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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ZHENYU LU, ROGER LINSDAY, and
SERGEI V. KOVESHNIKOV

Appeal 2018-008313
Application 14/228,247
Technology Center 2800

Before MICHAEL P. COLAIANNI, JEFFREY R. SNAY, and
BRIAN D. RANGE, *Administrative Patent Judges*.

SNAY, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision rejecting claims 1–5, 7–12, 14, 15, and 21–26. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

¹ We use the word Appellant to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies Intel Corp. as the real party in interest. Appeal Br. 3.

BACKGROUND

The invention relates to stacked circuit devices. Spec. ¶ 1. A three dimensional stacked circuit device includes multiple decks of circuit elements that are electrically connected by a highly doped hollow channel and a conductive stop layer. *Id.* ¶ 11. According to the Specification, providing a relatively thick insulator layer between decks permits using a two-step etch process to form uniform hollow channels. *Id.* ¶ 21. Claim 1 reads as follows:

1. A circuit device comprising:
 - multiple decks of memory cells, the decks being stacked on each other, wherein a deck includes:
 - multiple tiers of memory cells stacked on each other; and
 - at least one channel extending through the deck, the channel including a channel insulator, and a doped polycrystalline material surrounding the channel insulator at an end of the channel and positioned between the multiple tiers of memory cells and the channel insulator;
 - a conductive stop layer between a channel of a given deck and a channel of an adjacent deck, wherein the conductive stop layer is located over and completely covers the doped polycrystalline material and channel insulator of the channel of the given deck, and wherein the conductive stop layer is located under the doped polycrystalline material surrounding the channel insulator at the end of the channel of the adjacent deck; and
 - an insulating layer between the given deck and the adjacent deck, wherein the insulating layer is thicker than an insulating layer between two adjacent tiers of memory cells, and wherein the insulating layer is at least partially over and in contact with a top surface of the conductive stop layer near sides of the conductive stop layer.*

Appeal Br. 23 (Claims Appendix) (emphasis added to highlight a key recitation in dispute). Claim 9 recites an electronic device including essentially the circuit device of claim 1 coupled to a touchscreen display. Each remaining claim on appeal depends from claim 1 or 9.

REJECTIONS

- I. Claims 1, 2, 4, 8, 25, and 26 stand rejected² under 35 U.S.C. § 103 as unpatentable over Oh,³ Shim,⁴ and Baek.⁵
- II. Claim 3 stands rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, and Tanzawa.⁶
- III. Claim 5 stands rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, and Kim.⁷
- IV. Claims 7 and 21 stand rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, and Choi.⁸
- V. Claims 9–11 and 15 stand rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, and Lee.⁹
- VI. Claim 12 stands rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, Lee, and Kim.

² The Examiner’s statement of this rejection includes claims 5 and 6. Final Act. 2. However, claim 5 is not addressed in the body of the rejection and claim 6 is canceled.

³ US 2010/0109065 A1, published May 6, 2010 (“Oh”).

⁴ US 2011/0065270 A1, published March 17, 2011 (“Shim”).

⁵ US 2013/0044531 A1, published February 21, 2013 (“Baek”).

⁶ US 2012/0273862 A1, published November 1, 2012 (“Tanzawa”).

⁷ US 2014/0024189 A1, published January 23, 2014 (“Kim”).

⁸ US 2010/0051910 A1, published March 4, 2010 (“Choi”).

⁹ US 2013/0215679 A1, published August 22, 2013 (“Lee”).

VII. Claims 14 and 23 stand rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, Lee, and Choi.

VIII. Claim 22 stands rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, and Takahashi.¹⁰

IX. Claim 24 stands rejected under 35 U.S.C. § 103 as unpatentable over Oh, Shim, Baek, Lee, and Takahashi.

OPINION

Rejection I: obviousness over Oh, Shim, and Baek

With regard to rejection I, Appellant separately argues claims 1 and 26. Appeal Br. 6–17. Appellant does not separately argue claim 2, 4, 8, or 25. These claims stand or fall with claim 1.

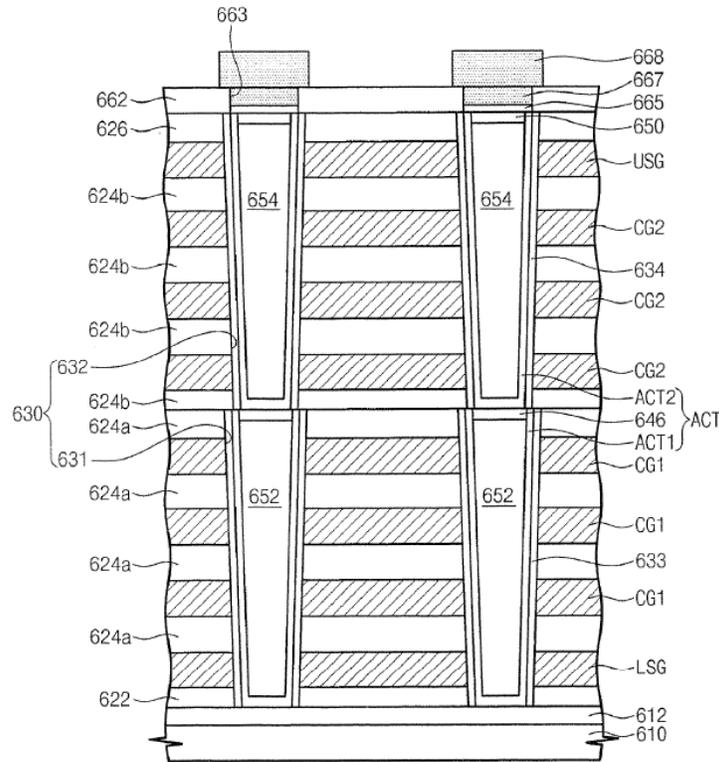
Claim 1

With regard to claim 1 and relevant to Appellant’s arguments on appeal, the Examiner finds Oh discloses a circuit device comprising stacked memory cell decks, but fails to provide the recited insulating layer between decks. Final Act. 2–3. The Examiner finds Baek teaches separating stacked decks with an insulating layer that is thicker than insulating layers between adjacent memory cells within a deck. *Id.* at 3. The Examiner determines it would have been obvious to provide Oh’s circuit device with an interdeck insulating layer such as that taught by Baek to enhance insulation conductive etch stops and conductive lines of the memory cells. *Id.*

Oh’s circuit device is exemplified in Figure 10A, which we reproduce below.

¹⁰ US 2014/0264525 A1, published September 18, 2014 (“Takahashi”).

Fig. 10A



Oh’s Figure 10A depicts a cross-sectional view of a nonvolatile memory device. Oh’s depicted device includes insulating layers 624a disposed between gate patterns CG1 in a lower deck, and insulating layers 624b disposed between gate patterns CG2 in an upper deck. Oh ¶ 119. Active bar ACT1 connects semiconductor substrate 610 to each lower deck gate pattern CG1 and conductive pad 646. *Id.* ¶¶ 123–124. Active bar ACT2 similarly connects conductive pad 646 to each upper deck gate pattern CG2. *Id.* ¶ 132.

Appellant argues “the memory device of Oh already includes an insulating layer, and it would not have been obvious to one of ordinary skill in the art to modify or replace the insulating layer of Oh with the thicker

insulating layer of Baek.” Appeal Br. 8. *See also* Reply Br. 3–4 (“Because *Oh* already discloses an insulating layer between the cell gate patterns, which presumably has sufficiently [sic] thickness to ensure operation, adding an extra insulating layer or increasing the thickness of the insulating layers of *Oh* would be unnecessary for operation, but would increase both cost (in materials) and size of the resulting device.”).

Appellant’s argument is not persuasive of reversible error. The fact that providing additional insulative material between decks would increase cost and size does not negate the Examiner’s finding that additional insulation advantageously would be provided between *Oh*’s lower deck conductive pad and upper deck cell gate patterns. A tradeoff of one advantage (increased electrical insulation) for another (cost and size) is not persuasive of reversible error in the Examiner’s obviousness determination. *See Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (“[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”).

Moreover, the Examiner explains that Shim would have provided a reason to configure *Oh*’s conductive pad 646 such that it extended completely over the underlying conductive channel (Final Act. 3), such that conductive pad 646 would partially extend below upper deck cell gate patterns, thereby warranting additional insulative thickness between lower deck pad 646 and upper deck cell gate patterns (Ans. 3). Such a configuration of conductive pad 646 would have been consistent with *Oh*’s disclosure. *See Oh* ¶ 127 (“Alternatively, the first pad portion **646** may be disposed on the top surface of the first sub-active bar ACT1. A sectional

area of the top surface of the first pad portion **646** may be wider than a sectional view of the top surface of the first sub-active bar ACT1.”). Appellant does not persuasively address this line of the Examiner’s reasoning.

Appellant additionally argues that “the structures and compositions of Baek and Oh are significantly different” and, for that reason, “are likely to include insulating layers with different dimensions.” Appeal Br. 12. Appellant does not, however, persuasively explain why structural differences between Oh and Baek would have precluded one of ordinary skill from applying Baek’s teaching of providing a relatively thick interdeck insulation to the multideck circuit device of Oh. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference Rather, the test is what the combined teachings of [those] references would have suggested to those of ordinary skill in the art.”).

For the foregoing reasons, we are not persuaded of error in the Examiner’s rejection of claim 1. Rejection I as applied to each of claims 2, 4, 8, and 25 is sustained.

Claim 26

Claim 26 additionally recites that “a region of the insulating layer between the given deck and the adjacent deck is between the top surface of the conductive stop layer and the doped polycrystalline material.”

In rejecting claim 26, the Examiner states that Oh, when modified in light of Shim and Baek, includes an insulating layer region positioned

between a conductive stop layer of one deck and an orthogonally-oriented doped polycrystalline channel of another. Final Act. 4. In support of that finding, the Examiner offers an annotated partial copy of Figure 5C taken from Baek. *Id.* Particularly, the Examiner interprets the structure in Baek's Figure 5C as including an insulating layer region that sits along an imaginary line drawn from the horizontal surface of element 165 and a vertical channel surface.

Regardless whether Baek depicts an arrangement that might reasonably be viewed as providing an insulating layer region between a conductive stop of one deck and channel of another, the Examiner offers no explanation how Oh would have been modified to meet the structure recited in claim 26. Merely pointing to a structural arrangement of elements in Baek does not provide evidence sufficient to support a finding that the same structural arrangement would have resulted in Oh if Oh were modified in light of Shim and Baek. Absent some reasoned explanation of how Oh would have been modified such that the recited structural arrangement would have been met, the rejection is conclusory.

Accordingly, we do not sustain Rejection I as applied to claim 26.

Rejections II–IX

Appellant does not present particular argument directed to the remaining rejections, except to rely on the arguments presented in connection with claim 1. *See* Appeal Br. 17–22. Accordingly, each of Rejections II–IX is sustained for the reasons set forth above in connection with the rejection of claim 1.

CONCLUSION

The Examiner’s decision rejecting claims 1–5, 7–12, 14, 15, and 21–25 is affirmed. The decision rejecting claim 26 is reversed.

DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 4, 8, 25, 26	103(a)	Oh, Shim, Baek	1, 2, 4, 8, 25	26
3	103(a)	Oh, Shim, Baek, Tanzawa	3	
5	103(a)	Oh, Shim, Baek, Kim	5	
7, 21	103(a)	Oh, Shim, Baek, Choi	7, 21	
9–11, 15	103(a)	Oh, Shim, Baek, Lee	9–11, 15	
12	103(a)	Oh, Shim, Baek, Lee, Kim	12	
14, 23	103(a)	Oh, Shim, Baek, Lee, Choi	14, 23	
22	103(a)	Oh, Shim, Baek, Takahashi	22	
24	103(a)	Oh, Shim, Baek, Lee, Takahashi	24	
Overall outcome			1–5, 7–12, 14, 15, 21–25	26

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-IN-PART