UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

SIONYX, LLC and PRESIDENT AND FELLOWS OF HARVARD COLLEGE,	)	
Plaintiffs,	)	**Civil Action No. 15-13488-FDS**
v.	)	
HAMAMATSU PHOTONICS K.K., HAMAMATSU CORP., and OCEAN OPTICS, INC.,	)	
Defendants.	)	

MEMORANDUM AND ORDER
ON CROSS-MOTIONS FOR SUMMARY JUDGMENT

SAYLOR, J.

This is an action for patent infringement, breach of contract, and correction of inventorship. The technology at issue involves a device that improves the detection of near-infrared light, which has a variety of potential commercial and scientific applications. Plaintiff SiOnyx, LLC alleges that it approached defendant Hamamatsu Photonics K.K. ("HPK") concerning a potential business partnership involving the technology. The parties entered into a nondisclosure agreement and SiOnyx provided HPK with certain technical information.

SiOnyx alleges that after the approach proved unsuccessful, HPK violated the nondisclosure agreement, obtained patents on SiOnyx's technology without naming SiOnyx personnel as inventors, and infringed other patents held by SiOnyx. HPK contends that its engineers independently developed the technology contained in its patents and practiced by its products, and that it does not infringe SiOnyx's patents.

Defendants previously filed six motions for partial summary judgment, and plaintiffs filed a seventh, which the court addressed in a memorandum and order on July 24, 2018. Defendants have now filed five additional motions for partial summary judgment, and plaintiffs have filed another such motion.

For the following reasons, those motions will be granted in part and denied in part.

I. Background

A. Factual Background

The following facts appear to be undisputed.

1. The Parties

SiOnyx, LLC was founded in 2006 by Eric Mazur, a physics professor at Harvard University, and James Carey, his former doctoral student. (ECF 337-40 at 7:5-6, 8:3-9:7). Their goal was to commercialize laser-textured black silicon photodetectors, which had been the topic of Carey's Ph.D. dissertation and postdoctoral work in Mazur's laboratory. (ECF 337-40 at 9:15-11:11). Stephen Saylor joined SiOnyx in the fall of 2006 as President and CEO. (ECF 337-40 at 9:8-14).[1] SiOnyx owns U.S. Patent No. 8,680,591, which it asserts in this lawsuit. (ECF 163-2 ¶¶ 12-17, 19).

The President and Fellows of Harvard College ("Harvard") are the assignees of the other patent asserted in this lawsuit, U.S. Patent No. 8,080,467, which covers Mazur and Carey's work.[2] SiOnyx is the exclusive licensee of that patent. (ECF 342 Ex. G).

Hamamatsu Photonics K.K. is a Japanese integrated photonics company that researches,

[1] Stephen Saylor is no relation to the undersigned judge.

[2] The complaint in this case also included allegations of infringement of U.S. Patent No. 7,884,446 (owned by Harvard and naming Mazur as an inventor), but the parties have since stipulated to dismissal of that patent from the suit. (ECF 422).

develops, and manufactures optical devices and image sensors. (ECF 163-2 ¶¶ 54-55; ECF 178 ¶¶ 54-55; ECF 337-41 at 114:5-18). It is the assignee of U.S. Patent Nos. 8,564,087; 8,629,485; 8,742,528; 8,884,226; 8,916,945; 8,994,135; 9,190,551; 9,293,499; and 9,614,109, in addition to several Japanese patents covering similar inventions. (ECFs 337-22 through 337-31).

Hamamatsu Corporation ("HC") is the marketing and sales company responsible for distributing HPK's products in North America. (ECF 97 at 3). It is a New Jersey corporation with its principal place of business in New Jersey. (ECF 97 at 3). HC is a wholly owned subsidiary of Photonics Management Corp., which is a holding company owned by HPK. (ECF 97 at 3, 13). HC purchases products from HPK at a price set by HPK. (ECF 97 at 3; ECF 382-1 at 62:21-65:7). HC has the authority to set its own resale prices, and it separately profits from its sales to end users. (ECF 97 at 3; ECF 382-1 at 62:21-65:7).

Ocean Optics is a Florida corporation with its principal place of business in Florida. (ECF 163-2 ¶ 6). It primarily sells spectrometers, some of which incorporate photodiodes purchased from HC. (*See* ECF 529-2 at 6, 9; ECF 529-3 at 107:13-108:20, 146:2-11).

2. The Technology at Issue

The technology at issue involves silicon photodetectors where one surface has been irradiated by a pulsed laser beam.

The photodetectors use p-n photodiodes, which work by transforming light into electrical current. The photodiode is formed from a silicon semiconductor substrate that has two types of charge-neutral impurities: (1) those that donate electrons (n-type impurities) and (2) those that accept electrons (p-type impurities), which can be said to have electron "holes." (ECF 377-1 at 87). When n-doped silicon is placed next to p-doped silicon, it creates a p-n junction, around which the electrons and holes rearrange themselves until they reach an equilibrium. (ECF 377-1 at 88-89). At equilibrium, there is a thin insulating layer at the juncture where the electrons and

holes (charge carriers) have recombined (depletion region), and an electric field—created by the ions left behind when the electrons and holes diffused away—preventing further diffusion. (ECF 377-1 at 89; *see* ECF 201 at 13:10-14:20).

The outermost electrons associated with the silicon substrate are said to be in the "valence band," and have a certain energy. The next-highest energy state available is in the "conduction band." The difference in energy between the valence band and the conduction band is a physical property of the semiconductor material; for silicon, the band-gap energy is about 1.07 eV, which corresponds to light with a wavelength around 1100 nm. (ECF 377-1 at 1, 63-64).

If a photon of sufficient energy (that is, for silicon, one with a wavelength of less than 1100 nm) interacts with the silicon substrate, it may transfer its energy to an electron in the valence band and promote it to the conduction band; in other words, the photon is absorbed. (ECF 377-1 at 63; *see* ECF 201 at 10:21-11:21). Higher-energy photons will be absorbed closer to the light-incident surface, while lower-energy photons are absorbed deeper in the substrate. (ECF 386 Ex E at HPK0022535; *see* ECF 201 at 12:8-13:9, 15:11-16:16).

When a photon is absorbed, it creates an electron-hole pair (by promoting an electron to the conduction band). (ECF 377-1 at 93). If the photon is absorbed in the depletion region of the photodiode, the electron and the hole are immediately separated because of the electric field, which creates a current. (ECF 377-1 at 93-94). Photons absorbed too far away from the depletion region are much less likely to produce a current. (ECF 201 at 15:11-16:16).

Thus, in an ordinary p-n photodiode, light enters through one surface of the photodiode and, to some extent, is absorbed in the depletion region, resulting in electric current. (ECF 377-1 at 63). Light that is not absorbed will either go right through the photodiode (in which case it

does not contribute to the sensitivity of the photodiode) or reflect off the back surface of the photodiode back into the photodiode, in which case it has another opportunity to be absorbed and turned into current. ('109 patent, col. 7 ll. 24-34). Whatever portion of that light is still unabsorbed after a second trip through the photodiode will either pass through the light-incident surface (again without contributing to the sensitivity of the photodiode) or be reflected by that surface, and so on. ('109 patent, col. 7 ll. 34-37). Infrared light is more likely to go through the photodiode without being absorbed than visible light, because its longer wavelength (and correspondingly lower energy) is absorbed deeper in the substrate and its energy may be insufficient to bridge the band gap of the silicon semiconductor. (ECF 377-1 at 6-7, 63-64; *see* ECF 201 at 9:3-13; 12:1-7).

The technology at issue seeks to improve the sensitivity of the photodiode to near-infrared light by irradiating a surface of the silicon substrate with a laser. That irradiation creates an irregular texture on the surface, so that, instead of being smooth, it has micro- or nanometer-scale features that cause the surface to look black to the human eye. (ECF 377-1 at 6-7). Changing the parameters of the irradiation protocol can change the size and shape of those features. (ECF 377-1 at 55 tbl.3.2).

When applied to the back surface of a photodiode, the irregular asperity has the effect of improving the sensitivity of the photodiode to infrared light. In that case, the light enters the photodiode from one surface, and, as before, some is absorbed by the substrate. But instead of meeting a smooth surface on the backside of the photodetector, the unabsorbed light meets the irregular asperity. Light components that hit the asperity an angles greater than or equal to 16.6° will be totally reflected, and because the asperity is irregular, they will be reflected back toward the first surface and the side surfaces in many different directions. ('109 patent, col. 7 ll. 39-50).

Because they are arriving from all different directions, they "are extremely highly likely to be totally reflected" on the first and side surfaces, and therefore to be "repeatedly totally reflected on different faces to further increase their travel distance" inside the photodiode. ('109 patent col. 7 ll. 51-59). By increasing the travel distance of light inside the photodiode, the asperity makes a thinner piece of silicon act "thicker," and infrared light that otherwise would pass through can be absorbed "deeper" than the photodiode actually is. (*See* ECF 201 at 16:12-18:3). The longer the light is trapped within the photodiode, the more likely it is to be absorbed and generate current, and the more sensitive the photodiode will be. ('109 patent, col. 7 l. 59-col.8 l. 2; *see* ECF 201 at 12:8-13:9; 17:20-18:3; 20:6-21:3).

3. HPK's Knowledge of Harvard's Early Black Silicon Work

On January 12, 2006, James Roberts (of HC's University Sales and Marketing department) sent a report about Harvard's black-silicon technology to Koei Yamamoto (Senior Executive Managing Director and General Manager of HPK's Solid State Division). (ECF 482-3). It summarizes ten academic publications and two published patent applications that list Carey and Mazur as inventors: U.S. Patent Application Publication Nos. 2003/0029495 (Application No. 10/155,429) and 2005/0127401 (Application No. 10/950,230). Those applications are ancestors of the '467 patent, which is asserted in this action, and the '446 patent, which has been dropped from this action.[3] Roberts updated the report in October 2006, to explain that Carey had left Mazur's lab to found SiOnyx and that SiOnyx had received seed funding, and emailed it to Yamamoto again. (ECF 474-9; ECF 526-2). The updated report cites to the same ten publications and two published patent applications that the original report cites to.

[3] The '591 patent asserted in this action is from a different family of patents.

HPK produced a slide presentation created by Terumasa Nagano (of HPK's Microelectrical Mechanical Systems Manufacturing Development Group) in November 2006, around the time that it began discussions with SiOnyx. That presentation describes Mazur and Carey's laser-texturing work at length. (ECF 377-14 at HPK0068525-39; *see* ECF 536-1 (Harvard's U.S. Pat. App. Pub. No. 2005/0127401)). It also includes two device architectures with surfaces textured by a silicon-dry-etching technique. The first shows a textured surface on the same side as the p-n junction (like Carey's preferred architecture, described below). The second has a textured surface opposite the p-n junction (like Carey's Alternative #1, described below). (ECF 377-14 at HPK0068533). Neither diagram indicates the surface through which the light enters the device, and the second needs to be flipped upside-down to match up with Alternative #1. An earlier slide in the same presentation states: "During dry-etching of Si, debris, naturally oxidized film, and so forth that stuck to the Si surface become a micro-mass, and the pillar-shaped structure is formed. → A failure for Si etching." (ECF 377-14 at HPK0068525).

4. The 2007 Nondisclosure Agreement

In late 2006, SiOnyx, through Mazur, reached out to HPK about a possible business relationship. (ECF 337-40 at 14:3-15:15; ECF 353 Ex. B at 119:4-24). Mazur, Carey, and Saylor went to Japan in November 2006 to meet with representatives of HPK, where Mazur gave a presentation introducing the technology. (ECF 386 Ex. F at 22:4-25:8; *see id.* Ex. E).

SiOnyx and HPK entered into a mutual nondisclosure agreement on January 11, 2007, to facilitate a possible business relationship. (ECF 337-2). The nondisclosure agreement provides:

> Each of the parties has developed certain products, technology and methodologies, including information that each party regards as confidential, proprietary, trade secret information. Each party proposes to disclose certain of such information to the other party, to be used by the other party solely for the limited purpose of EVALUATING APPLICATIONS AND JOINTS [sic]

> DEVELOPMENT OPPORTUNITES OF PULSED LASER PROCESS DOPED PHOTONIC DEVICES and for no other purposes whatsoever (the "Permitted Purpose.").

(ECF 337-2 at 1). SiOnyx and HPK agreed that any breach of the nondisclosure agreement would constitute irreparable harm, so that the "Disclosing Party" would be entitled to equitable relief to enforce the agreement. (ECF 337-2 at 2). And they agreed that all ownership rights in any intellectual property arising from "Confidential Information" would remain with the "Disclosing Party" in the absence of a separate written instrument expressly granting those rights. (ECF 337-2 at 2).

5. The Confidential Architectures

On January 16, 2007, Saylor and Carey met with Keith Kobayashi (of HPK's International Division) and Yamamoto by telephone to plan possible experimental prototypes. (ECF 337-3; ECF 337-40 at 17:13-19, 19:19-20:9).

The following day, on January 17, 2007, Carey emailed Kobayashi "the first draft of a device architecture we would like to pursue." (ECF 337-3 at 2). He explained that "[t]he suggested device architecture was selected based on our past experiments and what we believe is compatible with current Hamamatsu photodetectors," and he "also included two possible alternatives if the preferred architecture is difficult." (ECF 337-3 at 2-3). The "preferred" device architecture showed a laser-processed layer on the top of the device. (ECF 337-3 at 4). The first alternative—"Alternative #1"—showed a p-n photodiode where the laser-textured layer was positioned on the back of the device, opposite the side where light would enter the device. (ECF 337-3 at 5; ECF 337-40 at 19:13-20:21).

Carey testified that prior to his January 17, 2007 email, neither he nor anyone else at SiOnyx had ever discussed the idea of locating the laser-textured layer as depicted in Alternative #1 with anyone outside SiOnyx. (ECF 337-4 at 345:20-346:2; ECF 337-40 at 20:10-21:1).

6. The SiOnyx-HPK Collaboration

On April 4, 2007, Saylor traveled to Japan to meet with representatives of HPK. At the meeting, HPK representatives showed a presentation created by Akira Sakamoto (of HPK's Solid-State Production Development Group) at the direction of Yamamoto. The presentation outlined a plan for HPK to make four types of silicon test wafers, each created by up to three different processes. (ECF 337-8 at 55:5-57:17; ECF 337-7). The wafers would be laser textured by SiOnyx, sent back to HPK for final processing, and tested for their optical-response characteristics. (ECF 337-8 at 14:6-15:3). That presentation showed architectures very similar to those proposed by Carey, and included devices where the texture was placed on the light-incident surface. (*Compare* ECF 337-3 *with* ECF 337-7).

Between April and November 2007, SiOnyx and HPK jointly tested 38 wafers. HPK fabricated the test devices up until the laser-texturing step, and mailed them to SiOnyx for texturing. SiOnyx then returned them to HPK for final processing and testing. (ECF 337-8 at 14:3-15:3; ECF 337-40 at 44:21-45:20). The results of the testing showed that at least some of the devices that were laser-textured by SiOnyx had improved infrared photosensitivity as compared to one of HPK's standard devices. (ECF 337-9 at HPK0010411). The testing also showed that the photosensitivity of devices having the laser-textured surface on the side of the device opposite from the direction of incident light (front illuminated, in this case where the textured surface is on the back) had stronger performance than devices having the laser-textured surface on the same side as the incident light (back illuminated), which performed significantly worse than the reference device. (ECF 337-11 at 14).

Some knowledge about laser-texturing devices was in the public domain—due, in part, to Mazur's many academic publications on the topic. Carey testified, however, that SiOnyx had discovered that there was a preferred target size for the structures making up the texture, which

balanced optical response against certain disadvantageous properties. That texture, and the process for making it, was confidential information of commercial value to SiOnyx. (ECF 337-40 at 21:2-22:1). SiOnyx, when it textured the test devices from HPK, used its confidential process to produce its preferred texture. (ECF 337-40 at 49:21-50:14). But SiOnyx shared very limited information as to the process parameters for achieving that texture with HPK—nothing except the identity of the ambient gas in the laser-processing chamber. (ECF 337-10; ECF 45-2 at 69:4-15, 94:3-7). As part of the testing procedure, HPK took scanning-electron-microscope ("SEM") images of the textures, which showed detailed images of textures achieved and allowed structural features of the textures to be measured. (ECF 337-9 at HPK0010405-08, HPK0010415). Carey testified that the size of the features shown in these SEM images were within the target range identified by SiOnyx, which he considered to be confidential. (ECF 337-40 at 49:5-50:14).

An employee of HC was at the initial November 2006 meeting, and another employee of HC actually signed the nondisclosure agreement on behalf of HPK, but following that there were no communications between SiOnyx and HC. (ECF 97 at 13; ECF 345 Ex. Q at 172:10-19, Ex. S at 255:3-256:21, Ex. U at 121:10-15).

7. The End of the Collaboration and HPK's Further Activities

After the testing was finished, Saylor and Kobayashi exchanged a few emails concerning the possibility of further tests. (ECF 337-12). But on January 15, 2008, Kobayashi responded as follows:

> After discussing with related people mainly from technical aspects, we reached to the following conclusions.
>
> As a commercial entity, [HPK], of course, has to study the possibility to enhance our product capability. However, we are not confident that black silicon technology will greatly contribute. We would rather like to stick with our own technique/technology for that purpose because we would like to keep our own

> pace of development and accumulate our own know-hows. In [HPK] culture, business decisions almost always come after full technical evaluation, which seems to be quite different from your company. Therefore, we would like to do study by ourselves without further reference to proprietary information of SiOnyx.

(ECF 337-12 at 1). The collaboration effectively ended at that time.

That same day, someone from HPK's Central Research Laboratory emailed Kobayashi to say that technology regarding the processing of black silicon was a top priority. (ECF 337 ¶ 45 (Pl. SMF); *see* ECF 377 ¶ 45 (Def. Response)).

Nagano testified that HPK kept the test wafers than had been textured by SiOnyx until at least 2010. (ECF 337-13 at 84:5-16). Prototype reports from April 29 and May 22, 2008, show that HPK's Central Research Laboratory was attempting to replicate the quantum efficiency of the SiOnyx-textured device and comparing the textures they were able to achieve to those SiOnyx achieved. (ECF 337-36 at SIONYXHARVARD_00107908, SIONYXHARVARD_00107916; ECF 337-43 at HPK0012401, HPK0012412, HPK0012425; *see* ECF 337 ¶ 53). A presentation dated July 17, 2008—authored by Sakamoto and Nagano and titled "Black Silicon Technology In-House Production"—has, as its first page, a slide titled "PD sensitivity characteristics increase by SiOnyx Company laser processing." (ECF 337-13 at 131:22-132:25; *see also* ECF 337-14 (mostly in Japanese, but containing the words "Black Si" and "SiOnyx" in English)). That slide shows a graph of photosensitivity at different wavelengths of light (the same characteristics measured during the SiOnyx-HPK collaboration) that compares the performance of SiOnyx's device (labeled "SPL Si PD") with HPK's standard silicon photodiode (labeled "STD Si PD"). (ECF 337-13 at 134:11-136:10; ECF 337-14 at HPK0038509). Another slide in that presentation states that HPK had attempted its own laser texturing, but was not able to achieve the same infrared-sensitivity improvement as SiOnyx. (EDF 337-13 at 137:16-139:15; ECF 337-14 at HPK0038511). And another slide contains a

schedule, as to which Nagano testified:

> Q. Just looking at row 6, the first element in the rightmost column says prototype 1 comparison with SiOnyx; is that correct?
>
> A. Yes.
>
> Q. And in the next row down, row 7, does that refer to progress?
>
> A. Yes.
>
> Q. And the first item under progress is completed data acquisition of existing patterns SiOnyx laser processing; is that correct?
>
> A. Yes.

(ECF 337-13 at 140:4-20; *see* ECF 337-14 at HPK0038512).

Another HPK presentation, dated July 31, 2008, contains a slide titled "laser process conditions," and shows three scanning electron microscope ("SEM"**)** images. (ECF 337-13 at 142:15-23; ECF 337-17 at HPK0024515). The leftmost image is labeled "SiOnyx." (ECF 337-13 at 142:24-25; ECF 337-17 at HPK0024515). Under the third image, the text reads "visually equivalent to SiOnyx's wafer" and that, like SiOnyx's wafer, "no silicon scum is attached." (ECF 337-13 at 145:4-13; ECF 337-17 at HPK0024515).

Sakamoto testified that HPK's Central Research Laboratory had examined SiOnyx's publications and attempted to estimate the process conditions for the laser texturing. However, it was unable to recreate the texture shown in those publications, and saw almost no surface roughness. (ECF 337-8 at 119:5-122:16). He also testified that "[t]he samples provided to us by SiOnyx, we looked at them in the prototyping of the silicon photodiode black silicon processing." (ECF 337-8 at 122:1-16). Yamamoto testified that for the photodiode product that HPK produced, the "wafers were prepared by Hamamatsu without using the wafers from SiOnyx." (ECF 337-19 at 140:12-15). He further testified:

> Q. And that's because the Solid State Division had wafers that SiOnyx

had created the texture and worked to replicate that texture and the performance of that texture before you released a commercial product; isn't that true?

Mr. Simmons: Objection to form.

The Witness: No.

By Mr. Belanger:

Q: And you agree that if [HPK] had done that, that would have been a violation of your agreement with SiOnyx, correct?

Mr. Simmons: Objection to form.

The Witness: Yes.

(ECF 337-19 at 140:24-141:13).

8. The 2009 Photonics Fair Emails

A few years later, on February 9, 2009, Kobayashi sent an email to Saylor and Mazur at SiOnyx stating that "[HPK] will introduce various products under development at our general exhibition, PHOTON FAIR 2009 in February in Hamamatsu, Japan" and that "[o]ne of these products is Silicon Photodiode with higher sensitivity covering through 1200nm range." (ECF 316 Ex. E at 1). It reminded Saylor and Mazur that when the HPK-SiOnyx talks terminated, HPK had "informed you that we, by ourselves, would like to focus our development efforts on photovoltaic type," and explained that "while we are greatly appreciating having given us an opportunity to think about further enhancement/improvement of our accumulated know-how as a photonics company, we do not think we are infringing any of your IP or originality, or breaching any obligation of confidentiality." (*Id.*).

The email attached a file showing the architecture of HPK's device and a chart of its spectral photosensitivity. (*Id.* at 2). The email also described the device, stating that it "has PN junction on the one side and the back side consists of an accumulation layer by ion implantation over the black silicon surface fabricated by laser in the inert gas atmosphere." (*Id.* at 1).

Saylor responded by email ten days later, as follows:

> Regarding our prior collaboration and information exchanged under Mutual Non-Disclosure Agreement, SiOnyx is confident that [HPK] will ensure the integrity of SiOnyx confidential information. While the diagram provided in your email is insufficient for our understanding, it looks very similar to the work product of our collaboration. Should [HPK] wish to provide SiOnyx detailed specifications and English translation versions of the presentation materials planned for the Photon Fair, we may be able to comment on your conclusion that your laser processed NIR enhanced Silicon Photodiode does not utilize SiOnyx IP or violate any provisions of our prior agreement.

(ECF 316 Ex. H at 1).

On February 24, 2009, Kobayashi replied with the following assurances:

> First of all, we would like to emphasize that we only applied our own know-how and technology to the developed products, which we will introduce at our Photon Fair. . . . Although we briefly discussed the results, our structure and processes in the attached file are our own idea. Therefore, we strongly believe that our developed product does not infringe your patents or use any of your proprietary information disclosed to us because the development is based on only our own wafer process technologies. We believe that following points are explicit differences.
>
> > We do not use Femto second laser for fabrication of black silicon surface[.]
> > Laser treatment is in the inert gas atmosphere[.]
> > We form backside accumulation layer by ion implantation and high temperature annealing[.]
>
> All of above technologies are our own technologies. . . . [HPK] believes that we only applied our own know-how and technologies to the development of photovoltaic type Silicon Photodiode to be introduced at the Photon Fair.

(ECF 316 Ex. I at 1). That email attached a step-by-step process flow diagram, in English, describing how HPK's photodiode was made. (ECF 316 Ex. I at 4). HPK admits that the process-flow diagram was very similar to one discussed by the parties during the collaboration. (ECF 315 at 2-3; *see* ECF 316 Ex. B at 2).

Saylor replied on March 10, 2009, that SiOnyx would "review the information provided," and reiterated its interest in a possible business relationship with HPK. (ECF 316 Ex. K at 1). That same day, Kobayashi replied that HPK was not interested in a business relationship with

SiOnyx at that time. (ECF 316 Ex. L at 1). On April 15, 2009, Kobayashi contacted Saylor again to say that he hadn't heard from him about the proposed disclosure at the Photon Fair and to thank him for his "understanding that our technique explained in our e-mails is not infringing your intellectual property." (ECF 316 Ex. M at 1). There was no other communication between the parties about the photodiode HPK planned to show at the Photon Fair.

The parties were asked about those communications in their depositions. Carey testified that HPK's first email was concerning because it seemed to him that the diagram HPK sent depicted a device that would be covered by SiOnyx's intellectual property. (ECF 316 Ex. F at 265:16-266:11, 273:17). Mazur also testified that he thought the device shown in the diagram would be covered by SiOnyx's intellectual property. (ECF 316 Ex. G at 157:14-24). He further testified that the differences HPK pointed out in their second email failed to convince him that the HPK product did not infringe SiOnyx's rights. (ECF 316 Ex. G at 161:5-24, 163:1-165:24, 167:1-171:24). Saylor, testifying as SiOnyx's Rule 30(b)(6) deposition witness, stated that the architecture of HPK's photodiode was "the same architecture from an optical perspective as what Jim Carey disclosed." (ECF 316 Ex. J at 191:16-23). But he also testified that while Carey and another employee had suspicions because it was close to what SiOnyx and HPK had worked on together, Saylor "emphasized with them that [HPK] is clearly articulating to us that they had independently developed all of this." (ECF 316 Ex. J at 192:4-19). He read the emails "to mean that none of the people who worked on the project with us would have worked on this, because in big companies, you typically—what you would do is, you would firewall your team, so I'm assuming that's what they've done; otherwise, I don't know how he can claim that it's all their own know-how. They must have firewalled the team." (ECF 316 Ex. J at 189:3-10). He found Kobayashi's final email to be "amusing" because it thanked him for an understanding that he

never gave, but he never corrected him or sent a response. (ECF 316 Ex. J at 201:14-202:15).

A certified translation of an email sent on February 6, 2009, from Sakamoto to Kobayashi contains a draft of the email to SiOnyx. The text above that draft states:

> Thank you for all you'd done during the infrared high sensitivity device studies performed with SiOnyx the year before last. One sample prepared at that time was commercialized this time and the technology will be displayed at the Photon Fair. Although considered not likely to be in conflict with the patent filed by Harvard College, because there is a description, "photodetector that detects even at the wavelength of energy at or less than the Si bandgap due to a femtosecond laser processing" in one claim, and the N2 gas atmosphere is also described, we have been reviewing how to make the presentation. As a result, if it is commercialized and becomes successful business in the future, rather than hiding a risky notation, we have decided to appeal that our processing is completely different than the one performed by SiOnyx by clarifying the specifics. It is a fact that it was jointly studied in 2007 and since the structure of the sample fabricated at that time and the technique used were already defined, please convey this and notify of the commercialization.

(ECF 326-4 at 6-7). In response to the draft, Kobayashi asked, "Was the sample prepared at that time the one we prepared? And what kinds of information did we receive from SiOnyx for our preparing the sample?" (*Id.* at 5). Sakamoto responded that the sample was the one HPK had prepared, but that SiOnyx had done the black-silicon laser processing; that he thought they had received some information concerning the laser conditions from SiOnyx; and that while they had also received information concerning annealing conditions from SiOnyx, they were not currently using those annealing conditions. (*Id.*).

When asked about that email exchange, Kobayashi testified as follows:

> Q. [Sakamoto] suggests that you tell SiOnyx that you intend to commercialize the structures and methods that you jointly studied in 2007, correct?
>
> . . . .
>
> THE WITNESS: Well, if you put the two parts together, it may come out to that. What we wanted to impress upon SiOnyx was that what we are doing is something completely different. The background to this is that there is the fact that the way of making the structures was something that we had worked on jointly and wanted to make that clear to SiOnyx that what we were doing was

something different.

(ECF 326-6 at 109:5-23).

> Q. So you—your understanding of this email is Sakamoto was trying to give the impression that the [HPK] products were based only on information in the public domain?
>
> A. I believe what it was, was to give the impression that it was information in the public domain and also information that belonged to HPK itself.

(*Id.* at 123:18-25).

9. The Patents of HPK

As relevant to this lawsuit, HPK owns nine U.S. patents relating to silicon photodetectors with a textured surface that improves absorption of near-infrared light. U.S. Patent Nos. 8,564,087 ("the '087 patent"); 8,629,485 ("the '485 patent"); 8,742,528 ("the '528 patent"); 8,884,226 ("the '226 patent"); 8,916,945 ("the '945 patent"); 8,994,135 ("the '135 patent"); 9,190,551 ("the '551 patent"); 9,293,499 ("the '499 patent"); and 9,614,109 ("the '109 patent"). (ECFs 337-22 through 337-31).

HPK started applying for its Japanese patents in February 2009, and U.S. patents in February 2010. One or more of Sakamoto, Yamamoto, Nagano, and Kazuhisa Yamamura (another employee of HPK) are listed as inventors on every patent except the '226 patent. Seven of the nine patents (the '087, '528, '945, '485, '135, '551, and '109 patents) cite to patents or published patent applications in the same family as Harvard's patent, discussed below. Six of the nine patents (the '485, '528, '945, '135, '551, and '109 patents) claim priority to Japanese Patent Application 2009-041078. The "invention submission form" of that Japanese application mentions the collaboration between SiOnyx and HPK as part of the "background and motive of the invention." (ECF 337-34; ECF 337-35 at SIONYXHARVARD_00107991; *see* ECF 337

¶ 70 (Pl. SMF); ECF 377 ¶ 70 (Def. Response)).[4]

Those same six patents describe an embodiment wherein the photodiode is configured to have a laser-processed layer on the surface opposite to the light-incident surface, and contain, as Figure 11, a diagram of an architecture very close to the architecture Carey provided to HPK as "Alternative #1." ('485 patent, fig.11, col. 7 ll. 8-12; '528 patent, fig.11, col. 8 ll. 18-23; '945 patent, fig.11, col. 6 ll. 31-36; '135 patent, fig.11, col. 8 ll. 25-30; '551 patent, fig.11, col. 6 l. 66-col. 7 l. 4; '109 patent, fig.11, col. 7 ll. 18-23). The '087 patent shows a more complicated architecture at Figure 6 that nonetheless incorporates the basic idea of an irregular asperity opposite the p-n junction and incident light. ('087 patent, fig.6, col. 7 ll.7-26).

The six patents containing an architecture close to Carey's "Alternative #1" also contain a figure showing the invention's increased photosensitivity in the near-infrared range, which is similar to the results obtained from the HPK-SiOnyx joint testing. ('485 patent, fig.12, col. 8 ll. 31-35; '528 patent, fig.12, col. 9 ll. 32-46; '945 patent, fig.12, col. 7 ll. 44-58; '135 patent,

[4] There is some confusion as to the exact translation of the document. A certified translation of the document says: "Background and Motivation for the Invention . . . . From April through December 2007, in joint development with SiOnyx, the femtosecond laser of SiOnyx was used to prototype Si photodiodes that are sensitive to infrared." (ECF 337-35 at SIONYXHARVARD_00107991). Yamamura was asked about this document at his deposition, and the interpreters seemed to disagree slightly:

> Q. And what is the title of this section, the first line on this page on the left?
> A. The background and the motive of the invention.
> Q. And could you read the first sentence starting with 2007, please?
> A. Just the first sentence?
> Q. Yes, please.
> A. From April to December 2007, in collaboration with SiOnyx using femtosecond laser from SiOnyx, we prepared the prototype of a silicon PD that has infrared sensitivity.
> . . . .
> Check Interpreter. Excuse me. The beginning of the sentence, it was during our joint develop [sic] with SiOnyx, we did these things.
> The Lead Interpreter. In collaboration with SiOnyx.
> Check Interpreter. I have development.

(ECF 337 ¶ 70 (Pl. SMF, quoting from pages of the Yamamura deposition which are not attached to the motion); ECF 377 ¶ 70 (Def. Response, admitting that the quoted portion appears in the deposition)).

fig.12, col. 9 ll. 38-52; '551 patent, fig.12, col. 8 ll. 13-27; '109 patent, fig.12, col. 8 ll. 32-46). The '087 patent contains a figure showing somewhat improved sensitivity from illuminating the device from opposite the textured surface as compared to illuminating from the side with the textured surface, and much improved sensitivity from the use of texturing as compared to no texturing. ('087 patent, fig.13, col. 10 l. 64-col. 11 l. 13).

All nine patents teach an "irregular asperity," and contain a figure showing an SEM image of the asperity. ('087 patent, fig.5, col. 6 ll. 63-66; '485 patent, fig.8, col. 6 ll. 17-20; '528 patent, fig.8, col. 7 ll. 27-31; '226 patent, fig.6, col. 7 ll. 25-29; '945 patent, fig.8, col. 5 ll. 40-44; '135 patent, fig.8, col. 7 ll. 33-37; '551 patent, fig.8, col. 6 ll. 8-12; '499 patent, fig.8, col. 7 l. 61-col. 8 l. 1).

10. The Patents of SiOnyx and Harvard

One patent asserted in this lawsuit is owned by SiOnyx outright: U.S. Patent No. 8,680,591, which names six SiOnyx employees as inventors (but not Carey or Mazur). The other patent asserted in this lawsuit is owned by Harvard: U.S. Patent No. 8,080,467 (naming both Mazur and Carey as inventors). Harvard, however, licensed that patent to SiOnyx on an exclusive basis. (ECF 342 Ex. G). The Third Amended and Restated Exclusive Patent License Agreement dated July 27, 2015, gives SiOnyx the exclusive right to develop, make, use, sell, offer to sell, lease, or import the technologies covered by the claims. (ECF 342 Ex. G at 7-8).[5] In return, Harvard received a partial ownership interest in SiOnyx and the rights to certain royalties. (ECF 342 Ex. G at 11-17).

[5] The original exclusive patent-license agreement was dated February 10, 2006. (ECF 342 Ex. G at 1). It appears to have been amended to include new patents as they were filed.

11. HPK's S9840 CCD Sensor

HPK, HC, and Ocean Optics rely on HPK's S9840 CCD sensor in the invalidity contentions for the '591 patent. That sensor has been sold by HPK since 2005. (ECF 485-10 at 154; ECF 523 at C-4 through C-6). Defendants' invalidity contentions cite to an August 2007 datasheet and an October 2007 manufacturing specification, (ECF 523 at C-4 through C-6), as does the opinion of Dr. Shukri J. Souri, defendant's expert, (*e.g.*, ECF 485-10 at 155-56, 229, 236, 239-41). The datasheet was publicly distributed by HPK, but did not show the internal layers of the device or the manufacturing steps. (ECF 522-1 ¶ 20 Response). The manufacturing specification does show those layers and manufacturing steps, but is an internal HPK document that was not published or distributed to customers. (ECF 523-1 ¶¶ 3-5).

Defendants' expert, Dr. Souri, testified that in forming his expert opinion, he relied on documents, rather than the physical product itself:

> Q. You're relying on a Hamamatsu product as prior art for the '591 patent; correct?
>
> A. That is correct.
>
> Q. Did you test a sample of that product to support your opinion?
>
> A. No, I relied on publicly available information regarding that product.
>
> Q. Datasheets; correct?
>
> A. Yes.

(ECF 485-12 at 18:19-19:4).

12. Damages Evidence

Ocean Optics manufactures spectrometers, including the Maya2000 Pro and the Maya2000 Pro-NIR. The Maya2000 Pro incorporates Hamamatsu's (not-accused) S10420 CCD image sensor and uses aluminum mirrors. (ECF 529-3 at 50:4-11, 68:6-18). The Maya2000 Pro-NIR model incorporates Hamamatsu's (accused) S11510 CCD image sensor and uses gold

mirrors, making it uniquely suited to taking measurements in the near-infrared spectrum. (ECF 529-2 at 9; ECF 529-3 at 68:6-18).

Starting in October 2009 and extending to late 2010, Ocean Optics approached SiOnyx about supplying an image sensor for one of its spectrometers that would be able to extend its spectral range. (ECF 529-11 at 81:12-87:15; ECF 529-16). It appears that SiOnyx supplied some sensors to Ocean Optics at that time, but it is not clear whether Ocean Optics ever sold a spectrometer that incorporated a SiOnyx sensor. (ECF 529-11 at 85:17-87:15). In early 2011, Ocean Optics reached out to SiOnyx again regarding linear arrays. (ECF 529-11 at 89:1-91:4). SiOnyx did not have a sensor that met the specifications of Ocean Optics at that time, but indicated that it could develop one, although there would be nonrecurring engineering costs associated with that effort, which presumably SiOnyx would expect Ocean Optics to share. (ECF 529-11 at 91:10-99:15). Ocean Optics ultimately chose to use the S11510 manufactured by HPK, which it purchased through HC. (ECF 529-6 at 38:4-16; ECF 529-11 at 79:3-12, 99:16-24).

Plaintiffs' damages expert, Pauline Booth, provided a report in which she calculated reasonable-royalty damages based on a "hypothetical negotiation between SiOnyx and HPK and HC together, though the analysis would be the same for one party or the other because all of the relevant unit sales are overlapping and HC's 30(b)(6) witness indicated that 'for anything having to do with patents, we don't deal with it' generally deferring to HPK." (ECF 491-2 ¶ 122). She explained that she had "not analyzed a separate hypothetical negotiation with Ocean." (*Id.*). When asked about damages for Ocean Optics specifically at her deposition, she testified:

> Q: Do you give an opinion of damages for Ocean Optics in this case?
>
> A. I do not.
>
> Q. Why not?

A. I wasn't requested to split out any damages for Ocean Optics.

(ECF 491-3 at 88:4-9). However, the underlying data on which she based her opinion breaks out sales of the accused sensor from HC to Ocean Optics, and includes Ocean Optics' own data on sales of its accused spectrometer. (ECF 491-2 at 28 n.113, 68 n.284 (explaining that the underlying sales data from HPK was broken down into "sales to the U.S. for Ocean Optics" and "for U.S. other than Ocean Optics" and that sales data produced directly from Ocean Optics, although not utilized by her damages opinion, are nevertheless in the record); ECF 529-18 at 5:9-13:1 (testimony from Ocean Optics' 30(b)(6) deposition witness about spreadsheets detailing sales of the Maya2000 Pro-NIR))

B. Procedural Background

SiOnyx and Harvard filed this action on October 1, 2015. The second amended complaint, deemed filed on May 8, 2017, asserts 24 counts. Counts 1-14 and 21-24 seek relief under 35 U.S.C. § 256 and assert that Mazur and Carey should be named sole joint inventors on each of HPK's nine patents, or, alternatively, that they be named joint co-inventors with the inventors currently listed on those patents. (ECF 163-2 ¶¶ 127-168, 262-273). Count 15 seeks declaratory judgment of the same. (*Id.* ¶¶ 169-173). Count 16 alleges that HPK breached the nondisclosure agreement. (*Id.* ¶¶ 174-181). Count 17 alleges that HPK and HC were unjustly enriched. (*Id.* ¶¶ 182-188). Count 18 has been voluntarily dismissed. (ECF 422). And Counts 19-20 allege that all defendants have infringed each of SiOnyx and Harvard's patents. (ECF 163-2 ¶¶ 215-261).

On September 30, 2016, HC petitioned the Patent Trial and Appeal Board ("PTAB") for *inter partes* review ("IPR") of the '591 patent. (ECF 485-6) (PTAB IPR2016-01910). That petition identified HPK as a real party-in-interest, and requested that an IPR be instituted as to all 26 claims of the patent, as to one or more of five grounds. (ECF 485-6 at 1, 18-52).

Specifically, the petition requested review of:

- Claims 1, 4, 5, 7-9, 13, 24, and 25 for anticipation by Nakashiba[6];
- Claims 1-5, 7-9, 11, 13-22, and 24-26 for obviousness over Akahori[7] in view of Mazur[8];
- Claims 1, 2, 4, 5, 7-11, 13-21, and 23-26 for obviousness over Mabuchi[9] in view of Mazur;
- Claim 6 for obviousness over Mabuchi in view of Mazur and Uematsu[10]; and
- Claim 12 for obviousness over Mabuchi in view of Mazur and Furukawa.[11]

(ECF 485-6 at 18-52).

The PTAB instituted review on March 30, 2017. (ECF 485-8). But, as was its practice at the time, it instituted review only as to certain claims and certain grounds on which it deemed HC to have demonstrated a reasonable likelihood of prevailing:

- Claims 1, 4, 5, 7-9, 13, 24, and 25 for anticipation by Nakashiba;
- Claims 1, 2, 4, 5, 7-11, 13-18, 21, and 23-26 for obviousness over Mabuchi and Mazur;
- Claim 6 for obviousness over Mabuchi, Mazur, and Uematsu; and
- Claim 12 for obviousness over Mabuchi, Mazur, and Furukawa.

(ECF 485-8 at 42-43). The PTAB determined that HC had not demonstrated a reasonable

[6] U.S. Patent Application Publication No. 2007/0237504.

[7] U.S. Patent No. 6,204,506.

[8] U.S. Patent Application Publication No. 2003/0029495.

[9] U.S. Patent Application Publication No. 2003/0214595.

[10] Japanese Patent Publication No. H6-244444.

[11] U.S. Patent Application Publication No. 2006/0086956.

likelihood of prevailing in showing that claims 1-5, 7-9, 11, 13-22, and 24-26 were obvious over Akahori and Mazur because Akahori explicitly discourages texturing on the key surface. (ECF 485-8 at 27-28). It determined that HC had not demonstrated a reasonable likelihood of prevailing in showing that claims 19 and 20 were obvious over Mabuchi and Mazur because those references did not teach "forming surface features to have dimensions that selectively diffuse or selectively absorb a desired wavelength of electro-magnetic radiation" as required by those claims. (ECF 485-8 at 37-38).

On May 26, 2017, in response to SiOnyx's motion for rehearing, the PTAB reversed its decision to institute review of claims 9, 24, and 25 for anticipation by Nakashiba, and the IPR did not go forward as to those claims on that ground. (ECF 522-14 at 2).

The PTAB issued its final written decision on March 28, 2018. It ruled that claims 1, 2, 4-11, 13-18, 21, and 23-25 of the '591 patent were unpatentable, but upheld claims 12 and 26. (ECF 485-18 at 66). SiOnyx filed a notice of appeal on May 24, 2018. That appeal is still pending, and SiOnyx's opening brief is due September 7, 2018. (Fed. Cir. No. 18-2019). HC did not cross-appeal.

While the IPR was proceeding, discovery in this case was ongoing. Fact and expert discovery have now mostly closed, with the exception of some lingering disputes that have required the intervention of the magistrate judge or the undersigned. Defendants previously filed six motions for partial summary judgment, and plaintiffs filed one motion for partial summary judgment and a motion to amend the second amended complaint, which the Court addressed in a previous order.

Defendants have filed five more motions for partial summary judgment asserting the following contentions: (1) that SiOnyx and Harvard have failed to prove willful infringement;

(2) that SiOnyx and Harvard have failed to prove indirect infringement; (3) that SiOnyx has failed to prove infringement of the '591 patent; (4) that SiOnyx and Harvard have failed to prove that Carey and Mazur are the sole co-inventors of the HPK patents; and (5) that SiOnyx and Harvard have failed to prove any claims against Ocean Optics. Defendants have also filed a motion to strike the declarations of Ezekiel Kruglick. SiOnyx in turn has moved for summary judgment regarding inter partes review estoppel.

II. Standard of Review

The role of summary judgment is to "pierce the pleadings and to assess the proof in order to see whether there is a genuine need for trial." *Mesnick v. Gen. Elec. Co.*, 950 F.2d 816, 822 (1st Cir. 1991) (internal quotation mark omitted). Summary judgment is appropriate when the moving party shows that "there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). "Essentially, Rule 56[] mandates the entry of summary judgment 'against a party who fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial.'" *Coll v. PB Diagnostic Sys., Inc.*, 50 F.3d 1115, 1121 (1st Cir. 1995) (quoting *Celotex Corp. v. Catrett*, 477 U.S. 317, 322 (1986)). In making that determination, the court must "view the record in the light most favorable to the nonmovant, drawing reasonable inferences in his favor." *Noonan v. Staples, Inc.*, 556 F.3d 20, 25 (1st Cir. 2009). When "a properly supported motion for summary judgment is made, the adverse party must set forth specific facts showing that there is a genuine issue for trial." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 250 (1986) (internal quotation marks and footnotes omitted). The non-moving party may not simply "rest upon mere allegation or denials of his pleading," but instead must "present affirmative evidence." *Id.* at 256-57.

III. Analysis

A. Noninfringement of the '591 Patent

SiOnyx asserts that defendants infringe claims 3, 4, 9, 18-20, and 25 of the '591 patent. Claims 3, 4, 9, and 25 depend from claim 1, and claims 18-20 depend from claim 13. Claim 1 recites:

> 1. A photosensitive imager device, comprising:
>
> a semiconductor substrate having a substantially planar surface and multiple doped regions forming at least one junction;
>
> a textured region coupled to the semiconductor substrate on a surface opposite the substantially planar surface and positioned to interact with electromagnetic radiation;
>
> integrated circuitry formed at the substantially planar surface; and
>
> an electrical transfer element coupled to the semiconductor substrate and operable to transfer an electrical signal from the at least one junction.

('591 patent, col. 18 ll. 33-45). Claim 13 recites:

> 13. A method of making a photosensitive imager device, comprising:
>
> forming a textured region on a semiconductor substrate, wherein the semiconductor substrate has a substantially planar surface opposite the textured region and multiple doped regions forming a[t] least one junction, and wherein the textured region is formed in a position to interact with electromagnetic radiation;
>
> forming integrated circuitry on the substantially planar surface; and
>
> coupling an electrical transfer element to the semiconductor substrate such that the electrical transfer element is operable to transfer an electrical signal from the at least one junction.

('591 patent, col. 19 ll. 16-29). Therefore, all of the asserted claims contain the limitation that the "electrical transfer element" be "operable to transfer an electrical signal from the at least one junction."

In its claim-construction opinion, the Court construed the term "electrical transfer

element" to mean "an element used to transfer charge or signal from a photosensitive pixel." (ECF 251 at 36). The Court explained that the specification explicitly provides that the invention "can be incorporated into complementary metal-oxide-semiconductor (CMOS) imager architectures or charge-coupled device (CCD) imager architectures." ('591 patent col. 6 ll. 45-49). The Court further explained that the language "operable to transfer an electrical signal" "requires that the transfer element must be able to transfer a signal, it does not exclude the ability to transfer a charge." (ECF 251 at 35).

All of the devices SiOnyx accuses of infringement are CCDs or devices that incorporate CCDs.[12] SiOnyx does not dispute that the pixels of a CCD transfer a charge, which is converted to a voltage by an amplifier outside the pixel array (in contrast to a CMOS detector, in which the charge is converted to a voltage at each pixel). (*See* ECF 175-1 ¶¶ 17-21; ECF 481-5 at 56:8-13).

Defendants contend that they are entitled to summary judgment of noninfringement because the CCDs only transfer a charge, not a signal, and the claims specifically require that the "electrical transfer element" be "operable to transfer an electrical *signal*." They contend that by taking the position that both "charge" and "signal" must be included in the construction of "transfer element," SiOnyx has conceded that the two are different. In support, defendants point to the testimony of SiOnyx's expert, Michael Guidash, who stated, "To the extent Defendants' proposed construction [of electrical transfer element] only applies to 'transferring an electrical signal' it would rule out CCDs, which are explicitly defined as within the scope of the invention by the specification." (ECF 175-1 ¶ 55).

[12] SiOnyx has also accused MPPCs of infringement of the '591 patent, and sought an order compelling defendants to produce discovery related to those devices, which the Court has recently granted in part. (ECF 554). It is premature to decide whether summary judgment of noninfringement on those devices is appropriate.

Defendants' argument, however, mischaracterizes Guidash's testimony. Guidash has consistently opined that the claims of the '591 patent cover both CMOS and CCD detectors, and that it would be erroneous to read the claims to exclude CCD detectors when the specification clearly contemplates that its teachings could be applied to CCD detectors, which were previously well-known in the art. (*See* '591 patent, col. 1 ll. 18-22; *id.*, col. 6 ll. 45-49; *id.*, col. 11 ll. 11-13). Guidash opined that "[t]o those of ordinary skill of the art, particularly in view of the specification, the terms 'electrical transfer element' or 'transfer element' . . . refers [sic] to the circuitry or electrical components used in the pixels," which, as to a CCD pixel, would be "a MOS capacitor, which transfers the charge from the pixel to a shift register and ultimately to read-out circuitry where it is converted into a voltage." (ECF 175-1 ¶ 53). The Court acknowledged that in its claim-construction opinion, in which it explicitly relied on Guidash's unrebutted opinion as to how a skilled artisan would interpret the claims. (*See* ECF 251 at 35).

Claim construction is an exercise in clarification. As part of that process, SiOnyx (through Guidash) requested that the Court clarify that the "electronic transfer element" includes the transfer of charges. The Court can understand how defendants now view the inclusion of two words in the claim-construction opinion—signal and charge—to suggest a distinction between the two. Nonetheless, it is clear that "charges" are a kind of "signal" encompassed by the claim. Indeed, the patent does not distinguish between "signal" and "charge"—in fact, it does not use the word "charge" except to name "charge-coupled devices (CCDs)." But it does say that its teachings are applicable to CCDs, and Guidash explained that a person of ordinary skill would view the claims as covering them, despite the patent's use of the word "signal." (*See* ECF 175-1 ¶ 20 (explaining that CCDs transfer "signal charge packets")).

To be clear, this is not a back-door, after-the-fact construction of the word "signal."

Neither party requested a construction of that term, and its application to the accused devices will therefore be a question of fact for the jury. *See Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1320-21 (Fed. Cir. 2003); *Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1312-13 (Fed. Cir. 2003). The Court only holds that SiOnyx has not conceded, and the Court's claim-construction opinion does not require, that "signal" and "charge" are mutually exclusive categories.

Defendant's motion for summary judgment of noninfringement of the '591 patent will therefore be denied.

B. Motion of Ocean Optics for Summary Judgment

Plaintiffs allege that Ocean Optics is liable for infringing the '467 and '591 patents through its Maya2000 Pro-NIR spectrometer. That theory of infringement depends entirely on the spectrometer's incorporation of an HPK sensor as a component part. Ocean Optics contends that summary judgment should be granted in its favor because (1) plaintiffs have not requested damages from Ocean Optics; (2) even if they had requested damages, the record is bereft of evidence to actually prove those damages; and (3) an injunction would never be available against Ocean Optics. It contends that because plaintiffs thus would have no remedy against it separate from their remedies against HPK and HC, it should be dismissed from the case. The motion will be denied for multiple reasons.

First, the fact that plaintiffs did not specifically identify damages as a form of relief against Ocean Optics in their complaint is inconsequential. If Ocean Optics is judged to have infringed the patents, plaintiffs are entitled to damages. Section 281 provides: "A patentee shall have remedy by civil action for infringement of his patent." 35 U.S.C. § 281. Section 283 further provides: "The several courts having jurisdiction of cases under this title *may* grant injunctions in accordance with the principles of equity to prevent the violation of any right

secured by patent, on such terms as the court deems reasonable." *Id.* § 283 (emphasis added). And Section 284 provides: "Upon finding for the claimant the court *shall* award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court." *Id.* § 284 (emphasis added). Taking the three statutes together, it is clear that damages must be awarded against an infringer. *Dow Chem. Co. v. Mee Indus., Inc.*, 341 F.3d 1370, 1381-82 (Fed. Cir. 2003) ("The statute is unequivocal that the district court must award damages in an amount no less than a reasonable royalty.").

Second, plaintiffs have put forth adequate evidence to prove any damages Ocean Optics may owe. Plaintiffs concede that they can only recover one reasonable royalty for each infringing product. *See Glenayre Elecs., Inc. v. Jackson*, 443 F.3d 851, 864 (Fed. Cir. 2006) ("[A] party is precluded from suing to collect damages for direct infringement by a buyer and user of a product when actual damages covering that very use have already been collected from the maker and seller of that product."); *Shockley v. Arcan, Inc.*, 248 F.3d 1349, 1364 (Fed. Cir. 2001) ("Each joint tort-feasor is liable for the full amount of damages (up to a full single recovery) suffered by the patentee."). But plaintiffs have the option of recovering the amount attributable to the devices manufactured by HPK and sold to Ocean Optics through HC from any or every defendant. *Schockley*, 248 F.3d at 1364 ("[P]arties that make and sell an infringing device are joint tort-feasors with parties that purchase an infringing device for use or resale.") (citing *Birdsell v. Shaliol*¸ 112 U.S. 485, 488-89 (1884)). Although plaintiffs' damages expert calculated those amounts as part of the damages for HPK, the portion of those damages attributable to sales to Ocean Optics appears to be discernable from the underlying evidence, which details sales to Ocean Optics separately from other U.S. sales. (*See* ECF 491-2 at 28

n.113, 68 n.284; ECF 529-18 at 10:4-13:1). The fact that plaintiffs' expert did not specifically break out the figure attributable to Ocean Optics, or opine as to a separate hypothetical negotiation with it, does not preclude plaintiffs from ever collecting damages from Ocean Optics.[13]

Furthermore, even if there were no expert testimony on damages, the court would still be obligated to evaluate what evidence there was to come up with a reasonable royalty. In *Dow Chemical Co. v. Mee Industries, Inc.*, the district court judge excluded all of the plaintiff's expert's testimony on reasonable-royalty damages, and then held that the plaintiff had failed to prove any damages. 341 F.3d 1370, 1381 (Fed. Cir. 2003). The Federal Circuit reversed, explaining that 35 U.S.C. § 284 required that damages be awarded, and directed the district court on remand to consider the *Georgia-Pacific* factors and "award such reasonable royalties as the record evidence may support." *Id.* at 1382; *see Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1327-28 (Fed. Cir. 2014) ("If a patentee's evidence fails to support its specific royalty estimate, the fact finder is still required to determine what royalty is supported by the record."), *overruled on other grounds by Williamson v. Citrix Online, LLC*, 792 F.3d 1339 (Fed. Cir. 2017).[14] Therefore, the alleged inadequacy of plaintiffs' expert testimony on reasonable royalty damages, without more, is not a reason to grant summary judgment to Ocean Optics.

[13] Furthermore, the failure of SiOnyx's expert to address the *Georgia-Pacific* factors as to Ocean Optics would not necessarily preclude awarding reasonable-royalty damages. A reasonable jury could find on the evidence presented that SiOnyx would have negotiated a license with HPK and HC, and that HPK and HC would pass the cost of that license on to their customers. Therefore, there is evidence in the record to support the theory that any damages owed by Ocean Optics would be tied to the circumstances of the SiOnyx/HPK negotiation, not a separate SiOnyx/Ocean Optics negotiation.

[14] The Federal Circuit also noted that "the district court's obligation to award some amount of damages 'does not mean that a patentee who puts on little or no satisfactory evidence of a reasonable royalty can successfully appeal on the ground that the amount awarded by the court is not "reasonable" and therefore contravenes section 284.'" *Dow Chem. Co.*, 341 F.3d at 1382 (quoting *Lindemann Maschinefabrik GmbH v. Am. Hoist & Derrick Co.*, 895 F.2d 1403, 1407 (Fed. Cir. 1990)). Presumably in a case where there was actually *no* evidence of *any* damages, a court would be justified awarding a nominal royalty. But that is not the situation here.

Finally, it is inappropriate to determine at this time whether an injunction would be available in the event of infringement. Ocean Optics has presented no example of a case where a court has found, prior to trial, that a permanent injunction would never be available as a matter of law, regardless of liability. There are genuine issues of material fact as to whether the harm is irreparable and how the balance of the hardships, at the time the injunction would enter, would be determined.

Accordingly, the motion of Ocean Optics for summary judgment will be denied.

C. *Inter Partes* Review Estoppel

SiOnyx currently asserts that defendants infringe claims 3, 4, 9, 18-20, and 25 of the '591 patent, and defendants appear to have limited their counterclaims of invalidity to those same claims. (*See* ECF 522 at 5 ("The below table summarizes Defendants' current prior art invalidity grounds presented in this case . . . .")).[15] The PTAB declined to institute review of claims 3, 19, and 20, and has ruled that claims 4, 9, 18, and 25 are unpatentable. SiOnyx has appealed the unpatentability ruling to the Federal Circuit; defendants have not appealed the declination of review.

SiOnyx has now moved for summary judgment on the ground that HC, HPK, and Ocean Optics are estopped from arguing in this action that any of the asserted claims of the '591 patent are invalid based on:

- Prior art actually discussed in the PTAB's written decision, specifically
    - anticipation by or obviousness over Nakashiba,[16] and

[15] SiOnyx dropped some claims following the Court's claim construction. Therefore, the expert reports address more claims than are currently at issue in the litigation.

[16] The PTAB only addressed the issue of anticipation as to Nakashiba, and defendants now assert obviousness. However, both sides appear to agree anticipation and obviousness can be treated together.

- obviousness over Mabuchi and Mazur;

- Prior art raised in the petition as to which the PTAB did not institute review, specifically
  - obviousness by Akahori and Mazur; and
- Prior art that was not raised in the petition, but could have been, specifically
  - anticipation by Adkisson,[17] and
  - obviousness over the S9840 datasheets in combination with various other references.

The America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), created the IPR process. As part of the statute, Congress included an estoppel provision in an attempt to avoid duplicative validity challenges before the PTAB and the district courts. Under the statute, "[t]he petitioner in an inter partes review of a claim in a patent under this chapter that results in a final written decision under section 318(a), or the real party in interest or privy of the petitioner, may not assert in a civil action arising in whole or in part under section 1338 of title 28 . . . that the claim is invalid on any ground that the petitioner raised or reasonably could have raised during that inter partes review." 35 U.S.C. § 315(e)(2).

Notwithstanding the straightforward language of the statute, its application is considerably complicated by the PTAB's former practice of instituting IPRs as to only some of the challenged claims of a patent. *See SAS Inst., Inc. v. Complementsoft, LLC*, 842 F.3d 1223, 1224-25 (Fed. Cir. 2016) (Newman, J., dissenting from denial of the petition for rehearing en banc); *SAS Inst., Inc. v. Complementsoft, LLC*, 825 F.3d 1341, 1356-59 (Fed. Cir. 2016) (Newman, J., concurring in part and dissenting in part) ("Among the consequences of the PTO's

[17] U.S. Patent Application Publication No. 2009/0283807.

curious and unforeseen practice, partial review does not estop unreviewed claims as to either validity or invalidity, thereby adding to the litigants' burden rather than lightening it."), *rev'd sub. nom. SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348 (2018).

In 2016, the Federal Circuit ruled that estoppel did not apply to claims or grounds on which the PTAB declined to institute review. *Synopsys, Inc. v. Mentor Graphics Corp.*, 814 F.3d 1309, 1316 (Fed. Cir. 2016) ("The validity of claims for which the Board did not institute inter partes review can still be litigated in district court."); *Shaw Indus. Grp. v. Automated Creel Sys., Inc.*, 817 F.3d 1293, 1300 (Fed. Cir. 2016) (same for grounds); *see also Credit Acceptance Corp. v. Westlake Servs.*, 859 F.3d 1044, 1052-53 (Fed. Cir. 2017) (discussing *Synopsys* and *Shaw* in the context of post-grant reviews).

But on April 24, 2018, the Supreme Court, interpreting 35 U.S.C. § 318(a), held that the PTAB did not have the authority to institute review as to only certain claims, but "*must* address *every* claim the petitioner has challenged." *SAS Inst.*, 138 S. Ct. at 1354. The Court did not explicitly rule that the PTAB must institute review on every prior-art ground asserted in the petition. Nonetheless, the Federal Circuit has observed that "[e]qual treatment of claims and grounds for institution purposes has pervasive support in *SAS*." *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018).

In the wake of the *SAS* decision, the Patent and Trademark Office issued a "guidance" announcing that any petition instituted would be instituted on all claims and all grounds raised. U.S. Patent & Trademark Office, Guidance on the Impact of SAS on AIA Trial Proceedings (Apr. 26, 2018), https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial. The Federal Circuit has also endorsed the view that *SAS* "interpret[ed] the statute to require a simple yes-or-no institution choice respecting a

petition, embracing all challenges included in the petition." *PGS Geophysical*, 891 F.3d at 1359-60; *BioDelivery Sci. Int'l, Inc. v. Aquestive Therapeutics, Inc.*, -- F.3d --, 2018 WL 3625151, at *3 (Fed. Cir. July 31, 2018) ("We agree that *SAS* requires institution on all challenged claims and all challenged grounds."). The Federal Circuit has further held (1) that "it is appropriate to remand to the PTAB to consider non-instituted claims as well as non-instituted grounds"; and (2) that a party has not "waived its right to seek *SAS*-based relief due to failure to argue against partial institution before the PTAB." *BioDelivery Sci. Int'l*, -- F.3d --, 2018 WL 3625151, at *2-3 (citing cases).

1. Which Defendants Are Estopped

Here, the first issue is which of the three defendants are potentially estopped. Section 315(e) estops the petitioner or "or the real party in interest or privy of the petitioner." 35 U.S.C. § 315(e). HC, as the petitioner, and HPK, as an identified real party-in-interest in the IPR, clearly fall within the statutory definition. SiOnyx contends that Ocean Optics, although not identified as a real party-in-interest in the IPR, is nevertheless a privy of HPK and HC because it shares counsel with HPK and HC. Defendants do not argue that Ocean Optics should be treated differently. Therefore, the Court will treat all defendants together for the purposes of analyzing the estoppel issue.

2. Which Claims and Grounds Are Estopped

The second issue is which claims and grounds are subject to estoppel. There are three types of relevant claims and grounds: those as to which the PTAB actually instituted review; those as to which it declined review; and those that were not raised before the PTAB.

a. Claims and Grounds Actually Addressed in the PTAB's Final Written Decision

Defendants are clearly estopped from asserting any claims and grounds in this lawsuit as

to which the PTAB actually instituted review and issued a final written decision.

Defendants contend that they should not be estopped from raising grounds that were successful, because the appeal of the PTAB's decision is still pending and the estoppel provisions are meant to prevent only duplicative *abusive* challenges. But the statute makes no distinction between successful and unsuccessful grounds. Indeed, there appears to be no practical effect of holding that defendants can assert their successful grounds because the appeal is pending—either (1) the Federal Circuit will affirm the PTAB's decision, in which case the claims will remain unpatentable (as they are now) and there will be no reason for this Court to address their validity (or infringement), or (2) it will reverse the PTAB's decision, in which case the grounds defendants asserted will no longer be "successful" grounds and defendants will be estopped from raising them in this lawsuit. To the extent defendants are concerned that SiOnyx may be awarded damages in the interim for claims that are unpatentable, the Court will entertain further briefing and argument as to how to handle the situation should it arise. *Cf. XY, LLC v. Trans Ova Genetics*, 890 F.3d 1282, 1294-95 (Fed. Cir. 2018); *MaxLinear, Inc. v. CF CRESPE LLC*, 880 F.3d 1373, 1376-77 (Fed. Cir. 2018).

Accordingly, defendants will be estopped from arguing that claims 4, 9, 18, and 25 are invalid for (1) anticipation or obviousness over Nakashiba or (2) obviousness over Mabuchi in view of Mazur.

b. Claims and Grounds as to Which the PTAB Declined to Institute Review

As to the claims and grounds as to which the PTAB declined to institute review under the now-illegal, partial-institution regime, the question is murkier. If the law had not changed, defendants would apparently be free to make the same arguments before this Court, because the reason they were prohibited from raising those arguments before the PTAB was the PTAB's own

ruling. *HP Inc. v. MPHJ Tech. Invs., LLC*, 817 F.3d 1339, 1347 (Fed. Cir. 2016) ("[T]he noninstituted grounds do not become a part of the IPR. Accordingly, the noninstituted grounds were not raised and, as review was denied, could not be raised in the IPR. Therefore, the estoppel provisions of § 315(e)(1) do not apply."). Now, however, the practice of partial institution has been declared to be contrary to the statute, and the appropriate application of the estoppel statute to partially instituted IPRs is unclear.

Happily, the issue is easily resolved in this case. At the time the Supreme Court handed down *SAS*, HC's time to appeal the PTAB's decision had not yet run.[18] Where relevant, the Federal Circuit has remanded cases to the PTAB to allow it to consider noninstituted claims and grounds following that decision, and has not held that petitioners have waived their right to PTAB adjudication of all claims and grounds by failing to raise the issue before the PTAB prior to *SAS*. *BioDelivery Sci. Int'l*, -- F.3d --, 2018 WL 3625151, at *2-3 (citing cases). HC could have appealed and sought such a remand in order to allow the PTAB evaluate the claims and grounds that it raised in its petition on which the PTAB did not institute review. It therefore "reasonably could have raised" those grounds before the PTAB against *any* claim in the '591 patent, and is estopped from raising them again before this Court.

Accordingly, defendants will be estopped from arguing that any claim—including claims 3, 19, and 20—is invalid for obviousness based on any ground raised in the petition, including (1) anticipation by or obviousness over Nakashiba, (2) obviousness over Akahori in view of Mazur, (3) and obviousness over Mabuchi in view of Mazur.

[18] The PTAB's final written decision was issued on March 28, 2018. Either party then had 60 days to file a notice of appeal. 35 U.S.C. §§ 142, 319; 37 C.F.R. § 90.3; Fed. R. App. P. 4(a)(1)(B)(ii). SiOnyx filed its notice of appeal on May 24, 2018, giving HC an additional 14 days from that date to file a notice of cross-appeal. 37 U.S.C. § 90.3; Fed. R. App. P. 4(a)(3). *SAS* was handed down on April 24, 2018. Therefore, HC had almost six weeks following *SAS* to appeal the PTAB's decision not to institute certain claims and grounds to the Federal Circuit.

c. Claims and Grounds Not Raised Before the PTAB

The final category is claims that were not raised before the PTAB. As to these grounds, the question is whether defendants reasonably could have raised them.

i. Anticipation by Adkisson

In its IPR petition, HC did not include any grounds based on Adkisson. SiOnyx nevertheless contends that HC "reasonably could have raised" Adkisson as a reference, and thus should be estopped from raising it now.

Prior to *SAS*, a minority of district courts had held that only grounds actually raised in the petition could count as grounds that "reasonably could have been raised"; under that view, a petitioner could hold back certain grounds from its petition and be free to raise them later before a district court. *E.g.*, *Koninklijke Philips N.V. v. Wangs Alliance Corp.*, 2018 WL 283893, at *3-4 (D. Mass. Jan. 2, 2018) (citing cases that held otherwise); *Finjan, Inc. v. Blue Coat Sys., LLC*, 283 F. Supp. 3d 839, 855-57 (N.D. Cal. 2017). *But see Oil-Dri Corp. of Am. v. Nestlé Purina Petcare Co.*, 2017 WL 3278915, at *6-8 (N.D. Ill. Aug. 2, 2017) ("[W]hile it makes sense that noninstituted grounds do not give rise to estoppel because a petitioner cannot—to no fault of its own—raise those grounds after the institution decision, when a petitioner simply does not raise invalidity grounds it reasonably could have raised in an IPR petition, the situation is different."); *Parallel Networks Licensing, LLC v. Int'l Bus. Machs. Corp.*, 2017 WL 1045912, *11-12 (D. Del. Feb. 22, 2017). After *SAS*, that cannot be correct. Because the PTAB must now institute review (if at all) on all claims and grounds, there will be no such thing as a ground raised in the petition as to which review was not instituted.[19] Accordingly, for the words "reasonably could

[19] The PTAB has the option of wholly declining to institute any IPR. *See* 35 U.S.C. § 314. In that case, estoppel would not apply, because the review would not "result[] in a final written decision." 35 U.S.C. § 315(e).

have raised" to have any meaning at all, they must refer to grounds that were not actually in the IPR petition, but reasonably could have been included.

The question then becomes what is the standard for determining whether a ground not included in a petition reasonably could have been raised. In congressional debates, one of the key architects of the America Invents Act explained that "reasonably could have raised" is meant to include any patent or printed publication that a petitioner actually knew about or that "a skilled searcher conducting a diligent search reasonably could have been expected to discover." 157 Cong. Rec. S1375 (daily ed. Mar. 8, 2011) (statement of Sen. Kyl). Several district courts have adopted this as the standard. *E.g.*, *Parallel Networks Licensing*, 2017 WL 1045912, *11-12; *Clearlamp, LLC v. LKQ Corp.*, 2016 WL 4734389, at *7-8 (N.D. Ill. Mar. 18, 2016). This Court will do the same.

Adkisson was filed on May 14, 2008, (prior to the '591 patent) and published on November 19, 2009. It was therefore publicly available long before defendants' IPR petition. SiOnyx contends that the mere fact that defendants later found it and included it in their supplemental invalidity contentions in this case shows that a reasonably diligent search would have uncovered it at the time the IPR petition was filed. (ECF 485-1 at 13). Defendants counter that they first learned of Adkisson when plaintiffs produced it to them on May 2, 2017, and have provided declarations from HPK's Deputy General Manager of the Intellectual Property Department and in-house counsel to that effect. (ECF 522-6; ECF 522-8 at ¶¶ 1, 4-8; ECF 522-9 at ¶¶ 1, 4-6).

It appears that the issue of whether a skilled, diligent search reasonably should have uncovered a reference is a question of fact. Despite having the burden to show that estoppel applies, SiOnyx has presented no factual evidence showing that a skilled searcher would have

found Adkisson. *See Clearlamp*, 2016 WL 4734389, at *9 ("[Plaintiff] must present evidence that a skilled searcher's diligent search would have found the UVHC3000 datasheet. One way to show what a skilled search would have found would be (1) to identify the search string and search source that would identify the allegedly unavailable prior art and (2) present evidence, likely expert testimony, why such a criterion would be part of a skilled searcher's diligent search."). There thus appears to be a genuine question of material fact as to whether a diligent, skilled searcher would have found Adkisson at the time the IPR was field; indeed, the examiner of the '591 patent tried 56 search strings and still did not turn up Adkisson. (ECF 522-10). Therefore, to the extent SiOnyx is contending that defendants are estopped from relying on Adkisson as an invalidity ground, the motion for summary judgment will be denied.

ii. Grounds Based on S9840 and Its Datasheets

In their invalidity contentions, defendants have included several obviousness grounds that are ostensibly based on HPK's S9840 CCD sensor combined with either Mazur, Uematsu, or VanZeghbroeck,[20] all of which were discussed in the IPR petition. The sensor was not included as a reference in the IPR petition, because only patents and printed publications may be the basis for canceling a claim in an IPR. 35 U.S.C. § 311(b) ("A petitioner in an inter partes review may request to cancel as unpatentable 1 or more claims of a patent only on a ground that could be raised under section 102 or 103 and only on the basis of prior art consisting of patents or printed publications."). For a document to be considered a "printed publication," it must have been publicly available. *N. Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 936 (Fed. Cir. 1990).

Defendants contend that they cannot be estopped from using the S9840 CCD sensor as prior art because they could not have asserted a physical device before the PTAB. SiOnyx

[20] U.S. Patent No. 5,600,130.

contends that defendants are not actually relying on the physical S9840 device, but are instead relying on its datasheets, which were publicly available printed publications (unquestionably known to defendants, as they described HPK's own product) and therefore reasonably could have been included in the IPR petition. (*See* ECF 485-14).

If defendants were relying on the datasheet alone, this might be a close question, as several courts have held that a party may not escape estoppel by dressing up a ground based on publicly available datasheets as a ground based on a product. *Milwaukee Elec. Tool Corp. v. Snap-On Inc.*, 271 F. Supp. 3d 990, 1032 (E.D. Wis. 2017) (holding that reliance on printed sheets not allowed but could introduce specimens of physical device); *Clearlamp*, 2016 WL 4734389, at *9. Here, however, both defendants' contentions and their expert's opinion, from the beginning, have also relied on a 2007 manufacturing specification, which is the only citation for certain claim limitations. *See Star Envirotech Inc. v. Redline Detection LLC*, 2015 WL 4744394, at *4 (C.D. Cal. Jan. 29, 2015) ("[T]he physical machine itself discloses features claimed in the '808 Patent that are not included in the instruction manual, and it is therefore a superior and separate reference."). Although defendants' expert testified that he was relying on "publicly available" documents, defendants' declarations at least raise a genuine issue of material fact as to whether the manufacturing specification was public. Therefore, SiOnyx has not carried its burden to show that publicly available materials are the "real" references that defendants are now trying to pass off as the product itself.

SiOnyx contends that even if the manufacturing specification is not public, defendants are still not relying on the *actual product*, and if the manufacturing specification is secret, then it is not prior art and the invalidity grounds must fail as a matter of law. The Court declines to so hold. Defendants are relying on the S9840 product itself as the prior art. (*See* ECF 485-10 at

154-56). It is true that defendants' expert did not examine the product itself, but relied on documentation describing the product. But that documentation is evidence of how the product is configured, how it is made, and how it works. SiOnyx does not contend that the documentation fails to describe the product accurately. Defendants' expert may rely on the combination of the publicly available datasheet and the private manufacturing specification to form his opinion that the publicly available product (in combination with other references) meets the elements of the claims.

Therefore, to the extent SiOnyx is contending that defendants are estopped from relying on the S9840 CCD sensor, the motion for summary judgment will be denied.

D. Sole Inventorship

HPK has moved for summary judgment on the ground that Carey cannot be the sole inventor of the nine disputed HPK patents.[21]

A court may order the Director of the Patent and Trademark Office to correct a patent "[w]henever through error a person is named in an issued patent as the inventor, or through error an inventor is not named in an issued patent." 35 U.S.C. § 256. Inventorship is a question of law based on underlying fact findings. *Gen. Elec. Co. v. Wilkins*, 750 F.3d 1324, 1329 (Fed. Cir. 2014). There is a presumption that the named inventors on an issued patent are correct, and "[t]he general rule is that a party alleging misjoinder or non-joinder of inventors must meet the heavy burden of proving its case by clear and convincing evidence." *Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1358 (Fed. Cir. 2004). "Conception is the touchstone of inventorship," and it is "'the formation in the mind of the inventor, of a definite and permanent idea of the

[21] The motion as filed requests summary judgment that Carey and Mazur together cannot be sole inventors. Because the Court has granted HPK's earlier motion for summary judgment that plaintiffs cannot prove that Mazur is a co-inventor, only Carey remains as a potential unnamed inventor.

complete and operative invention, as it is hereafter to be applied in practice.'" *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994) (quoting *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986)).

Where an invention is the work of several inventors, "each person claiming to be a joint inventor must have contributed to the conception of the invention," and "must show that he made 'a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention, and [did] more than merely explain to the real inventors well-known concepts and/or the current state of the art.'" *Acromed Corp. v. Sofamor Danek Grp., Inc.*, 253 F.3d 1371, 1379 (Fed. Cir. 2001) (alteration in original) (quoting *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1351 (Fed. Cir. 1998). The question of inventorship is tied to the subject matter of the claims at issue, and a co-inventor need only contribute to a single claim to be properly listed on the patent. *Ethicon, Inc. v. U.S. Surgical Corp.*, 135 F.3d 1456, 1460 (Fed. Cir. 1998). But "one does not qualify as a joint inventor by merely assisting the actual inventor after conception of the claimed invention," and "one of ordinary skill in the art who simply reduced the inventor's idea to practice is not necessarily a joint inventor." *Id.*

HPK's argument is essentially as follows: (1) at most, Carey could have taught HPK laser texturing the surface of a photodetector opposite the light-incident surface of the device; (2) all the patents contain claims that are broader than that idea, either because they cover non-laser texturing or because they cover texturing the light-incident surface; therefore (3) the HPK inventors must have contributed something to the patents, and Carey cannot be the sole inventor.

There are multiple flaws in that argument. First, to the extent that HPK bases its argument on the fact that the patents cover textures not formed by a laser, the method of formation is immaterial. The patent claims that do not specifically recite laser irradiation cover

devices, not methods; they claim photodiodes that have an "irregular asperity," not a method for making that irregular asperity. *See Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1344 (Fed. Cir. 2008) ("Courts must generally take care to avoid reading process limitations into an apparatus claim, because the process by which a product is made is irrelevant to the question of whether that product infringes a pure apparatus claim." (citation omitted)).[22] Carey did not have to conceive of every possible way to make the irregular asperity in order to have "a definite and permanent idea of the complete and operative invention," and conception of additional methods of making the irregular asperity would not add to the scope of the claim. This is so even where the patent clearly covers devices with an irregular asperity made in other ways (such as in the '551 patent, which contains an independent claim that only requires an "irregular asperity" and a dependent claim that requires an "irregular asperity . . . formed by applying a pulsed laser beam," ('551 patent, col. 18 l. 50; *id.* col. 19 ll. 5-6)), and where the actual texture achieved by other methods cannot be obtained with laser processing. In other words, conception is tied to the claims; where the claims are to an apparatus, what matters for conception is whether the inventor has conceived of the apparatus; and one way of making the apparatus is sufficient to put the inventor in possession of the apparatus.

To the extent HPK bases its argument on the fact that the patents cover placing the texture on the light-incident surface, there appears to be a genuine issue of material fact as to whether that placement was in the prior art or whether Carey alone conceived of that placement. HPK points to a November 2006 presentation as evidence that it had considered texturing at least the light-incident surface prior to receiving the confidential architectures from Carey. (ECF 482-

[22] The only method claims in the patents are claims 1-4 of the '087 patent, which claim "[a] photodiode manufacturing method comprising . . . a step of irradiating the thinned portion of the silicon substrate with a pulsed laser beam from the first principal surface side to form an irregular asperity." ('087 patent, col. 13 ll. 6, 38-40).

5 at HPK0068533).[23] But that evidence is not sufficient to grant summary judgment.

First, the mere fact that the claimed inventions may cover more than just laser texturing opposite the light-incident surface does not mean that contribution to those elements makes one a co-inventor. Rather, the contribution must be "not insignificant in quality, when that contribution is measured against the dimension of the full invention," and must be more than "well-known concepts and/or the current state of the art.'" *Acromed Corp.*, 253 F.3d at 1379 (quoting *Pannu*, 155 F.3d at 1351). The November 2006 presentation includes many slides showing images and results from Carey and Mazur's prior, publicly available work. (*Compare* ECF 482-3 *with* ECF 482-5). At least one slide shows a figure from a 2004 Applied Physics article (authored by Carey and Mazur, among others) depicting an experiment where the authors laser textured the light-incident surface of a photodiode. (*Compare* ECF 482-3 at HPK0087733 *with* ECF 482-5 at HPK0068529). Therefore, there is a genuine issue of material fact as to what was in the prior art and whether Carey conceived of the "full and operative invention[s]" claimed by the HPK patents on his own.

Second, the November 2006 presentation specifically states that the texturing was made by a silicon-dry-etching technique, and further states that silicon etching was "a failure." (ECF 482-5 at HPK0068525). "[A]n inventor need not know that his invention will work for conception to be complete," but conception requires that the "inventor has a specific, settled idea, a particular solution to the problem at hand, not just a general goal or research plan he hopes to pursue." *Burroughs Wellcome*, 40 F.3d at 1228. HPK argues that the incorporation of

[23] The "preferred" architecture Carey sent to Kobayashi shows a laser-processed layer on the top of the device, which may be the light-incident surface. (ECF 337-3 at 4; *see also* ECF 337-9 at HPK0010400-HPK10010401 (showing an architecture that was actually tested during the SiOnyx-HPK collaboration and that is very similar to the preferred architecture with yellow arrows pointing to the textured surface)).

Harvard's laser-texturing data in the presentation shows that HPK was considering using laser texturing at least on the light-incident surface at that time. But in the absence of any explicit statements in the presentation, the mere juxtaposition of Harvard's laser-texturing results with architectures showing silicon-dry-etch texturing does not conclusively show that HPK had a specific plan to laser-texture any particular photodiode; rather, a reasonable juror could find that the presentation showed no more than a general research plan.[24]

Defendants' motion for summary judgment that Carey cannot be the sole inventor of the disputed patents will accordingly be denied.

E. Motion to Strike Kruglick Declarations

During the briefing of defendants' motions for summary judgment concerning willful and indirect infringement, it became clear that the parties disputed the meaning of the metadata associated with the copy of the '467 patent produced by HPK.

It appears that the first time plaintiffs informed defendants that they were relying on the metadata in connection with their claims of willful and indirect infringement was in their oppositions to defendants' motions for partial summary judgment. Defendants responded with declarations from Akifumi Takeda, the Deputy General Manager of the Intellectual Property Department at HPK, in whose custody the '467 patent was found. Takeda attested that he first

[24] Plaintiffs further contend that there is no evidence that HPK reduced the inventions of the disputed patents to practice prior to its collaboration with SiOnyx. But that argument misunderstands the law. In order to be named as an inventor, an HPK employee need not show that he reduced the invention to practice, only that he contributed non-trivially to the conception of at least one claim in the patent. Therefore, at trial, to show that Carey is the sole inventor, plaintiffs will have to show that no HPK employee contributed to conception of the invention; when it was reduced to practice is immaterial.

The Court notes that the America Invents Act in 2011 changed U.S. patent law from a first-to-invent system to a first-to-file system. All patents that contain a claim with an effective filing date on or after March 16, 2013, are subject to the new law. Pub. L. No. 112-29, § 3(n)(1), 125 Stat. 284, 293. Only one of the nine patents was filed after March 16, 2013—the '135 patent, filed on December 23, 2013—but every claim therein claims priority to 2009. Therefore, all the patents at issue are subject to the prior, first-to-invent law.

downloaded the '467 patent on October 2, 2015, which is the day after the lawsuit was filed. (ECF 537-6; ECF 535-3). That date shows up as the "date last modified" in the metadata. (*See* ECF 545-3). Plaintiffs responded with (identical) declarations from an expert, Dr. Ezekiel Kruglick, that the "date created" field generally corresponds to the date the document was first saved to a given file system, which, in this case, means that someone at HPK downloaded and saved the file no later than August 3, 2013. (ECF 545-2 ¶¶ 7, 10; ECF 546-2 ¶¶ 7, 10).

Defendants have now moved to strike the Kruglick declarations on the ground that they constitute an untimely expert report. "If a party fails to provide information or identify a witness as required by Rule 26(a) or (e), the party is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless." Fed. R. Civ. P. 37(c). "[T]he required sanction in the ordinary case is mandatory preclusion." *Poulis-Minott v. Smith*, 388 F.3d 354, 358 (1st Cir. 2004) (alteration in original) (internal quotation marks omitted) (quoting *Klonoski v. Mahlab*, 156 F.3d 255, 269 (1st Cir. 1998)). But "preclusion is not a strictly mechanical exercise; district courts have some discretion in deciding whether or not to impose that onerous sanction." *Santiago-Díaz v. Laboratorio Clínicio y de Referencia del Este*, 456 F.3d 272, 276 (1st Cir. 2006). In determining the proper sanction, the court should consider "(1) the party's justification for the late disclosure; (2) the opposing party's ability to overcome any prejudice; (3) the impact on the court docket; (4) the party's history of litigation abuse; and (5) the party's need for the late evidence." *Glass Dimensions, Inc. ex rel. Glass Dimensions, Inc. Profit Sharing Plan & Trust v. State Street Bank & Trust Co.*, 290 F.R.D. 11, 17 (D. Mass. 2013) (citing *Harriman v. Hancock Cty.*, 627 F.3d 22, 30 (1st Cir. 2010)); *see also Gagnon v. Teledyne Princeton, Inc.* 437 F.3d 188, 191 (1st Cir. 2006).

Plaintiffs contend that the expert declarations are proper rebuttal argument to the Takeda declarations. But it is plaintiffs who ultimately have the burden of proof to show that defendants had knowledge of their patents. Plaintiffs presumably intended to use the metadata associated with the '467 patent to show that HPK knew of the patent as of the "date created"—as defendants point out in their motions, merely pointing to HPK's copy of the patent does not show when HPK learned of it. Plaintiffs took the risk that the meaning of the date in the "date created" field would not be self-explanatory. The proffer of the expert opinion is therefore untimely.

It is also not "harmless" within the meaning of Fed. R. Civ. P. 37(c). First, Kruglick was not designated as an expert on metadata. Second, defendants have shown (at the hearing on the summary judgment motions, which was their first opportunity) that there are two "date created" fields associated with a pdf file—one stored in the database the pdf is saved in, and one stored within the pdf itself. Defendants have proffered evidence that these fields can differ, and that the "date created" field within the pdf file can pre-date the download of the document onto a particular file system. All these are holes that defendants might have poked in Kruglick's opinion, but they had no opportunity to cross-examine him about these topics or to respond with their own expert.

The motion to strike will therefore be granted. For the purposes of the summary judgment motions that follow, the Court will assume that the fact of the date in the "date created" field could be evidence that the document was in HPK's possession as of that time, and construe it in the light most favorable to the non-moving party. The Court takes no position as to whether Kruglick's testimony would be admissible at trial.

F. Willful Infringement

Defendants have moved for summary judgment as to plaintiffs' claims that all three

defendants willfully infringed the '467 and '591 patents.

A court may award treble damages "'in a case of willful or bad-faith infringement.'" *Halo Elecs., Inc. v. Pulse Elecs., Inc.*, 136 S. Ct. 1923, 1930 (2016) (quoting *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 508 (1964)) (citing 35 U.S.C. § 284). The Supreme Court recently clarified the standard for willful infringement in *Halo Electronics, Inc. v. Pulse Electronics, Inc.*, 136 S. Ct. 1923 (2016). Prior to *Halo*, the governing standard for determining enhanced damages under § 284 was that promulgated in *In re Seagate Technology, LLC*, 497 F.3d 1360 (Fed. Cir. 2007). Under *Seagate*, a patentee seeking enhanced damages had to show, by clear and convincing evidence, that the infringer acted "despite an objectively high likelihood that its actions constituted infringement of a valid patent" (the "objective recklessness" prong) *and* that the risk of infringement "was either known or so obvious that it should have been known to the accused infringer" (the "subjective knowledge" prong). 497 F.3d at 1371. In *Halo*, the Supreme Court explicitly rejected the "objective recklessness" requirement. 136 S. Ct. at 1932. It explained that "[t]he subjective willfulness of a patent infringer, intentional or knowing, may warrant enhanced damages, without regard to whether his infringement was objectively reckless." *Id.* at 1933.

Under the standard articulated in *Halo*, enhanced damages "are not to be meted out in a typical infringement case." *Id.* at 1932. "The sort of conduct warranting enhanced damages has been variously described in [Supreme Court] cases as willful, wanton, malicious, bad-faith, deliberate, consciously wrongful, flagrant, or—indeed—characteristic of a pirate." *Id.* While a district court has discretion to award enhanced damages, they are generally reserved for "egregious cases of culpable behavior." *Id.*

"[C]ulpability is generally measured against the knowledge of the actor at the time of the

challenged conduct." *Id.* at 1933. Therefore, even after *Halo*, "[k]nowledge of the patent alleged to be willfully infringed continues to be a prerequisite to enhanced damages." *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1341 (Fed. Cir. 2016). But knowledge of the patent is only one part of the knowledge required for culpable infringement—the accused infringer must also know that its acts constitute infringement. *See Halo*, 136 S. Ct. at 1936 (Breyer, J., concurring). Whether the conduct was "willful" is a question of intent that must be inferred from all the circumstances by the factfinder. *WCM Indus., Inc. v. IPS Corp.*, 721 F. App'x 959, 970 (Fed. Cir. 2018) (citing *Gustafson, Inc. v. Intersystems Indus. Prods., Inc.*, 897 F.2d 508, 510-11 (Fed. Cir. 1990)); *see Exmark Mfg. Co. v. Briggs & Stratton Power Prods. Grp., LLC*, 879 F.3d 1332, 1353 (Fed. Cir. 2018) ("[T]he entire willfulness determination is to be decided by the jury."). The Supreme Court further held that a patentee need only establish willfulness by a preponderance of the evidence, instead of the clear-and-convincing standard previously required by the Federal Circuit. *Halo*, 136 S. Ct. at 1934.

1. HPK

a. Knowledge of the Asserted Patents

HPK contends that there is no evidence that it even knew of the patents prior to the lawsuit, and therefore it cannot be liable for pre-suit enhanced damages. Plaintiffs argue that that even without direct proof that HPK knew of the patents, there is enough circumstantial evidence to create a genuine issue of material fact as to whether they knew of the patents or were willfully blind to their existence.

As an initial matter, the parties dispute whether knowledge of patents that are related to the asserted patents, or knowledge of an asserted patent's application before it has issued, can be substantial evidence from which a reasonable jury can infer that an accused infringer had knowledge of the asserted patent itself. Multiple district courts, post-*Halo*, have held that neither

general knowledge of a patent portfolio nor actual knowledge of a patent application or of related patents, without more, is sufficient even to plausibly allege knowledge of a particular asserted patent. *Finjan, Inc. v. Juniper Networks, Inc.*, 2018 WL 905909, at *3 (N.D. Cal. Feb. 14, 2018) (knowledge of other patent in family not enough); *Bayer Healthcare LLC v. Baxalta Inc.*, 2017 U.S. Dist. LEXIS 126904, at *2-3 (D. Del. Aug. 10, 2017) (knowledge of parent application not enough); *Windy City Innovations, LLC v. Microsoft Corp.*, 193 F. Supp. 3d 1109, 1117 (N.D. Cal. 2016) (allegations that defendant knew of an unasserted patent and the application that later issued as the asserted patent not enough to plausibly allege knowledge of asserted patent); *Finjan, Inc. v. Cisco Sys. Inc.*, 2017 WL 2462423, at *5 (N.D. Cal. June 7, 2017) ("Knowledge of a patent portfolio generally is not the same thing as knowledge of a specific patent."); *see Verint Sys. Inc. v. Red Box Recorders Ltd.*, 2016 WL 7177844, at *2 (S.D.N.Y. Dec. 7, 2016) (summary judgment).

But the Federal Circuit has cast significant doubt on that authority. In *WCM Industries, Inc. v. IPS Corp.*, 721 F. App'x 959 (Fed. Cir. 2018), the Federal Circuit affirmed a finding of willful infringement. The defendant's primary argument on appeal, like HPK's argument here, was that it had no knowledge of the patents before the lawsuit began. It cited to *State Industries, Inc. v. A.O. Smith Corp.*, 751 F.2d 1226 (Fed. Cir. 1985), and *Gustafson, Inc. v. Intersystems Industrial Products, Inc.*, 897 F.2d 508 (Fed. Cir. 1990), for the proposition that "[t]o willfully infringe a patent, the patent must exist and one must have knowledge of it." *WCM*, 721 F. App'x at 970 (quoting *State Insdus.*, 751 F.2d at 1236). The Federal Circuit stated that "*State Industries* does not establish a per se rule" and the infringer's intent must be inferred from the totality of the circumstances. It went on to hold that the patentee had "provided sufficient evidence for a reasonable jury to conclude that [the accused infringer] *did* know of [the patentee's] patents as

they issued, if not earlier." *WCM*, 721 F. App'x at 970. That evidence included testimony from an employee of the accused infringer that "he had monitored WCM's products for decades and possessed catalogs and other literature indicating that WCM's products were marked with 'patent pending'" and that the accused infringer had a "culture of copying." *Id.* at 971. The Federal Circuit noted its prior precedent that "knowledge of a pending patent application cannot support a finding of willfulness," and questioned, without deciding, whether those holdings remain valid now that applications and realtime prosecution activity are published. *Id.* at 970 n.4.

In short, it appears that there is no bright-line rule as to what level of knowledge is sufficient. Like any question of intent, it must be inferred from all the evidence and circumstantial evidence can suffice. *See Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1365 (Fed. Cir. 2004) ("[D]irect evidence of a fact is not necessary. Circumstantial evidence is not only sufficient, but may also be more certain, satisfying and persuasive than direct evidence. . . . A patentee may prove . . . intent through circumstantial evidence . . . ." (quoting *Moleculon Research Corp. v. CBS, Inc.*, 793 F.2d 1261, 1272 (Fed. Cir. 1986)) (internal quotation marks omitted)).

Here, plaintiffs contend that HPK was "actively monitoring" the intellectual property of Harvard and SiOnyx since 2006. They point to the following pieces of evidence to support that theory: (1) a January 2006 report from HC to HPK summarizing Harvard's work, which includes citations to two pending patent applications that name Carey and Mazur as inventors and that are great-grandparent and great-great-grandparent applications of the asserted '467 patent (ECF 474-3); (2) an updated version of that report from October 2006, explaining that Carey had left Mazur's lab to found SiOnyx and that SiOnyx had received seed funding; (ECF 474-9); (2) Nagano's November 2006 presentation, which looks like it was based on the same

information as the October 2006 report and cites to the same figures (ECF 377-14); (3) the fact of the collaboration back in 2007, in which SiOnyx shared information pursuant to a confidentiality agreement; (4) a June 21, 2007 email between HPK and HC employees forwarding a news report about Harvard's failure to patent certain aspects of its technology (ECF 474-11); (5) the fact that in the "prior art" section of seven of HPK's patents (the '087, '528, '945, '485, '135, '551, and '109 patents), HPK cited to patents and patent applications in the same family as the '467 patent; (6) the copy of a child of the '591 patent that HPK does not dispute was in its possession as of July 2013; and (7) the copy of the '467 patent itself, which, taking the facts in the light most favorable to plaintiffs, the Court must assume was in HPK's possession in August 2013.

The Court cannot conclude, as a matter of law, that the evidence is insufficient to establish that HPK knew of the asserted patents. This is not a case where, in the course of its ordinary business of research and development, HPK happened upon some patents that turned out to be related to the patents later asserted against it. HPK had a confidential business relationship with SiOnyx; it was studying the work coming out of Mazur's laboratory to try to replicate the reported NIR photosensitivies; it reached out to SiOnyx in 2009 because it was concerned about Harvard's patents and represented that it did not think its products infringed any of those patents, suggesting that it was paying attention to plaintiffs' patent activity at least as of that time; and it cited to some of Harvard's patents in the process of obtaining its own. In circumstances such as these, a reasonable factfinder could conclude that HPK's knowledge of related patent bears on its knowledge of the asserted patents. And the Court is assuming, for the purposes of this motion, that a reasonable jury could conclude from the "date created" metadata that HPK had a copy of the '467 patent as of August 2013. Therefore, there is a genuine issue of

material fact as to whether HPK in fact knew of the asserted patents prior to this lawsuit.

b. Culpability

HPK argues that even if plaintiffs can show that it had knowledge of the patents, they cannot show that HPK's behavior was egregious or culpable.

To show culpable behavior, plaintiffs point to the evidence supporting their claim that HPK violated the nondisclosure agreement and used SiOnyx's confidential information to develop the accused products. HPK contends that its behavior in 2008-2009 cannot amount to culpable behavior because the patents asserted in this suit were not even filed until May 10, 2010 (the '467 patent) and September 17, 2010 (the '591 patent); were not published until September 23, 2010 (the '467 patent); and September 22, 2011 (the '591 patent); and did not issue until December 20, 2011 (the '467 patent), and March 25, 2014 (the '591 patent). It contends that, at most, it continued to sell products that might be infringing, which is not alone egregious conduct. *Intellectual Ventures I, LLC v. Symantec Corp.*, 234 F. Supp. 3d 601, 612 (D. Del. 2017).

As an initial matter, there appears to be a genuine issue of material fact as to when exactly the accused products were first sold in the United States. Defendants, in their statement of material facts, assert that "HPK and HC began selling the Accused Products into the United States in 2010," but they do not cite to any record evidence to support that fact. (ECF 474-2 ¶ 31). Plaintiffs, in their response, state that they "lack knowledge to admit or deny this paragraph." (ECF 526-1 ¶ 31). In their opposition to the motion, they contend that HPK introduced new allegedly infringing products after October 2015, when the lawsuit was filed and HPK indisputably had knowledge of the patents. (ECF 526 at 15). Therefore, HPK may well have done more than simply continued to sell products it had been making since before the patents issued.

Second, the facts of this case may be sufficient to establish that HPK knowingly or

recklessly infringed SiOnyx's patents, even if the products were developed and first sold prior to the asserted patents' issuance. Again, the facts must be interpreted in the light most favorable to plaintiffs. If HPK indeed knew that SiOnyx had shared confidential technology; knew that SiOnyx planned to patent that technology; secretly copied that technology, falsely led SiOnyx to believe that it had developed the technology on its own; and then commercialized it, that behavior would not be excused simply because HPK managed to get its products on the market before SiOnyx's patents issued. While HPK certainly cannot infringe a patent that does not exist, once the patents do issue, its prior conduct does not disappear—as of the date the patents issued, HPK could have been purposely selling products based on technology it allegedly stole. And its decision to copy confidential technology would surely factor into the question of whether it had reason to know that its actions would constitute patent infringement. Again, the question is not whether those facts have been proved, but whether a material factual dispute exists.

Plaintiffs have therefore put forth sufficient evidence to create a genuine issue of material fact as to whether HPK willfully infringed the asserted patents, and summary judgment on that issue as to HPK will be denied.

2. HC

Plaintiffs further allege that HC is a willful infringer. The allegations of knowledge as to HC, however, are extremely weak. Indeed, plaintiffs make no effort in their opposition to separately cite evidence supporting HC's willful infringement—they only refer collectively to "Hamamatsu" and "defendants." (ECF 526 at 10-14).

Of the evidence that plaintiffs cite to support their contention that HPK was actively monitoring SiOnyx's patent portfolio, the only things that point to knowledge by HC are (1) the January 2006 report from HC to HPK summarizing Harvard's work, which includes citations to two pending patent applications that name Carey and Mazur as inventors and that are great-

grandparent and great-great-grandparent applications of the asserted '467 patent (ECF 474-3); and (2) an updated version of that report from October 2006, explaining that Carey had left Mazur's lab to found SiOnyx and that SiOnyx had received seed funding, (ECF 474-9); and (3) the June 21, 2007 email between HPK and HC employees forwarding a news article about Harvard's failure to patent certain aspects of its technology (ECF 474-11). The 2006 report was written long before the patents-in-suit were filed by someone in the "University Sales/Marketing" department, not an intellectual-property person. The 2007 article generally discusses Harvard's technology transfer office, with only a few paragraphs about Mazur, one mention of SiOnyx, and no citation to any specific patents. There is no evidence that HPK and HC regularly communicated about intellectual property matters. Although HC knew about the collaboration between HPK and SiOnyx—its secretary signed the non-disclosure agreement on behalf of HPK—there is no evidence that HC knew what happened during or after the collaboration, or knew that HPK kept the wafers and possibly copied the technology. HC's corporate representative testified at its deposition that it first learned of the patents-in-suit when the lawsuit was filed. (ECF 474-4 at 41:7-11).

Even taken together, that evidence is insufficient for a reasonable jury to conclude that HC knew of the patents-in-suit. At most, it shows that HC's University Sales department was interested in Mazur's work at Harvard in in 2006 and 2007, and knew of two published patent applications many generations away from the asserted patents here. There is no allegation that HC conducts research and development in this area or regularly researches patent applications; it only sells products HPK develops. Nor is the evidence sufficient to show any culpable behavior by HC—all of the evidence tending to show copying and allegedly misleading statements about HPK's development of the accused products implicates HPK. Again, plaintiffs do not even

attempt to separate what it alleges to be HC's culpable conduct from HPK's, which does not bolster their claim.

Plaintiffs contend that even if HC did not actually know of the asserted patents, the evidence establishes that it was willfully blind to them. *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 766 (2011). But willful blindness requires more than just "deliberate indifference to a known risk that a patent exists." *Id.* Instead, "(1) the defendant must subjectively believe that there is a high probability that a fact exists *and* (2) the defendant must take deliberate actions to avoid learning of that fact." *Id.* at 769 (emphasis added). Plaintiffs have not alleged any "deliberate actions" taken by HC to avoid learning of the patents, or even any reason for HC to have been looking for them. Thus, plaintiffs have failed to show that HC was willfully blind to the asserted patents.

Plaintiffs further contend that subjective recklessness is enough to support a finding of willful infringement under *Halo*, and, therefore, they need only establish that "Hamamatsu and Ocean knew *or should have known* of Plaintiffs' Patents and, thus, that developing the Accused Products unreasonably risked infringement thereof." (ECF 526 at 9 (emphasis added)). To the extent plaintiffs are arguing that enhanced damages can be warranted where an accused infringer "acts '*knowing* or *having reason to know* of facts which would lead a reasonable man to realize' his actions" create an unreasonable risk of infringement, that appears to be correct. *Halo*, 136 S. Ct. at 1933. That is essentially the same as the subjective knowledge prong of *Seagate*, which *Halo* appeared to leave undisturbed. *See In re Seagate*, 497 F.3d at 1371 (explaining that the risk of infringement must be "either known or so obvious that it should have been known to the accused infringer"); *see also Georgetown Rail Equip. Co. v. Holland L.P.*, 867 F.3d 1229, 1245 (Fed. Cir. 2017); *WCM*, 721 F. App'x at 971 (agreeing with the patentee that the jury had

"enough evidence to conclude that [the accused infringer] knew of [the patentee's] patents as they issued (if not earlier) and that the risk of infringement was known to [the accused infringer] or so obvious that it should have been known.").

At times, however, plaintiffs appear to be arguing that recklessness as to the existence of the patents alone is enough to establish culpable behavior. The Court need not decide that question at this time, because it concludes that the evidence is not strong enough to support a finding that HC should have known about the asserted patents in this case. But it is at least doubtful, in light of *Halo*, whether evidence establishing that an infringer should have known of the existence of certain patents (but did not know their exact contents) can suffice to establish that it should have known that its particular actions were infringing and therefore that its behavior was "egregious."

Accordingly, summary judgment will be granted to HC as to plaintiffs' claims of willful infringement.

3. Ocean Optics

The complaint does not allege willful infringement by Ocean Optics. (ECF 163-2 ¶¶ 40, 193-94, 219-20, 242-43, 274 (only alleging willful infringement by "Hamamatsu")). To the extent plaintiffs now wish to advance that claim, the only evidence they have put forward to show that Ocean Optics knew of the patents is (1) that Ocean Optics approached SiOnyx to purchase black silicon; (2) that SiOnyx and HPK/HC were the only competitors in the market for laser-processed silicon, NIR-enhanced photodiodes; and (3) that Ocean Optics was aware that SiOnyx's products were "unique."

Those facts, alone, are insufficient to create a genuine issue of material fact as to willfulness. There is no evidence that Ocean Optics knew of any of Harvard's or SiOnyx's patents. The corporate representative of Ocean Optics testified that it did not learn of the

asserted patents until it was named as a defendant in the first amended complaint in early 2016. (ECF 474-5). There is no evidence to the contrary—for example, to show that Ocean Optics even knew about the 2007 SiOnyx-HPK collaboration or that HPK could possibly have copied SiOnyx's technology. Following its discovery of the patents, Ocean Optics merely continued to sell its spectrometers during the pendency of what is, as to it, a "garden-variety" patent infringement lawsuit.

Summary judgment as to lack of willful infringement by Ocean Optics will therefore be granted.

G. Indirect Infringement

HPK, HC, and Ocean Optics have further moved for summary judgment as to the claims of indirect infringement.

A claim for indirect infringement can be based on inducement under 35 U.S.C. § 271(b) or contributory infringement under 35 U.S.C. § 271(c). "[L]iability for inducing infringement attaches only if the defendant knew of the patent and that 'the induced acts constitute patent infringement.'" *Commil USA, LLC v. Cisco Sys., Inc.*, 135 S. Ct. 1920, 1926 (2015) (quoting *Global-Tech*, 563 U.S. at 766). "Like induced infringement, contributory infringement requires knowledge of the patent in suit and knowledge of patent infringement." *Id.* In order for a defendant to be liable for either type of indirect infringement, a patentee must show that some party has directly infringed. *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2117 & n.3 (2014).

Under 35 U.S.C. § 271(b), "[w]hoever actively induces infringement of a patent shall be liable as an infringer." The patentee must establish that "the defendant possessed specific intent to encourage another's infringement and not merely that the defendant had knowledge of the acts alleged to constitute inducement." *Vanda Pharm., Inc. v. West-Ward Pharm. Int'l Ltd.*, 887 F.3d

1117, 1129 (Fed. Cir. 2018) (quoting *DSU Med. Corp. v. JMS Co.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006) (en banc in relevant part)). "[I]nducement must involve the taking of affirmative steps to bring about the desired result." *Global-Tech*, 563 U.S. at 760. Evidence of affirmative steps can "be found in advertising an infringing use or instructing how to engage in an infringing use." *Vanda*, 887 F.3d at 1129 (quoting *Takeda Pharm. U.S.A. v. West-Ward Pharm. Corp.*, 785 F.3d 625, 630-31 (Fed. Cir. 2015)).

Under 35 U.S.C. § 271(c), "[w]hoever offers to sell or sells within the United States or imports into the United States a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer."

As an initial matter, neither plaintiffs' contentions nor their opposition to defendants' motion address contributory infringement. Plaintiffs have not contended that any defendant makes a component specially adapted for use in infringing their patents—they have not identified a component, the infringing machine it is specially adapted for, or the identity of the direct infringer. At this point, therefore, plaintiffs have waived any argument that any defendant contributorily infringes.

As to induced infringement, plaintiffs provided contentions only as to the '591 patent. Neither their opposition nor their surreply addresses inducement with respect to the '497 patent; the Court will therefore consider any argument that any defendant actively induced infringement of the '497 patent to be waived.

The '591 inducement contentions stated the following under the heading "Infringement

under 35 U.S.C. § 271(b)":

> Plaintiffs contend that HPK, HC, and OO are liable as direct [sic] infringers of claims 3, 4, 9, 25, and 26 of the '591 Patent for actively inducing infringement by their customers who make, use, offer for sale, or sell in the United States or import into the United States the accused products identified above in Section I.B.
>
> . . . .
>
> Having knowledge of Harvard's and SiOnyx's Patents, Defendants induced others in the United States to use, sell, and/or offer for sale in the United States, and/or import into the United States products that include Hamamatsu's image sensors that practice all elements of one or more of claims 3, 4, 9, 25, and 26 of the '591 patent."

(ECF 475-6 at 15-16).[25]

As discussed above, plaintiffs have put forth sufficient evidence to create a genuine issue of material fact as to whether HPK knew of the asserted patents. They have not, however, met their burden to show a genuine issue of material fact as to the knowledge of HC or Ocean Optics. Because there is insufficient evidence that HC or Ocean Optics knew of the patents prior to the lawsuit, summary judgment as to the claim of induced infringement will be granted as to HC and Ocean Optics.

HPK contends that even if plaintiffs can prove knowledge of the patents, they cannot prove that HPK had the specific intent to encourage infringement by others. However, as discussed above, if plaintiffs are correct that HPK deliberately copied SiOnyx's confidential technology, that would tend to prove at a minimum that HPK knew it was misusing information in a way that, as soon as the patents issued, could be infringing.

As to affirmative steps of encouragement, plaintiffs point to a single document that

[25] Claim 26 is no longer asserted in this case. (ECF 459).

appears to be a marketing specification sheet for the S11510 series of CCD image sensors.[26] That document states that "[t]he S11510 series is a family of FFT-CCD image sensors for photometric applications that offer improved sensitivity in the near infrared region at wavelengths longer than 800 nm" and "[i]n addition to having high infrared sensitivity, the S11510 series can be used as an image sensor with a long active area in the direction of the sensor height by binning operation, making it suitable for detectors in Raman spectroscopy." (ECF 516-11). While thin, that is enough to create a genuine issue of material fact as to whether HPK was encouraging its customers to use their image sensors in products that practice all the elements of claims 3, 4, 9, and 25 of the '591 patents.

Defendants motion for partial summary judgment as to indirect infringement will therefore be denied as to the claim that HPK induced infringement of the '591 patent, and otherwise granted.

IV. Conclusion

For the foregoing reasons:

- The motion of HPK, HC, and Ocean Optics for partial summary judgment as to all claims of infringement on the '591 patent is DENIED.
- The motion of Ocean Optics for summary judgment as to all claims is DENIED.
- The motion of SiOnyx concerning *inter partes* review estoppel is GRANTED in part and DENIED in part. Defendants will be estopped from arguing that any claim of the '591 patent—including claims 3, 19, and 20—is invalid for obviousness based on any ground raised in the *inter partes* review petition,

[26] Plaintiffs attach two versions of this document to their motion—one in English and one in Japanese. (ECF 516-11; ECF 516-12). The English document appears to have been produced in English by HC, and is not a certified translation, whereas the Japanese document was produced by HPK.

including (1) anticipation by or obviousness over Nakashiba, (2) obviousness over Akahori in view of Mazur, (3) and obviousness over Mabuchi in view of Mazur.

- The motion of HPK, HC, and Ocean Optics for partial summary judgment on the ground that Carey cannot be the sole inventor of the HPK patents is DENIED.
- The motion of HPK, HC, and Ocean Optics to strike the Kruglick declaration is GRANTED.
- The motion for partial summary judgment as to all claims of willful infringement is GRANTED as to HC and Ocean Optics and DENIED as to HPK.
- The motion for partial summary judgment as to all claims of indirect infringement is DENIED as to the claim that HPK induced infringement of the ’591 patent, but is otherwise GRANTED.

So Ordered.

/s/ F. Dennis Saylor
F. Dennis Saylor, IV
United States District Judge

Dated: August 30, 2018