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LEX IP MEISTER, PLLC 5180 PARKSTONE DRIVE, SUITE 175 CHANTILLY, VA 20151			MILLER, JR, JOSEPH ALBERT	
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YOUNGHOON KIM, DAE YOUN KIM, and SANG WOOK LEE

Appeal 2019-001575
Application 15/396,697
Technology Center 1700

Before JEFFREY B. ROBERTSON, GEORGE C. BEST, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

ROBERTSON, *Administrative Patent Judge*.

DECISION ON APPEAL¹

STATEMENT OF THE CASE

Appellant² appeals under 35 U.S.C. § 134(a) from the Examiner’s Final Rejection of claims 1–19. (Appeal Br. 4.) We have jurisdiction pursuant to 35 U.S.C. § 6(b).

We REVERSE.

¹ This Decision includes citations to the following documents: Specification filed January 2, 2017 (“Spec.”); Final Office Action mailed April 16, 2018 (“Final Act.”); Appeal Brief filed September 10, 2018 (“Appeal Br.”); Examiner’s Answer mailed October 12, 2018 (“Ans.”); and Reply Brief filed December 14, 2018 (“Reply Br.”).

² We use the word “Appellant” to refer to “Applicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as ASM IP Holding, B.V. (Appeal Br. 3.)

THE INVENTION

Appellant states the invention relates to a method of depositing a thin film. (Spec. 1, l. 12.)

Claim 1, the only independent claim on appeal, is representative and reproduced below from the Claims Appendix to the Appeal Brief:

1. A method of depositing a thin film, the method comprising:

supplying a source gas to a reaction space;

repeating a first gas supply cycle a first plurality of times, the first gas supply cycle comprising supplying first plasma while supplying a reactant gas to the reaction space;

supplying the source gas to the reaction space; and

repeating a second gas supply cycle a second plurality of times, the second gas supply cycle comprising supplying second plasma while supplying the reactant gas to the reaction space,

wherein the supplying of the first plasma is executed by supplying remote plasma, and the supplying of the second plasma is executed by supplying direct plasma,

wherein the first gas supply cycle is firstly repeated the first plurality of times at initial step of depositing the thin film to reduce sub-layer oxidation, and then the second gas supply cycle is repeated the second plurality of times, and

wherein the repeating of the first plurality of times comprises repeating the first gas supply cycle up to ten times.

(Appeal Br. (Claims Appendix) 14.)

REJECTIONS

1. The Examiner rejected claims 1–9, 13–17, and 19³ under 35 U.S.C. § 103 as obvious over Kraus et al. (US 2005/0042373 A1, published February 24, 2005, hereinafter “Kraus”).
2. The Examiner rejected claims 1–19 under 35 U.S.C. § 103 as obvious over Wang et al. (US 2008/0020593 A1, published January 24, 2008, hereinafter “Wang”) and Kraus.
3. The Examiner rejected claims 4, 5, 8, 9, 15, 16, 18, and 19 under 35 U.S.C. § 103 as obvious over Wang and Moghadam et al. (US 2005/0019494 A1, published January 27, 2005, hereinafter “Moghadam”).

(Final Act. 2–7.)

We limit our discussion to independent claim 1, which is sufficient for disposition of this appeal.

Rejection 1

ISSUE

The Examiner found Kraus discloses an atomic layer deposition (ALD) process including providing a pulse of source gas into a reaction space, and repeating a sequence of applying a reactant gas into the process

³ The Examiner’s statement of rejection lists only claims 1, 3–5, 8, 9, 15, 16, and 19 as subject to this rejection, but the Examiner discusses also claims 2, 3, 6, 7, 13, 14, and 17 under this rejection. (Final Act. 2–3.) As such, we understand these claims to be rejected as well. The Examiner’s error in listing the rejected claims is harmless as these claims all depend from claim 1, and Appellant presents arguments for claim 1 only as a basis for patentability of all the claims. (*See* Appeal Br. 11.)

space while supplying a first and second plasma, where Kraus teaches remote and direct plasma are applied as the plasma source. (Final Act. 2.) The Examiner determined, alternatively, that it would have been obvious to have applied a remote plasma source in addition to a direct power source, because Kraus discloses both power supplies “are operably applied together.” (*Id.*) The Examiner stated the first and second gas supply steps are considered to be either alternative or simultaneous, and because Kraus discloses the steps are repeated, the first and second supply cycles are repeated. (*Id.*) In the Answer, the Examiner stated further that “one would apply a remote plasma to form a specific thickness and then alternate to direct plasma, with an expectation of operability.” (Ans. 9.) The Examiner determined Kraus is not limiting as to the number of cycles such that it would have been obvious to apply the cycle ten times to obtain a desired film thickness. (*Id.* at 3.)

Appellant argues, *inter alia*, Kraus does not teach or suggest the claimed order of the remote plasma (first plasma) and the direct plasma (second plasma), where the first gas supply cycle is repeated a first plurality of times at an initial step of depositing the thin film in order to prevent sub-layer oxidation. (Appeal Br. 7.) Rather, Appellant argues Kraus merely discloses remote plasma and direct plasma as suitable sources, and Kraus is indifferent to the processing order of supplying remote and direct plasma. (*Id.*)

Accordingly, the dispositive issue with respect to this rejection is:
Has Appellant identified a reversible error in the Examiner’s position that it would have been obvious in view of Kraus to repeat a first gas supply cycle including supplying a first plasma as a remote plasma up to ten times

and then repeating a second gas supply cycle including supplying second plasma as a direct plasma a second plurality of times as required in claim 1?

DISCUSSION

We are persuaded by Appellant's arguments that the Examiner has not provided sufficient reasoning to render the first and second gas cycles recited in claim 1 obvious. In particular, claim 1 recites that the first gas supply cycle executed by supplying remote plasma "is firstly repeated the first plurality of times at initial step of depositing the thin film to reduce sub-layer oxidation, *and then* the second gas supply cycle is repeated the second plurality of times" (emphasis added), the second gas supply cycle being executed by supplying direct plasma. Thus, claim 1 requires a first gas supply cycle applying a remote plasma a first plurality of times prior to a second gas supply cycle applying a direct plasma a second plurality of times.

Kraus discloses "[a]lternately or in addition thereto, the second precursor plasma can be generated from applying plasma power to a flowing second precursor externally of the deposition chamber, such as using remote plasma." (Kraus, ¶ 23.) Although we agree with the Examiner that Kraus discloses either direct or remote plasma as a plasma source in some fashion, we are of the view the Examiner's reasoning, relying generally on repeating a number of cycles to achieve a desired thickness and "operability" to conclude that the method of claim 1 would have been obvious, is not based on sufficient rational underpinnings. That is, Kraus's disclosure does not speak to the particular arrangement of repeating a number of cycles where remote plasma is first used as the plasma source and then repeating a second number of cycles where direct plasma is used as the plasma source. (*See*

Reply Br. 5.) The Examiner's general statements do not provide a sufficient basis in view of the disclosure in Kraus to explain why one of ordinary skill in the art would have arranged the remote and direct plasma sources as recited in claim 1.

As a result, the Examiner's analysis falls short as to providing sufficient reasoning to explain why claim 1 would have been obvious to one of ordinary skill in the art. *KSR Int'l. Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007), quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”).

Rejection 2

Similar to Rejection 1, the Examiner found Wang discloses a method of depositing a film utilizing gas supply cycles including plasma, where the steps are repeated. (Final Act. 3–4.) The Examiner found Wang discloses the plasma applied is direct and/or remote, such that it would have been obvious to have applied either direct and/or remote plasma for any portion of the process with an expectation of success. (*Id.* at 4.) The Examiner again cited Kraus as evidence a combination of each of the plasma formation methods would have been operable. (*Id.*) The Examiner determined also the first and second gas supply cycles would have been applied multiple times, such as about ten times, in order to form an operable layer. (*Id.* at 5.)

Similar to Rejection 1, Appellant argues Wang discloses remote and direct plasma as alternatives, and Wang does not disclose repeating times of the first gas supply cycle. (Appeal Br. 8.) In this regard, Wang discloses

“[t]he plasma generator may be a direct plasma generator (i.e., in situ or direct plasma generation) or a remote plasma generator (i.e., ex situ or remote plasma generation). (Wang, ¶ 21.)

Thus, Rejection 2 suffers from the same deficiencies discussed above with respect to Rejection 1. In particular, Wang does not remedy the deficiencies discussed above with respect to Kraus as to the arrangement of plasma sources recited in the method of claim 1.

Therefore, we reverse Rejection 2 for similar reasons.

Rejection 3

Claims 4, 5, 8, 9, 15, 16, 18, and 19, subjected to Rejection 3, all depend from claim 1. Moghadam is cited only for disclosing constant flow of oxygen during ALD processes (Final Act. 6–7), and does not remedy the deficiencies discussed above with respect to Wang. As a result, we reverse Rejection 3 for similar reasons as Rejection 2.

DECISION

Claims Rejected	Basis	Affirmed	Reversed
1–9, 13–17, and 19	§ 103 Kraus		1–9, 13–17, and 19
1–19	§ 103 Wang and Kraus		1–19
4, 5, 8, 9, 15, 16, 18, and 19	§ 103 Kraus and Moghadam		4, 5, 8, 9, 15, 16, 18, and 19
Overall Outcome			1–19

REVERSED