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Paper 9
Entered: September 4, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HAMAMATSU CORPORATION,
Petitioner,

v.

PRESIDENT AND FELLOWS OF HARVARD COLLEGE,
Patent Owner.

Case IPR2017-00909
Patent 8,080,467 B2

Before JONI Y. CHANG, JENNIFER S. BISK, and JACQUELINE T. HARLOW, *Administrative Patent Judges.*

HARLOW, *Administrative Patent Judge.*

DECISION
Denying Request for Rehearing
37 C.F.R. § 42.71

Petitioner, Hamamatsu Corporation ("Hamamatsu"), requests rehearing of the Board's Decision (Paper 7) ("Decision") declining to institute *inter partes* review of claims 1, 2, and 6–8 of U.S. Patent No. 8,080,467 B2 (Ex. 1001) as obvious over the Wu Thesis[1] in view of Gibbons[2] and claim 3 as obvious over the Wu Thesis in view of Gibbons and Carey.[3] Paper 8 ("Request for Rehearing" or "Req. Reh'g"). For the reasons that follow, Hamamatsu's Request for Rehearing is *denied*.

ANALYSIS

Pursuant to 37 C.F.R. § 42.71(d):

> A party dissatisfied with a decision may file a single request for rehearing without prior authorization from the Board. The burden of showing a decision should be modified lies with the party challenging the decision. The request must specifically identify all matters the party believes the Board misapprehended or overlooked, and the place where each matter was previously addressed in a motion, an opposition, or a reply.

When reconsidering a decision on institution, we review the decision for an abuse of discretion. 37 C.F.R. § 42.71(c). An abuse of discretion exists where a "decision [i]s based on an erroneous conclusion of law or clearly

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[1] Wu, *Femtosecond laser-gas-solid interactions* (2000) (Ph.D. thesis, Harvard University) ("Wu Thesis") (Ex. 1006).
[2] Gibbons, *Ion Implantation in Semiconductors—Part II: Damage Production and Annealing*, 60(9) PROC. IEEE, 1062–1096 (1972) ("Gibbons") (Ex. 1007).
[3] Carey et al., *In-situ Doping of Silicon Using the Gas Immersion Laser Doping (GILD) Process*, 43 APPL. SURF. SCI., 325–332 (1989) ("Carey") (Ex. 1009).

erroneous factual findings, or . . . a clear error of judgment." *PPG Indus. Inc. v. Celanese Polymer Specialties Co.*, 840 F.2d 1565, 1567 (Fed. Cir. 1988).

Hamamatsu contends that we misapprehended the annealing procedure in the Wu Thesis, misapprehended the Wu Thesis' consideration of Wilson[4], and made other factual and legal errors. Req. Reh'g 1–8. We address these arguments below.

First, Hamamatsu asserts that we misapprehended the purpose for the annealing experiment discussed in the Wu Thesis. *Id*. at 2–3. Specifically, Hamamatsu contends that the Wu Thesis did not broadly investigate the appropriateness of annealing generally but, rather, conducted its annealing experiment to verify a theory about the reasons for the increase in a spiked silicon's ability to absorb visible and infrared wavelengths. *Id*. Based on this alleged misapprehension, Hamamatsu asserts that we improperly presumed that the reported "deleterious" effects on absorptance caused by the annealing protocol in the Wu Thesis was "a generalized indictment of the annealing process on spiked silicon" and "point[ed] away" from such a process. *Id*. at 2–6.

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[4] Wilson, *Depth distributions of sulfur implanted into silicon as a function of ion energy, ion fluence, and anneal temperature*, 55 J. APPL. PHYS. 3490 (1984). Wilson has not been submitted as prior art or as an exhibit in this case. Hamamatsu states that they are relying on the Wu Thesis' characterization of Wilson, rather than Wilson itself.

We do not agree that we misapprehended the teachings of the Wu Thesis. Our Decision explained that the "Wu Thesis employs annealing (Ex. 1006, 51) to investigate the 'especially puzzling' difference in below-bandgap absorption between ordinary and spiked silicon." Decision 11. We also cited Hamamatsu's expert, Dr. Souri, in describing the purpose of the annealing step in the Wu Thesis to "test the effects of sulfur incorporation in the silicon lattice on the optical properties of the sample related to absorptance in the infrared range." *Id*. at 15 (citing Ex. 1012 ¶ 62). Furthermore, our Decision recognized that the Wu Thesis did not provide a general discussion of annealing, stating that "[t]he Wu Thesis [did] not posit the use of annealing to improve the performance of a photovoltaic device, or suggest any positive effect of annealing on dopant activation or on the electrical properties of spiked silicon." *Id*. at 17.

In addition, there is no dispute that the annealing protocol employed by the Wu Thesis "prove[d] deleterious to the functionality of the silicon device, particularly to its infrared wavelength absorptance capabilities." *Id*. at 15 (citing Pet. 21). Based on these observations, we concluded that the Petitioner did not "adequately explain why an ordinarily skilled artisan would have sought to anneal the sulfur-doped spiked silicon disclosed by the Wu Thesis in view of the reference's teachings concerning the characteristics of spiked silicon, and the limitations of annealing such devices." *Id*. at 17.

Hamamatsu also contends that we erred in finding that Wilson does not suggest that "anneal temperature plays a large role in the location and

activation of sulfur dopants and resulting electrical [and] optical properties of the doped sample, and that optimizing the annealing parameters is a crucial element to enhancing the performance of a photovoltaic device." Req. Reh'g 5 (citing Decision 19). According to Hamamatsu, we "overlooked that [the] Wu Thesis relied on Wilson to determine a proper anneal temperature for achieving a desired result (*i.e.*, removal of sulfur), and that the procedure worked as expected." *Id*.

We did not overlook the fact that the Wu Thesis relied on Wilson to determine the proper anneal temperature for the removal of sulfur. Our Decision states the description of Wilson by the Wu Thesis "addresses only the location of sulfur atoms, relative to the silicon substrate in which they were implanted, as a function of temperature." Decision 19 (citing Ex. 1006, 52). However, as we further explained,

> [t]he Wu Thesis does not, either in its description of Wilson or elsewhere, indicate an annealing time 'selected to enhance a density of charge carriers in [the] surface layer,' as recited in claim 1, address the activation of sulfur dopants or the resultant electrical properties of doped substrates, or suggest that optimizing annealing parameters is crucial to enhancing the performance of a photovoltaic device.

Id. Therefore, we recognized that Wilson — as described in the Wu Thesis — taught the temperature required for sulfur removal; however, we did not find that it more broadly taught optimization of annealing parameters as asserted by Hamamatsu.

Hamamatsu also contends that we erred by stating that the Wu Thesis does not "posit" or "contemplate" the "use of annealing" for various aspects.

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