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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte PAULINE SERRE, THIERRY BARON, and CELINE TERNON

Appeal 2019-000444
Application 14/950,639
Technology Center 1700

Before BEVERLY A. FRANKLIN, N. WHITNEY WILSON, and BRIAN D. RANGE, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's November 30, 2017 decision finally rejecting claims 1–3 and 6–23 ("Final Act."). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We reverse.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies Commissariat a L'Energie Atomique et aux Energies Alternatives, CNRS Centre National de la Recherche Scientifique, and Institut Polytechnique de Grenoble, as the real parties in interest (Appeal Br. 2).

CLAIMED SUBJECT MATTER

Appellant's disclosure relates to a method for producing a network of nanostructures from at least one semiconductor material, comprising a step of forming nanostructures on the surface of a substrate, at least a part of the nanostructures having areas of contact between each other (Abstract). After forming the nanostructures, the following steps are performed in sequence: (1) deoxidising the surface of the nanostructures and (2) reinforcing the bond between the nanostructures at the contact areas (*id.*). Details of the claimed process are set forth in representative claim 1, which is reproduced below from the Claims Appendix to the Appeal Brief:

> 1. A method for producing a network of nanostructures from at least one semiconductor material, comprising:
>
> forming the nanostructures on a surface of a substrate, with at least a part of the nanostructures having contact areas between each other,
>
> after said forming, reinforcing a bond between the nanostructures at the contact areas, wherein said reinforcing comprises a heat treatment in the form of annealing, and
>
> after said forming and prior to said reinforcing, deoxidising the surface of the nanostructures.

REJECTION

Claims 1–3 and 6–23[2] are rejected under 35 U.S.C. § 103 as unpatentable over Reifenberg[3] in view of Coffey.[4]

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[2] The statement of the rejection in the Final Action indicates that claim 5 was also part of the rejection (Final Act. 3). However, claim 5 has been canceled in an amendment filed October 9, 2017.
[3] Reifenberg et al., US 2014/0116491 A1, published May 1, 2014.
[4] Coffey et al., US 2010/0112373 A1, published May 6, 2010.

DISCUSSION

Because we decide this appeal on the basis of a limitation appearing in independent claim 1, and hence part of each of the claims on appeal, we focus our analysis on the rejection of claim 1. The Examiner's findings are set forth at pages 3–4 of the Final Action. The Examiner finds that Reifenberg teaches each limitation of claim 1, except that it does not specifically teach deoxidizing before the annealing step (Final Act. 3). The Examiner further finds that Coffey teaches a nanowire structure in which an activating process including etching, cleaning, and reducing can be performed prior to a heating or annealing step (Final Act. 4, citing Coffey ¶¶ 233, 249). According to the Examiner, it would have been obvious to have utilized a precleaning/reducing step to remove native oxides thereon prior to annealing with the expectation of achieving an improved connection between the wires at the contact points thereof (*id.*).

Appellant argues that Reifenberg does not teach "forming the nanostructures on a surface of a substrate, with at least a part of the nanostructures having contact areas between each other" (Appeal Br. 4). Instead, according to Appellant, Reifenberg teaches the formation of bulk-size nanostructured sold materials by sintering (*id.*). Appellant also disputes the Examiner's finding the Coffey teaches deoxidisation of the nanowire structure followed by a reinforcing annealing step (Appeal Br. 5). The Examiner relies on Coffey's ¶ 233 as support for the finding that Coffey teaches activation of the nanowires (Final Act. 4). This passage reads as follows:

> In some embodiments, a process of the present invention comprises *activating a surface of a substrate*. As used herein, "activating" refers to treating a substrate prior to, or concomitant with, disposing to enhance the quality of a

> deposition process (e.g., provide enhanced yield, a faster deposition rate, a more controlled deposition process). Activating can include, without limitation, cleaning, reducing, oxidizing, functionalizing, derivatizing, polishing, roughening, plasma treating, thermally treating, and combinations thereof. In some embodiments, activating comprises removing a native oxide layer from a surface of a conductive and/or semiconductive substrate.

(Coffey ¶ 233, emphasis added). Thus, Appellant argues that Coffey does not teach activation (deoxidization) of the nanostructures, as is called for by the claim (Appeal Br. 6).

In response, the Examiner acknowledges that Coffey explicitly teaches activating/deoxidizing the substrate prior to applying the nanostructures (Ans. 3). However, the Examiner finds that Coffey also suggests when forming multiple layers of nanostructures, performing an activation step prior to the application of subsequent layers (*id*.). Thus, according to the Examiner:

> while Reifenberg[] teaches performing the removal of native oxides after the annealing step, Reifenberg[] also teach[es] forming this step in conjunction with the annealing step and hence the combination of references teaches that it is known to perform a native oxide removal step (deoxidizing step) before, after and during an annealing step as these are all taught to be ways to improve conductivity of the applied nanostructures.

(Ans. 3–4).

Having considered the arguments of both Appellant and the Examiner, and the evidence of record, we determine that Appellant has demonstrated reversible error in the rejection.

As discussed by Appellant (Reply Br. 3)[5], Coffey specifically defines "pre-treating" as chemically or physically modifying a surface, and includes reducing (i.e., deoxidizing) that surface (Coffey ¶ 267). Coffey also describes "post-treating" its multilayer coating, to include annealing, and states that post-treating can take place after deposition of a single layer, multiple layers, or the entire coating (Coffey ¶ 301). Thus, as argued by Appellant, nothing in Coffey suggests "activation" as a form of post-treatment. That is, the evidence of record does not support a finding that Coffey (or Reifenberg) teaches or suggests a deoxidizing step for the nanostructures prior to the annealing step.

To establish a prima facie case of obviousness, the Examiner must show that each and every limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art or the inferences and creative steps a person of ordinary skill in the art would have employed. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988); *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). In the absence of a proper prima facie case of obviousness, an applicant who complies with the other statutory requirements is entitled to a patent. *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998); *see also In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). On the record before us, the Examiner has not adequately shown that the limitation of "after said forming and prior to said reinforcing, deoxidizing the surface of the nanostructures" was taught or suggested by, or otherwise rendered obvious, over the cited art. Accordingly, we reverse the rejection of claim 1. Because the

[5] The pages of the Reply Brief are not numbered, but we refer to pages by number.

remaining claims on appeal depend from claim 1 and, therefore, contain this same limitation, we also reverse the rejection of the remaining claims.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	References(s)/Basis	Affirmed	Reversed
1–3, 6–23	103	Reifenberg, Coffey		1–3, 6–23

REVERSED