 53-59, *see*, Fig. 3. The dielectric layer is made of materials selected from a group including tantalum oxide, zirconium oxide, or barium strontium titanate. Col. 3, ll. 42-47.

6. Narwankar teaches a capacitor with a bottom electrode 604, a dielectric layer 606, and a top electrode 610, *see*, Figs. 1 and 6f, wherein the top electrode is annealed in an oxygen environment. Col. 11, ll. 4-6. The annealing is plasma-enhanced, or remote plasma enhanced, col. 13, ll. 14-20, and is done at a pressure of 2.5 Torr over a period of 2 minutes, col. 13, ll. 10-15.

7. Forbes discloses a processor system having a processor 114 and a memory device 102, Fig. 1, whereby the memory device is coupled to the processor and is comprised of DRAM with an array of memory cells 126. *See* col. 3, l. 34 – col. 4, l. 10.

PRINCIPLES OF LAW

“During examination, ‘claims . . . are to be given their broadest reasonable interpretation consistent with the specification, and . . . claim language should be read in light of the specification as it would be

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interpreted by one of ordinary skill in the art.”” *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004)

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’”” *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007)

The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)

When a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield predictable results to be patentable under 35 U.S.C. § 103(a). *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740.

If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Id.*

The method of claiming a product by listing the steps to obtain it, commonly called a product-by-process claim, is perfectly acceptable and does not inherently conflict with the second paragraph of 35 U.S.C. §112, so long as the claims particularly point out and distinctly claim the product for

which protection is sought. However, when the prior art discloses a product which reasonably appears to be identical with or only slightly different than a product claimed in a product-by-process claim, a rejection based alternatively on either section 102 or 103 is eminently fair and acceptable.

In re Brown, 459 F.2d 531, 535 (CCPA 1972).

Patentability is determined by the product itself, and does not depend on the method of production. *In re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985). The PTO has the initial burden of providing evidence that the product described by the prior art is the same or substantially the same product which is claimed. *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977). Once a prima facie case has been established, the burden shifts to Appellants “to prove that the prior art products do not necessarily or inherently possess the characteristics of [their] claimed product.” *In re Fitzgerald*, 619 F.2d 67, 70 (CCPA 1980);

DISCUSSION

CLAIM CONSTRUCTION

“oxidizing gas annealed”

Claim 69 contains the limitation of an oxidized gas annealed layer. The relevant excerpt from the specification states:

Suitable oxidizing gas compounds for use in the second anneal step include: Oxygen (O₂), Ozone (O₃), Nitrous Oxide (N₂O), Nitric Oxide (NO), and water vapor (H₂O). These gases can be introduced individually into an oxidizing chamber or can be produced from reactions of other materials in the oxidation chamber. The oxidizing gas could also be a mixture of one or more these gases with an

inert gas such as Argon (Ar), Helium (He), Nitrogen (N₂), or other compound mixtures which produces reacting oxygen ions.

Spec. 8:14-20.

Accordingly, we construe the claim term, “oxidizing gas annealed layer,” to be understood by one skilled in the art as meaning a layer which has been annealed using a gas consisting at least of one or more of the gases oxygen, ozone, nitrous oxide, nitric oxide and water vapor, either alone or in a mixture of one or more inert gases consisting of argon, helium, and nitrogen. We further construe this term to be a product-by-process limitation.

1. Obviousness over Forbes in view of Iizuka

Claims 69-71, 76, 78, 79, 83, 84, 86, 88, 89, 97, and 98 stand rejected under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka.

Appellants do not argue the patentability of the claims separately, but present arguments for claim 69, and for the other claims based on their dependency on claim 69. Accordingly, the claims of this rejection are treated as a group, to stand or fall together, with claim 69 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

Regarding claim 69, the Examiner found that Forbes discloses a processor system with a processor, a memory device coupled to the processor, the memory device being of a DRAM design, which involves a capacitor structure. Ans. 4. We agree (FF 7).

However, the Examiner acknowledges Forbes does not teach the limitations of the capacitor in claim 69. *Id.* Iizuka discloses a capacitor device comprising a layered structure of a bottom electrode, a dielectric layer and a top electrode, FF 1. The layers are annealed using an oxygen

and nitrogen gas annealing process, FF 2. As we have construed the term, “oxidizing gas annealed” above, Iizuka discloses an oxidizing gas anneal process.

Appellants contend that Iizuka does not disclose all elements of claim 69, in that it fails to teach a separate first annealing process for the dielectric layer and a subsequent second annealing process for the top electrode.

Appellants contend that the claim must be read as limiting the device to one produced by two sequential and distinct anneal processes, App. Br. 13-14, and that the claim recites an annealed structure which was annealed by two distinct anneal processes, *id.*

We do not find Appellants’ argument persuasive. While claim 69 is limited to annealed structures, Appellants attempt to distinguish their claim from the prior art by the method for producing or fabricating that annealed structure. Such a method of claiming is acceptable, but it is the patentability of the resulting product claimed, and not the process steps, which must be established. *Brown*, 459 F.2d at 535.

The Examiner bears the initial burden of showing the claimed invention to be identical to or an obvious modification of the prior art. *In re Marosi*, 710 F.2d 799, 802 (Fed. Cir. 1983). We determine that, *prima facie*, the Examiner has done so. The Examiner has shown that Iizuka teaches a capacitor having a bottom conducting layer, an annealed dielectric layer and an oxidizing gas annealed top electrode. Ans. 3. We agree. FF 1, 2. The burden then shifts to Appellants to show that the prior art does not necessarily or inherently possess the characteristics of the claimed device. *Fitzgerald*, 619 F.2d at 70. Appellants have merely pointed out the differences in the number or sequence of annealing steps performed, App.

Br. 10, without showing any inherent differences in the structure of the annealed layers of the capacitor resulting from the two processes.

Finally, we determine the improvement of the processor system of Forbes with the capacitor of Iizuka in the DRAM to have been obvious to one of ordinary skill in the art as the substitution of a known element for another to obtain predictable results. *KSR*, 127 S.Ct. at 1740.

Accordingly, the first rejection of the Examiner is sustained.

2. Obviousness over Forbes in view of Iizuka and Emesh

Claims 73, 74 and 85 stand rejected under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka and Emesh. Claims 73 and 74 depend on claim 69 adding a further limitation that the bottom conducting layer is formed of a metal alloy and a conducting metal oxide, respectively. Claim 85 depends on claim 69, adding a further limitation that the top conducting layer is formed of a conducting metal oxide.

The Examiner contends that Emesh discloses an analogous device in which the bottom electrode may be formed of a metal alloy or metal oxide, and the top electrode of a conducting metal oxide. Ans. 6. We agree with the Examiner's findings. *See FF 4*. We determine that the substitution of metal alloy or metal oxide for the top or bottom electrode, as applicable, as taught in Emesh for the noble metal electrodes of Iizuka would have been obvious to one of ordinary skill in the art at the time of the invention. *KSR*, 127 S. Ct. at 1740.

Appellants traverse the Examiner's rejection, arguing first that claim 69, upon which these claims all depend, is patentable as Iizuka does not teach all the limitations of claim 69, and that Emesh fails to correct this deficiency. As we have previously found the limitations in common with

claim 69 are disclosed by Forbes in combination with Iizuka, this argument is unconvincing.

Appellants then argue that Iizuka teaches away from the substitution, as Iizuka specifically discloses the upper and lower electrodes are formed of a noble metal, without any teaching that they may also be formed of a metal alloy or conducting metal oxide, as applicable. We do not find this convincing. Appellants do not cite anything in Iizuka that would discourage a skilled practitioner from making the combination or would have led a skilled artisan in a divergent direction. *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). Similarly, nothing in Iizuka criticizes, discredits or otherwise discourages the solution claimed in the application. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). We do not find anything in the cited prior art which teaches away from substituting the electrode materials in Emesh with those in Iizuka.

Accordingly, the Examiner's second rejection is sustained.

3. *Obviousness over Forbes in view of Iizuka and Alers*

Claims 75 and 81 stand rejected under 35 U.S.C. § 103(a) as obvious over Forbes in view of Iizuka and further in view of Alers. Claim 75 depends on claim 69, adding a further limitation that the bottom conducting layer is formed of a metal nitride. Claim 81 likewise depends on claim 69, adding a further limitation that the dielectric layer is a material selected from the listed group. The Examiner contends Alers teaches an analogous device with these additional limitations, Ans. 7. We agree, as Alers teaches at least three of the dielectric materials. FF 5.

Appellants traverse this rejection by first arguing that claim 69, upon which these claims depend, should be found allowable, and Alers does not

cure the deficiencies of Iizuka. App. Br. 16-17. However, as we have found the limitations in common with claim 69 are disclosed in Forbes in combination with Iizuka, this argument is unpersuasive.

Appellants also argue that Iizuka teaches away from substituting another material for its electrodes, as it teaches only noble metal electrodes. App. Br. 17. This argument is unpersuasive, for the same reasons discussed in the second rejection, *supra*.

Accordingly, the third rejection is sustained.

4. Obviousness over Forbes in view of Iizuka and in view of Narwankar

Claim 94 was rejected under 35 U.S.C. § 103(a) over Forbes in view of Iizuka and further in view of Narwankar. Claim 94 depends on claim 69, adding a limitation that the annealed top conducting layer is a plasma enhanced annealed top conducting layer. This limitation further limits or modifies the annealing process step, and is not a limitation on the final structure of the claimed capacitor device. Thus, this limitation does not patentably distinguish over the combination of Forbes and Iizuka. *See In re Thorpe*, 777 F.2d at 698.

Notwithstanding, the Examiner contends Narwankar teaches an analogous method and device, in which an oxidizing anneal step is plasma-enhanced. Ans. 8. We agree, FF 6.

Appellants do not dispute that Narwankar teaches a plasma enhanced annealed layer, but argues that neither it, nor Iizuka, disclose distinct first and second annealing processes. App. Br. 15. But, as previously discussed, we determine these merely to be process steps which do not distinguish the resulting structure from the prior art. This argument was addressed and

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found unpersuasive in the discussion related to the first rejection, and our comments are likewise adopted here.

We additionally determine the invention of claim 94 to be an obvious use of a known technique, i.e., plasma enhancement, to improve a similar method, namely an oxidizing anneal process, in the same way to achieve predictable results. *KSR*, 127 S. Ct. at 1740.

The Examiner's fourth rejection is accordingly sustained.

CONCLUSION

For the reasons above, the four rejections of the Examiner are sustained.

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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