

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLIED MATERIALS, INC.,
Petitioner,

v.

OCEAN SEMICONDUCTOR LLC,
Patent Owner.

IPR2021-01348
Patent 6,836,691 B1

Before SCOTT B. HOWARD, JOHN D. HAMANN, and
DAVID COTTA, *Administrative Patent Judges*.

HAMANN, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Applied Materials, Inc. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–19 of U.S. Patent No. 6,836,691 B1 (Ex. 1001, “the ’691 patent”) pursuant to 35 U.S.C. § 311. Ocean Semiconductor LLC (“Patent Owner”) filed a Patent Owner Preliminary Response (Paper 9, “Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply (Paper 10) to the Preliminary Response relating to discretionary denial under 35 U.S.C. § 314(a), and Patent Owner filed a Preliminary Sur-Reply (Paper 11) in response to the Preliminary Reply.¹

We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4(a) (2021). An *inter partes* review may be instituted if “the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018).

Upon consideration of the papers, we determine that the information presented in the Petition does not demonstrate a reasonable likelihood that Petitioner would prevail in establishing that at least one challenged claim is unpatentable. Accordingly, we deny the Petition and do not institute *inter partes* review.

¹ We do not reach the issue of discretionary denial under § 314(a) because we determine that Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing that at least one claim of the ’691 patent is unpatentable.

A. Real Parties-in-Interest

The parties identify themselves as the real party-in-interest. Pet. 1; Paper 8, 2. Petitioner also identifies PDF Solutions, Inc. as a “potential real party-in-interest” with whom Petitioner “discussed this Petition and the Ground presented.” Pet. 1. Petitioner also identifies Analog Devices, Inc.; Huawei Device USA, Inc.; Huawei Device Co., Ltd.; HiSilicon Technologies Co., Ltd.; Infineon Technologies AG; Infineon Technologies Americas Corp.; MediaTek Inc.; MediaTek USA Inc.; NVIDIA Corporation; NXP USA, Inc.; Renesas Electronics Corporation; Renesas Electronics America, Inc.; Silicon Laboratories Inc.; STMicroelectronics, Inc.; and Western Digital Technologies, Inc. as “potential real parties-in-interest, none of whom had any access to the Petition,” according to Petitioner. *Id.* at 1–2.

B. Related Matters

The parties indicate that the ’691 patent has been asserted in the following proceedings: *Ocean Semiconductor LLC v. Analog Devices, Inc.*, No. 1:20-cv-12310 (D. Mass); *Ocean Semiconductor LLC v. Infineon Technologies AG*, No. 1:20-cv-12311 (D. Mass.); *Ocean Semiconductor LLC v. Huawei Device USA Inc.*, No. 4:20-cv-911 (E.D. Tex.); *Ocean Semiconductor LLC v. MediaTek Inc.*, No. 6:20-cv-1210 (W.D. Tex.); *Ocean Semiconductor LLC V. NVIDIA Corp.*, No. 6:20-cv-1211 (W.D. Tex.); *Ocean Semiconductor LLC v. NXP Semiconductors NV*, No. 6:20-cv-1212 (W.D. Tex.); *Ocean Semiconductor LLC v. Renesas Electronics Corp.*, No. 6:20-cv-1213 (W.D. Tex.); *Ocean Semiconductor LLC v. Silicon Laboratories Inc.*, No. 6:20-cv-1214 (W.D. Tex.); *Ocean Semiconductor LLC v. ST Microelectronics Inc.*, No. 6:20-cv-1215 (W.D. Tex.); and *Ocean Semiconductor LLC v. Western Digital Technologies, Inc.*, No. 6:20-cv-1216 (W.D. Tex.). Pet. 2; Paper 8, 2–3.

C. The Challenged Patent

The '691 patent “relates generally to an industrial process . . . in a semiconductor device manufacturing environment.” Ex. 1001, 1:8–11. In such an environment, “a set of processing steps is performed on a wafer using a variety of processing tools, including photolithography steppers, etch tools, deposition tools, polishing tools, rapid thermal processing tools, [and] implantation tools.” *Id.* at 1:27–30. “One technique for improving the operation of a semiconductor processing line includes using a factory wide control system to automatically control the operation of the various processing tools,” such as “an advanced process control (APC) system.” *Id.* at 1:31–34, 1:39–44.

In such a system, “metrology data is collected on a regular basis, generally in accordance with a sampling plan, for process control purposes.” Ex. 1001, 1:49–51. More specifically, “[t]he collected metrology data is used by the process controllers for the tools.” *Id.* at 1:51–53. For example, “[o]perating recipe parameters are calculated by the process controllers based on the performance model and the metrology information to attempt to achieve post-processing results as close to a process target value as possible.” *Id.* at 1:53–57.

According to the '691 patent, “[m]etrology data[, however,] is also used for other purposes not related to process control,” such as for fault detection and classification. Ex. 1001, 1:61–62. Thus, “when a process controller gathers metrology data to update its control model or generate a control action for subsequent processing, it retrieves . . . metrology data collected through the regular sampling plans implemented in the facility, and the metrology data collected for other purposes.” *Id.* at 2:10–17. However, “[s]ome of the metrology data does not accurately reflect the state of the

process or the devices manufactured” (e.g., “devices processed by a tool that was malfunctioning may have characteristics that were affected by the malfunction ([i.]e., a special cause) rather than by normal process variation (i.e., common cause)).” *Id.* at 2:17–23. “Employing this data for use in process control routines may introduce a source of variation that cannot be addressed by the process controller” *Id.* at 2:23–26. The invention of the ’691 patent is directed to overcoming this problem. *Id.* at 2:27–29.

To that end, the ’691 patent teaches storing “context data that includes identification data and collection purpose data,” in addition to storing the collected metrology data. Ex. 1001, 6:11–13. “Exemplary identification data includes lot identification number (ID), wafer ID, location data (e.g., location of measurement on die or wafer), [and] process-operation data (e.g., last completed step in the fabrication process).” *Id.* at 6:14–17. “The collection purpose data indicates the initial purpose for the collection of the metrology data” (e.g., for “process control sampling, fault detection sampling, [and] targeted fault detection”). *Id.* at 6:17–21. The ’691 patent teaches that the collection purpose data can comprise collection purpose codes, such as (i) “01” for “Process Control Sampling,” (ii) “02” for “Fault Detection Sampling,” (iii) “03” for “Targeted Fault Detection,” (iv) “88” for “Fault Detection - no fault identified,” and (v) “99” for “Known Defective.” *Id.* at 6:66–7:12 (including Table 1).

For embodiments of the ’691 patent, “the collection purpose data is used to filter the metrology data for subsequent uses.” Ex. 1001, 6:22–24. In particular, “a process controller . . . [, which] would conventionally employ all metrology data for a particular tool . . . for updating the states of its control model and generating a control action for modifying an operating recipe parameter for the tool,” can use the collection purpose data to filter

the metrology data so as to exclude metrology data collected for fault detection purposes. *Id.* at 6:24–32. Put differently, when a process controller “gathers metrology data for process control purposes (e.g., state update or control action generation), it filters the metrology data, so that data that is less useful for process control purposes is ignored.” *Id.* at 7:52–55. “For example, the process controller . . . may gather ‘01,’ ‘02,’ and ‘88’ data and exclude the metrology data where fault conditions are more likely to exist ([i.]e., the ‘03’ and ‘99’ data).” *Id.* at 7:56–59. According to the ’691 patent, “[f]iltering the metrology data in this manner may improve the performance of the process controller . . . by removing outlier data that exhibits variation from a source other than normal process variation.” *Id.* at 6:32–35. “[A] process control activity related to one of the tools [then can be] conducted based on the filtered metrology data.” *Id.* at 8:4–6.

D. The Challenged Claims

Petitioner challenges claims 1–19 of the ’691 patent. Claims 1 and 10 are independent. Claim 1 is illustrative, and is reproduced below:

1. A method, comprising:
 - collecting metrology data related to the processing of workpieces in a plurality of tools;
 - generating context data for the metrology data, the context data including collection purpose data;
 - filtering the metrology data based on the collection purpose data; and
 - conducting a process control activity related to one of the tools based on the filtered metrology data.

Ex. 1001, 8:19–27.

E. Asserted Ground of Unpatentability

Petitioner asserts the following ground of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis²
1–19	103(a) ³	Funk, ⁴ Stoddard ⁵

Pet. 15, 33–66. Petitioner submits the Declaration of Miltiadis Hatalis, Ph.D. (Ex. 1002) in support of its arguments.

II. LEVEL OF ORDINARY SKILL IN THE ART

To determine whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). “[O]ne or more factors may predominate.” *Id.*

² Petitioner also lists the “background knowledge” of one of ordinary skill in the art. Pet. 15. We consider such knowledge as part of our obviousness analysis, but do not identify it separately as a reference. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013).

³ The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the ’691 patent issued from an application filed before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability. *See* Ex. 1001, code (22).

⁴ US 7,123,980 B2, issued Oct. 17, 2006 (Ex. 1005, “Funk”).

⁵ US 6,587,744 B1, issued July 1, 2003 (Ex. 1008, “Stoddard”).

Petitioner argues that one of ordinary skill in the art at the time of the invention of the '691 patent “would have at least a B.S. in mechanical engineering, electrical engineering, materials science engineering, or a related field, and four years of experience working with semiconductor manufacturing processes and measurement techniques.” Pet 17 (citing Ex. 1002 ¶ 29). Patent Owner does not identify a level of skill in the art that one would have had at the time of the invention of the '691 patent or identify any specific shortcoming in Petitioner’s formulation. *See generally* Prelim. Resp.

For purposes of this Decision, and based on the current record, we adopt Petitioner’s assessment of the level of skill for one of ordinary skill in the art. Pet. 17.

III. CLAIM CONSTRUCTION

Because the Petition was filed after November 13, 2018, we construe the challenged claims by applying the standard used in federal courts, in other words, the claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Under *Phillips*, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning they would have to a person of ordinary skill in the art at the time of the invention, in light of the specification and prosecution history. *See Phillips*, 415 F.3d at 1312–13.

The parties do not identify any claim terms for construction. Pet. 15; *see* Prelim. Resp. And we determine that no express constructions are needed for us to render our Decision on Institution. *See, e.g., Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and

only to the extent necessary to resolve the controversy.” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

IV. PRINCIPLES OF LAW

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person having ordinary skill in the art. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of non-obviousness, if present.⁶ *Graham*, 383 U.S. at 17–18. When evaluating a claim for obviousness, we also must “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

V. ALLEGED OBVIOUSNESS OVER FUNK AND STODDARD

Petitioner argues that the combination of Funk and Stoddard renders claims 1–19 obvious. Pet. 33–66. We have reviewed the parties’ arguments and the evidence of record. For the reasons that follow, we determine that Petitioner does not demonstrate a reasonable likelihood that it would prevail in showing that at least one of these claims of the ’691 patent would have been obvious.

⁶ Patent Owner does not present arguments or evidence of such objective evidence of non-obviousness. *See generally* Prelim. Resp.

A. Summary of Funk

Funk “is related to semiconductor processing systems, particularly to semiconductor processing systems, which use Advanced Process Control (APC).” Ex. 1005, 1:35–37. More specifically, Funk provides an APC system, which includes Graphical User Interfaces (“GUIs”) “for monitoring and controlling a semiconductor manufacturing process that is performed by a semiconductor processing system.” *Id.* at code (57). “The semiconductor processing system includes a number of processing tools, a number of processing modules (chambers), and a number of sensors, and the APC system comprises an APC server, database, interface server, client workstation, and GUI component.” *Id.*

B. Summary of Stoddard

Stoddard relates “to microelectronic circuit fabrication and, more particularly, to methods and apparatus for controlling microelectronic circuit fabrication processes.” Ex. 1008, 1:15–18. More specifically, Stoddard teaches “an advanced run-to-run controller for controlling manufacturing processes compris[ing a] set of processing tools, a set of metrology tools for taking metrology measurements from the processing tools, and a supervising station for managing and controlling the processing tools.” *Id.* at 2:19–23. Stoddard’s “supervising station comprises an interface for receiving metrology data from the metrology tools and a number of variable parameter tables, one for each of the processing tools, collectively associated with a manufacturing process recipe.” *Id.* at 2:24–28. Stoddard teaches that its “supervising station also includes one or more internal models which relate received metrology data to one or more variables for a processing tool, and which can modify variables stored in the variable parameter table to control

the process tools using feedback and/or feed-forward control algorithms.”
Id. at 2:28–33.

C. Generating Context Data for the Metrology Data, the Context Data Including Collection Purpose Data

Petitioner argues that the combination of Funk and Stoddard teaches “generating context data for the metrology data, the context data including collection purpose data,” as recited in independent claim 1. Pet. 44–48. We focus on Petitioner’s showing for generating collection purpose data for the metrology data and find its showing insufficient for the reasons discussed below.⁷

First, Petitioner argues that “[t]he combination of the Funk APC system, leveraging the collection and analysis of metrology data as taught by Stoddard, discloses the context data including collection purpose data.” Pet. 46 (citing Ex. 1002 ¶ 135). Petitioner argues that “Funk discloses that a control strategy defines a set of sequences for a single wafer, a single tool, a single lot, or a combination of tool activities, including a combination of processing activities, and that ‘context information associates a process step or recipe with one or more strategies and/or plans.’” *Id.* (quoting Ex. 1005, 22:35–44; citing Ex. 1002 ¶ 136). Petitioner argues that Funk teaches “that plans for data collection, preprocessing, judgment, sensors, parameter selection, and trim are executed as part of the data collection strategy and overall control strategy.” *Id.* (citing Ex. 1005, 25:8–12, 26:3–6; Ex. 1002 ¶ 136). Petitioner adds that “[t]he data collection, data preprocessing, and

⁷ We address one limitation of independent claim 1 here because Petitioner’s insufficient showing for this limitation is dispositive for our decision on institution. By doing so, however, we do not suggest that Petitioner has made a sufficient showing for the remaining limitations of the challenged claims.

judgment plans are associated with their own IDs.” *Id.* (citing Ex. 1005, 24:61–65, Fig. 10; Ex. 1002 ¶ 136). According to Petitioner, “[e]ach of these plans reflects a purpose within the control strategy (i.e., a data collection plan has the purpose of process control sampling and judgment/intervention plans have the purpose of fault detection), and the data collection plan ID and judgment plan ID are therefore collection purpose data included within the context data.” *Id.* (citing Ex. 1002 ¶ 136).

We find that these arguments are insufficient to show that Funk and Stoddard teach the limitation. Petitioner relies on Funk’s control strategies and plans, but Petitioner does not identify generated context data that corresponds to collection purposes (e.g., a collection purpose code or other such data) for the strategies or plans. *Id.* At most, Petitioner identifies plan IDs, but does not show sufficiently how such plan IDs provide the generated collection purpose data for the corresponding collected metrology data. *Id.* Rather, such plan IDs are akin to context data that comprises “identification data.” *Compare* Ex. 1001, 6:14–17 (“Exemplary identification data includes lot identification number (ID), wafer ID, location data (e.g., location of measurement on die or wafer), process-operation data (e.g., last completed step in the fabrication process), etc.”), *with* Ex. 1005, 24:46–55 (“Each control strategy can contain at least some of the following context information: tool ID, lot ID, chamber ID, cassette ID, slot ID, wafer ID, recipe ID, control job ID, process job ID, start time, end time, step number, state, maintenance counter value, product ID and material ID.”), *and id.* at 24:61–65). In contrast, “[t]he collection purpose data indicates the initial purpose for the collection of the metrology data” (e.g., “process control sampling, fault detection sampling, [and] targeted fault detection”).

Ex. 1001, 6:11–21. Again, Petitioner does not show sufficiently that Funk’s plan IDs indicate the collection purpose of the collected metrology data.

In addition, Petitioner incorrectly conflates an alleged purpose of a plan with a collection purpose for collected metrology data. For example, Petitioner argues that “judgment/intervention plans have the purpose of fault detection.” Pet. 46. However, Petitioner does not sufficiently show how these plans relate to a collection purpose and collecting metrology data. In particular, the portions of Funk that Petitioner cites for judgment/intervention plans do not relate to collecting data (nor have an associated collection purpose), but rather relate to other processes or analysis (e.g., selecting actions, sending messages, determining whether an alarm has been produced, stopping a tool). *See, e.g.*, Pet. 34 (citing Ex. 1005, 26:57–27:4, 28:60–29:48, Fig. 9), 46.

Second, Petitioner argues that “Funk discloses several other examples of context data that include collection purpose data.” *Id.* at 47. In particular, Petitioner argues that these examples comprise (i) “data collected during production runs that yield high quality product to establish ‘good tool state’ data”; (ii) “when a tool health control strategy is executed, the context can be tool, module, or sensor diagnostics”; and (iii) “dummy wafers used in fingerprinting-related data collection plans and recipes, which can be used to refine process and tool modeling.” *Id.* (citing Ex. 1005, 25:13–15, 25:25–29, 25:46–50; Ex. 1002 ¶ 138).

We find that these arguments also are insufficient to show that Funk and Stoddard teach the limitation. In particular, we find that Petitioner does not explain sufficiently how these teachings from Funk, as modified by Stoddard, teach generating collection purpose data for the collected metrology data. *Id.* More specifically, Petitioner does not identify

sufficiently what it contends is the disclosed collection purpose data for the three examples. *Id.* As to the first example, Funk teaches that “[d]ata collected during production runs that yield high quality product can be used to establish ‘good tool state’ data, and data collected subsequently can be compared with this baseline data to determine if a tool is performing correctly in real-time.” Ex. 1005, 25:13–15. At most, this passage teaches that as part of production runs, data is collected that can be used for subsequent process control if deemed to yield high quality product. *Id.* There is no teaching of generating collection purpose data indicating the initial purpose for the collection of the data. *Id.* Likewise, with regard to Petitioner’s latter two examples, we find that Funk teaches context data that is identification data, rather than teaching generating collection purpose data indicating the initial purpose for the collection of the data. *See* Ex. 1005, 25:25–29, 25:46–50; Pet. 47.

Third, Petitioner argues that Funk teaches that the data collected can be sent to a Structured Query Language database “to be processed by different algorithms defined by the user through plans in the data management portion of the APC system and by scripts defined by a control job.” Pet. 47 (quoting Ex. 1005, 8:36–40, 26:33–34; Ex. 1002, ¶ 139). According to Petitioner, one of ordinary skill in the art “would have understood that Funk discloses context data including collection purpose data and that using a data collection plan ID associated with each collection purpose would correspondingly limit the data to be processed by a specified algorithm.” *Id.* (citing Ex. 1002 ¶ 139). “For instance, [(i)] an algorithm relying on data collected for a specific collection purpose can be used ‘to establish a “good tool state” model,’” or (ii) “after a cleaning process (i.e., [wet clean]) the data collected from a number of dummy wafers can be

analyzed using seasoning related models.” *Id.* at 47–48 (citing Ex. 1005, 28:8–12, 28:28–31; Ex. 1002 ¶ 139).

We find that these arguments also are insufficient to show that Funk and Stoddard teach the limitation. In particular, we find that Petitioner does not show that Funk, as modified by Stoddard, teaches generating collection purpose data for the collected metrology data. Rather, we find Petitioner’s arguments unavailing for the reasons we discuss above, including that Petitioner does not show that Funk’s plan IDs are collection purpose data, and does not explain sufficiently how Funk’s teachings concerning a good tool state model and dummy wafers teach this limitation.

Moreover, we provide little weight to the cited testimony of Dr. Hatalis as we find that the testimony does not explain sufficiently why Funk’s teachings, as modified by Stoddard, allegedly disclose generating collection purpose data for the collected metrology data, and does not provide a factual basis to support what Dr. Hatalis opines that one of ordinary skill in the art would have understood in light of these teachings. *See* Ex. 1002 ¶¶ 135–139; 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

In sum, Petitioner does not show that the combination of Funk and Stoddard teaches “generating context data for the metrology data, the context data including collection purpose data.”

Accordingly, Petitioner has not demonstrated a reasonable likelihood of success in challenging independent claim 1, as well as independent claim 10, which comprises limitations of commensurate scope, and for which Petitioner does not provide separate arguments. The remaining challenged claims (i.e., 2–9 and 11–19) depend from these independent claims, and

Petitioner's arguments for these dependent claims do not cure the above deficiencies of the independent claims. Pet. 51–65. Thus, Petitioner has not demonstrated a reasonable likelihood of success in challenging claims 1–19 as being rendered obvious by Funk and Stoddard.

VI. CONCLUSION

For the foregoing reasons, we determine that the information presented in the Petition does not demonstrate a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of any of the challenged claims of the '691 patent on the asserted ground of unpatentability.

VII. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is denied and no trial is instituted.

For PETITIONER:

Eric Krause
Pan Lee
AXINN VELTROP & HARKRIDER LLP
ekrause@axinn.com
plee@axinn.com

For PATENT OWNER:

Timothy Devlin
Alex Chan
Joel Glazer
DEVLIN LAW FIRM LLC
TD-PTAB@devlinlawfirm.com
achan@devlinlawfirm.com
jglazer@devlinlawfirm.com