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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HAMAMATSU CORPORATION,
Petitioner,

v.

PRESIDENT & 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 Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Hamamatsu Corporation ("Petitioner"), filed a Petition requesting an *inter partes* review of claims 1–3 and 6–8 of U.S. Patent No. 8,080,467 B2 (Ex. 1001, "the '467 patent"). Paper 2 ("Pet."). President & Fellows of Harvard College ("Patent Owner") filed a Preliminary Response. Paper 6 ("Prelim. Resp."). We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314, which provides that an *inter partes* review may not be instituted unless the information presented in the petition "shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition."

For the reasons set forth below, we deny the Petition.

A. Related Matters

The '467 patent is asserted against Petitioner in *SiOnyx LLC v. Hamamatsu Photonics K.K.*, Case No. MAD-1-15-cv-13488 (D. Mass.) Pet. 1; Paper 4, 1.

B. The '467 Patent

The '467 patent is titled "Silicon-Based Visible and Near-Infrared Optoelectric Devices." Ex. 1001, [54]. The '467 patent issued from U.S. Patent Application No. 12/776,694, filed on May 10, 2010. *Id.* at [21], [22]. The '467 patent is a continuation of U.S. Patent Application No. 12/365,492, filed on February 4, 2009, which is a continuation of U.S. Patent Application No. 11/445,900, filed on June 2, 2006 (now U.S. Pat. No. 7,504,702), which is a continuation of U.S. Patent Application

No. 10/950,230, filed on September 24, 2004 (now U.S. Patent No. 7,057,256), which is a continuation-in-part of U.S. Patent Application No. 10/155,429, filed on May 24, 2002 (now U.S. Patent No. 7,390,689). *Id.* at [63]. The ’467 patent claims priority to U.S. Provisional Patent Application No. 60/293,590. *Id.* at [60].

The ’467 patent describes methods for fabricating “silicon photodetectors that are suitable for detecting electromagnetic radiation over a wide wavelength range, e.g., from visible to the infrared, with enhanced responsivity.” Ex. 1001, 1:28–31. The ’467 patent explains that although silicon is less expensive and more easily oxidized than other semiconductors, its utility in photodetectors is limited by the fact that it “is a relatively poor light emitter,” and not well-suited “for use in detecting radiation having long wavelengths, such as, infrared radiation employed for telecommunications.” *Id.* at 1:32–41.

The ’467 patent discloses a two-step process for producing silicon-based photodetectors that purportedly exhibit superior long-wavelength absorption and responsivity relative to silicon-based photodetectors fabricated using prior art methods. *Id.* at 5:58–65, 10:54–65, 12:4–18, 16:63–17:4. In the first step, the “surface of a silicon substrate is irradiated with one or more laser pulses while exposing the surface to a substance having an electron-donating constituent so as to generate surface inclusions containing a concentration of the electron-donating constituent.” *Id.* at 5:58–65. In the second step, the substrate is annealed at “a sufficiently elevated temperature for a selected time duration so as to cause an increase in the charge carrier density in the microstructured layer, e.g., by a factor in a range of about 10 percent to about 200 percent." *Id.* at 10:54–60. The '467 patent teaches that the substrate can preferably be annealed at a temperature in a range of about 500 K to about 900 K, for a duration in a range of about a few minutes to about a few hours. *Id.* at 10:60–67.

With regard to the laser pulse irradiation step, the '467 patent discloses that the resultant, unannealed, surface "exhibits an undulating surface morphology (topography) with micron-sized surface height variations" (Ex. 1001, 7:42–43), as well as improved photon absorptance for longer-wavelength radiation, such as infrared (*id.* at 12:4–18). Figure 5 of the '467 patent is reproduced below.

FIG. 5

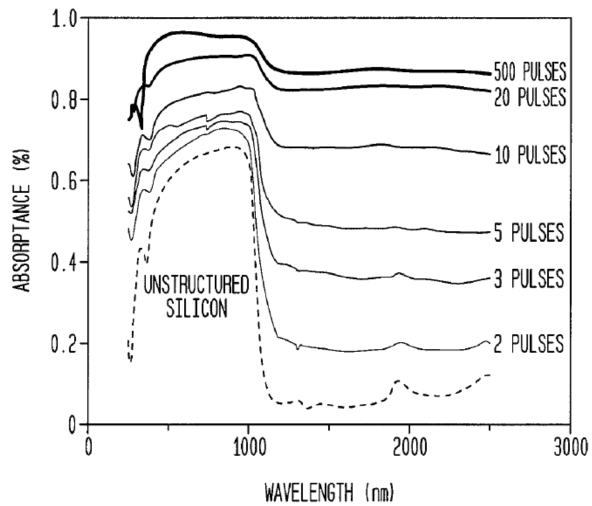

Figure 5 shows "wavelength absorptance of prototype microstructured silicon wafers as a function of an average number of 100 laser shots (8 kJ/m^2) per location employed for microstructuring the wafers in the presence of SF_6." *Id.* at 4:9–13. "This exemplary data indicates that the microstructured wafers exhibit an enhanced absorption of incident electromagnetic radiation, relative to unstructured silicon, across the entire recorded wavelength range, and particularly for wavelengths above about 1050 nm, which corresponds to the band-gap energy of crystalline silicon (1.05 eV)." *Id.* at 12:4–9.

The '467 patent additionally reports that "proper annealing," exemplified as annealing at a temperature of 725 K or 825 K, enhances the responsivity of a photodetector employing a wafer irradiated in accordance with the first step described above. Ex. 1001, 16:63–17:4. Figure 13 of the '467 patent is reproduced below.

FIG. 13

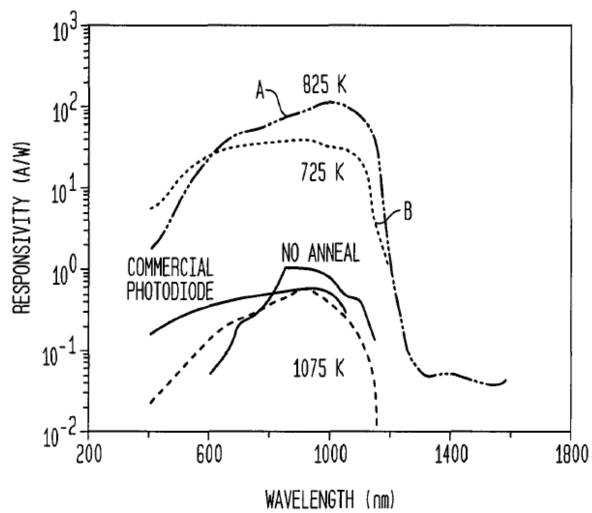

Figure 13 "presents graphs depicting responsivity of a plurality of silicon wafers microstructured by exposure to femtosecond laser pulses in the presence of SF_6 (with no annealing and with annealing at different temperatures) as a function of wavelength in comparison with that of a commercial photodiode." *Id.* at 56–61. The '467 patent explains that

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