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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HOON KIM, and KISIK CHOI¹

Appeal 2015-005155
Application 13/462,619
Technology Center 2800

Before BRADLEY R. GARRIS, PETER F. KRATZ, and MICHAEL G.
McMANUS, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1–8 and 16–22. We have jurisdiction under 35 U.S.C. § 6.

We AFFIRM.

¹ Globalfoundries Inc. is identified as the real party in interest. App. Br. 1.

Appellants claim a method of fabricating an integrated circuit comprising: depositing a layer of a first barrier material 105 (Fig. 2); depositing a layer of an n-type work function material 106 over the layer of the first barrier material (Fig. 3); etching the layer of the first barrier material and the layer of the n-type work function material from a first area (Fig. 4); depositing a layer of a second barrier material 107 (Fig. 5); and depositing a layer of a p-type work function material 108 (Fig. 6) (independent claim 1; *see also* remaining independent claims 16 and 21).

A copy of representative claim 1, taken from the Claims Appendix of the Appeal Brief, appears below.

1. A method of fabricating an integrated circuit, comprising:
depositing a layer of a first barrier material;
depositing a layer of an n-type workfunction material over the layer of the first barrier material;
etching the layer of the first barrier material and the layer of the n-type workfunction material from a first area;
depositing a layer of a second barrier material; and
depositing a layer of a p-type workfunction material.

Under 35 U.S.C. § 103(a), the Examiner rejects as unpatentable:

claim 1 over Kwon et al., (US 2012/0132998 A1, published May 31, 2012) (“Kwon”) in view of Li et al., (US 2011/0215409 A1, published Sept. 8, 2011) (“Li”); and

remaining claims 2–8 and 16–22 over these references alone or in combination with additional prior art.

Appellants do not present separate arguments specifically directed to dependent claims 2–8, 17–20, and 22 (App. Br. 8–17). Therefore, these dependent claims will stand or fall with their parent independent claims 1, 16, and 21. Because the arguments advanced against the rejection of claim 1

(*id.* at 8–14) correspond to those concerning the rejections of claims 16 and 21 (*id.* at 16–17), claim 1 is representative of the independent claims.

We sustain the Examiner’s rejections of the appealed claims for the reasons expressed in the Final Action, the Answer, and below.

The Examiner finds that Kwon discloses a method of fabricating an integrated circuit comprising (i) depositing layers of the claim 1 materials including layer 38L of a second barrier material and (ii) etching from a first area the n-type work function layer, albeit not the first barrier layer as claimed (Final Action 2–3 (citing Kwan Figs. 10, 12, 13 and ¶¶ 62, 69, 73, 76)). In this latter regard, the Examiner concludes that it would have been obvious to etch the first barrier layer as well as the n-type work function layer of Kwon in view of Li’s teaching of etching first barrier as well as work function layers in a first area during integrated circuit fabrication (*id.* at 3 (citing Li Figs. 4–6 and ¶¶ 47, 48, 52)).

Appellants argue the Examiner erred in finding that Kwon’s layer 38L corresponds to their claimed second barrier layer (App. Br. 8–9).² Specifically, Appellants point out that layer 38L is taught to be a second work function material not the claimed second barrier material and argue that, although both of these materials may be titanium nitride, Kwon’s work function material would not serve the purpose of a barrier material because “titanium nitride, depending on how it is formed, may function either as a barrier material (as in Appellants’ invention) or as a work function material (as in Kwon)” (*id.* at 8).

² Appellants initially argued that the Examiner also erred in finding Kwon discloses their claimed p-type workfunction layer (App. Br. 9) but have expressly withdrawn this argument (Reply Br. 3).

Appellants' argument is not persuasive. As the Examiner correctly finds, Kwon's work function layer 38L comprises the same materials and thicknesses as barrier layer 36L (Ans. 16 (citing Kwon ¶¶ 75–77 and 65–66 respectively)). We emphasize that Appellants do not challenge this finding by the Examiner in the record before us (*see, e.g.*, the Reply Brief generally). Therefore, the Examiner's finding is reasonably supported by the circumstance wherein both of these layers comprise the same material (e.g., titanium nitride) having the same thickness such that work function layer 38L necessarily and inherently would possess the capability of performing the barrier function of Appellants' claimed second barrier material (e.g., titanium nitride (*see* Spec. ¶ 19 and dependent claim 5)).

Appellants further contend that “the Office fails to provide any well-founded reason or rationale why it would have been obvious to modify Kwon with Li in the manner suggested in the Office Action” (App. Br. 11).

The Examiner explains that modifying Kwon by etching away the first barrier layer (i.e., 36L) as well as the n-type work function layer (i.e., 34L) would have been suggested by Li's teaching of etching away both a first barrier layer and a work function layer prior to depositing layers 28 and 29 of Li which correspond to layers 38L and 40L of Kwon (Ans. 17–18).

Appellants do not address this explanation with any reasonable specificity and therefore do not show it to be erroneous (*see* Reply Br. 2–4). Based on the record before us, the proposed modification of Kwon is nothing more than the predictable use of a known etching technique for its established function of preparing for the subsequent deposition of Kwon's layers 38L and 40L as evidenced by Li.

Finally, Appellants argue that, “[i]f the barrier material layer 36L in Kwon were removed, then the subsequently-deposited second-type work function material layer 38L (see FIG. 13, paragraphs [0074] – [0077]) would be deposited directly on to the oxide gate dielectric layer 32L . . . [which] would result in a non-function[al] device” (App. Br. 12). According to Appellants, “the modification to Kwon suggested in the Office Action makes [Kwon’s] principal of operation not possible, namely the barrier material layer 36L would be removed from region 25B, leaving only the second work function material layer 38L in place” (*id.* at 13).

In response, the Examiner once again expresses the finding that layers 36L and 38L of Kwon comprise the same materials having overlapping thicknesses (Ans. 19; *see also id.* at 16). For example, layer 36L may comprise titanium nitride (Kwon ¶ 65) having a thickness from 0.5–5 nm (*id.* at ¶ 66), and layer 38L may comprise titanium nitride (*id.* at ¶ 76) having a thickness from 2–100 nm (*id.* at ¶ 77). As indicated previously, the Examiner’s finding is not challenged or otherwise addressed by Appellants in their Reply Brief. For this reason, Appellants fail to provide the record with any explanation why Kwon’s device would be non-functional or the principal of operation not possible if, for example, Kwon’s envisioned combination of a 1 nm layer 36L of titanium nitride and a 1 nm layer 38L of titanium nitride on gate dielectric layer 32L were replaced with a 2 nm layer 38L of titanium nitride. Appellants’ argument that the latter circumstance would be non-functional or contrary to Kwon’s principal of operation is not convincing because, in either circumstance, the result would be a 2 nm thick layer of titanium nitride on dielectric layer 32L.

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The decision of the Examiner is affirmed.

TIME PERIOD

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

AFFIRMED