

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD.,
Petitioner,

v.

MARLIN SEMICONDUCTOR LTD.,
Patent Owner.

Case No. IPR2025-01082
U.S. Patent No. 6,888,181

DECLARATION OF ROBERT W. BAHR

I, Robert W. Bahr, declare as follows:

I. INTRODUCTION

1. I am submitting this declaration on behalf of Taiwan Semiconductor Manufacturing Company Limited (“TSMC”) in connection with a petition for *inter partes* review of U.S. Patent No. 6,888,181 (“’181 Patent”), which I understand is being submitted to the Patent Trial and Appeal Board of the United States Patent and Trademark Office.

2. I am a partner at the law firm of Maier & Maier PLLC, where I specialize in United States Patent and Trademark Office (USPTO) patent policy, practice, and procedure. My expertise includes USPTO patent policy, practice, and procedures, and advising attorneys and our clients on complex patent prosecution matters.

3. TSMC has retained me as an expert to investigate the file history of U.S. Patent No. 6,888,181 (the ’181 patent) and provide my expert opinion relating to the examination leading to the ’181 patent. I have been asked to provide information about the relevant procedures that govern patent application examination, and the applicable rules and guidance provided by the edition of the Manual of Patent Examining Procedure (“MPEP”) that was in effect during the examination of the application that led to the ’181 patent: Revision 2 of the Eighth

Edition.¹ And I have compared these standard search procedures with what occurred during the actual examination of the '181 patent.

4. Based on my experience and knowledge of the relevant procedures governing patent examination, it is my opinion that the file history of the '181 patent reveals that the search conducted during the examination process contained a number of significant errors that resulted in the failure to uncover pertinent prior art², namely U.S. Patent Application Publication No. 2004/0256647 to Lee et al.

¹ All references to the MPEP are to Revision 2 of the Eighth Edition (May 2004). In addition, all references to 35 U.S.C. § 102 or 103 are to pre-AIA 35 U.S.C. § 102 or 103.

² I understand that the Lee patent (TSMC-1004), the Sugiyama patent (TSMC-1005), and the Dakshina patent (TSMC-1006) were asserted to be prior art under 35 U.S.C. § 102(a) or (e) in the petition for *inter partes* review ("IPR petition") of the '181 Patent. I further understand that the Lee'647 and Dakshina'019 publications contain the same substantive disclosure as the corresponding Lee and Dakshina patents. For purposes of this declaration, I will assume that all of the above references are prior art under 35 U.S.C. § 102 that disclose the limitations of the claims as explained in the IPR petition (the "pertinent prior art").

(“Lee’647”; TSMC-1039), U.S. Patent No. 6,774,390 to Sugiyama et al. (“Sugiyama”; TSMC-1005), U.S. Patent No. 6,803,631 to Dakshina-Murthy et al. (“Dakshina”; TSMC-1006), and U.S. Patent Application Publication No. 2004/0145019 to Dakshina-Murthy et al. (“Dakshina’019”; TSMC-1038).

Specifically, here the examiner errors included at least:

- failing to search limitations viewed as defining the claims over the prior art, where having searched these terms would have found the Lee, Sugiyama, and Dakshina patents or application publications;
- focusing almost exclusively on forward citation searches (*e.g.*, searches for documents that cite or mention a specified U.S. patent) without reason or justification, and including databases that would have been known to return zero hits from this type of search;
- effectively excluding the USPTO’s U.S. patent application publication database (PGPB) without reason or justification;
- misspelling a material keyword in a search query that would have returned Lee’s application publication from the PGPB database if spelled correctly; and
- overlooking the Sugiyama patent and the Dakshina patent/application publication that would have been retrieved by the “finfet” keyword search and/or the subclass searches performed by the examiner.

Without these errors, the examiner would have uncovered multiple references (or their corresponding application publications) that, according to the IPR petition, are prior art under 35 U.S.C. § 102 and should have been used to reject the pending claims.

II. BACKGROUND AND QUALIFICATIONS

5. I worked at the USPTO for over 38 years. I began my career at the USPTO in September 1984, and was a patent examiner in Examining Group 330 (now Technology Center 3700) until April 1994. Between March 2016 and August 2023, I served as the Deputy Commissioner for Patents responsible for the patent examination policy area (“Deputy Commissioner for Patent Examination Policy”).³ I also served as the acting Deputy Commissioner for Patent Examination Policy between August of 2015 and March 2016, and from November 2009 until December 2011. Between November 2000 and March 2016, I served as the Senior Patent Counsel to the Deputy Commissioner for Patent Examination Policy (except when I was acting Deputy Commissioner). Between April 1994 and July 2000, I was a Legal Advisor in the Office of Patent Legal Administration (OPLA).

6. I led the implementation of numerous rulemakings while at the USPTO, most notably the patent examination provisions of the Leahy-Smith America Invents

³ From 2016 to 2020, this position was titled “Deputy Commissioner for Patent Examination Policy,” and in October 2020 that title changed to “Deputy Commissioner for Patents.” This position was titled “Associate Commissioner for Patent Examination Policy” from 2009 to 2011.

Act (AIA), the Patent Law Treaty provisions of the Patent Law Treaties Implementation Act (PLTIA), and the continued examination, patent term adjustment, and eighteen-month publication provisions of the American Inventors Protection Act of 1999 (AIPA). I also provided training to patent examiners on various changes to the patent laws, regulations, and examining procedures, including the continued examination, patent term adjustment, and eighteen-month publication provisions of the AIPA.

7. I completed my undergraduate studies at the University of Maryland in 1983 with a Bachelor of Science in Mechanical Engineering. I attended the National Law Center of George Washington University, receiving my Juris Doctor in law with honors in May of 1993. I am a member of the Virginia State Bar and the Bars of the U.S. Court of Appeals for the Federal Circuit (Federal Circuit), and U.S. Supreme Court. I am registered to practice as a patent attorney before the U.S. Patent and Trademark Office.

III. SUMMARY OF THE PROSECUTION AND EXAMINATION OF THE '181 PATENT

8. The USPTO issued a non-final Office action on September 7, 2004, in which the examiner: (1) indicated that claims 1 through 5 were allowed; (2) rejected claims 6 and 9 through 11 under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 6,764,884 to Yu et al. ("Yu"); and (3) indicated that claims 7 and 8 were objected

to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The examiner also cited U.S. Patent No. 6,727,546 to Krivokapic et al. (“Krivokapic”) in the non-final Office action.

9. On December 2, 2004, the applicant responded to this non-final Office action by amending claim 6 to include the limitations of claim 7: “said semiconductor core ha[ving] a first lattice constant that mis-match[es] a second lattice constant of said strained epitaxy layer.”

10. The USPTO issued a notice of allowance and notice of allowability (notice of allowance) on January 13, 2005, in which the examiner indicated that claims 1 through 6 (as amended) and 8 through 11 were allowed. The examiner also cited U.S. Patent No. 6,838,322 to Pham et al. (“Pham”) in the notice of allowance.

IV. USPTO SEARCH SYSTEMS IN THE 2004-2005 TIMEFRAME

11. In 2004-2005, the USPTO provided two desktop search tools for examiners to search U.S. patents and U.S. patent application publications: the Examiner’s Automated Search Tool (EAST) and the Web-based Examiner Search Tool (WEST). MPEP § 902.03(e). EAST and WEST each provide examiners with access to a common text-searchable database of U.S. patents and U.S. patent

application publications, and each permit an examiner to view retrieved documents as either images or text.

V. RELEVANT USPTO SEARCH GUIDANCE

12. The USPTO instructs examiners that U.S. patent application publications are, for purposes of 35 U.S.C. §§ 102(a) and (b), publications as of their publication date, regardless of whether the underlying application is subsequently abandoned or patented. MPEP §§ 901.02 and 901.03. In addition, U.S. patent application publications are prior art under 35 U.S.C. § 102(e) as of the earliest effective U.S. filing date of the published application. *Id.*, § 901.03. Moreover, patent application publications are usually the first publication of a patent application as patent applications are typically published as patent application publications before they issue as patents.⁴ Patent application publications may be the only publication of a patent application as applications abandoned after publication never become patents.

⁴ MPEP § 901.04(a) (explaining that after March of 2001 patent application publications are “A” documents as the first publication of patent applications and that patents are now “B” documents as the second publication of patent applications).

13. In formulating a search, the USPTO instructs examiners:

When determining the field of search, three reference sources must be considered - domestic patents (including patent application publications), foreign patent documents, and nonpatent literature (NPL). None of these sources can be eliminated from the search unless the examiner has and can justify a reasonable certainty that no references, more pertinent than those already identified, are likely to be found in the source(s) eliminated.

See MPEP § 904.02.

14. Thus, an examiner may eliminate, for example, a nonpatent literature search only if the examiner has and can justify a reasonable certainty that no references more pertinent than those already identified in a search of domestic and foreign patent documents are likely to be found in a nonpatent literature search. An examiner, however, cannot ever justify eliminating performing any U.S. patent application publication search, since an examiner could never have a reasonable certainty that no references more pertinent than those already identified in a domestic issued patent search are likely to be found in a patent application publication search. This is because patent applications are published as patent application publications, which are then only sometimes published as patents. Thus, patent application publications are typically the first, and sometimes the only, publication of a patent application, and a search of U.S. patent application publications should therefore never be omitted from an examiner's search.

15. The MPEP instructs examiners that great care should be taken so as to clearly indicate the places searched and the date(s) on which the search was conducted. MPEP § 719.05. The MPEP also instructs examiners that: (1) if a complete search of a subclass is conducted (including all domestic and foreign patent documents), the complete classification (class and subclass) should be recorded (MPEP § 719.05(I)(A)); but (2) if a limited or cursory search or scan of a subclass is conducted, the class and subclass should be recorded with parentheses defining the limitation of the search (*e.g.*, “(cursory review)”) (MPEP §§ 719.05(I)(B) and (II)(B)). The MPEP instructs examiners that any search updates should include all of the databases and the search queries and classifications employed in the original search. MPEP § 904.

VI. THE SEARCHES CONDUCTED BEFORE ALLOWING THE ’181 PATENT

16. The file history of the ’181 patent indicates that the examiner conducted a classification search and a keyword (automated) search prior to each of the non-final Office action of September 7, 2004 and notice of allowance of January 13, 2005. The keyword search was conducted using the Web-based Examiner Search Tool (WEST).

17. With respect to the search conducted in September 2004: The Search Notes in the file history of the ’181 patent indicate that the examiner conducted a

classification search of class 257, subclasses 331 through 369, as well as a keyword search through WEST. The Search Notes do not indicate that this classification search was limited in any way. The Search History printout (TSMC-1002, 47-48)⁵ indicates that the examiner conducted the following keyword search:⁶

September 2004 Search History			
Set	Database	Query	Hit Count
L1	USPT	finfet	57
L2	USPT	6727546 and fin	0
L3	USPT	finfet or “fin structure”	1259
L4	USPT		
L5	USPT		
L6	PGPB	L5	0

⁵ The databases referenced in the printout are as follows: (1) USPT is U.S. Patents (after 1971); (2) PGPB is U.S. Patent Application Publications; (3) USCO is U.S. Patents prior to 1971 captured by optical character recognition; (4) EPAB is European Patent Office (EPO) Abstracts; (5) JPAB is Japan Patent Office (JPO) Abstracts; (6) DWPI is Derwent World Patent Index; and (7) TDBD is IBM Technical Disclosure Bulletins.

⁶ In the available print copy of the file history, the searches for L4 and L5 have been cut-off.

L7	USOC	L6	0
L8	EPAB	L7	0
L9	JPAB	L8	0
L10	DWPI	L9	0
L11	TDBD	L10	0
L12	USPT	L4 and epitax\$7	0

18. With respect to the search conducted in January 2005: The Search Notes indicate that the examiner conducted a classification search of class 257, subclass 192, and a keyword search through WEST. The Search Notes do not indicate that this classification search was limited in any way, and do not indicate that the classification search done in September 2004 (of class 257, subclasses 331 through 369) was updated in January 2005. The Search History printout (TSMC-1002, 21-22) indicates that the examiner conducted the following keyword searches:

January 2005 Search History			
Set	Database	Query	Hit Count
L1	USPT	6727884	1
L2	USPT	“fin” same (“tripple gate” or “tri-gate”)	0
L3	USPT	L1 and epitax\$5	0
L4	PGPB	L3	0
L5	USOC	L4	0
L6	EPAB	L5	0

L7	JPAB	L6	0
L8	DWPI	L7	0
L9	TDBD	L8	0
L10	USPT	4996574	63
L11	USPT	5338959	26
L12	USPT	L11 and fin	3
L13	USPT	4996574 and finL12	0
L14	USPT	4996574 and fin	7
L15	USPT	4996574 and epitax\$5	37
L16	USPT	finfet	88
L17	USPT	6838322	1

VII. EXAMINER ERRORS WITH THE SEARCHES FOR THE '181 PATENT

A. The Examiner Conducted Inadequate Searches

Limited Classification Search Conducted

19. The examiner cited three U.S. patents during examination of the '181 patent: Yu, Krivokapic, and Pham. Krivokapic is classified in class 257, subclass 331 (an area searched). But, neither Yu nor Pham are classified in any of the areas in which the examiner conducted a classification search (class 257, subclasses 192 and 331 through 369). Yu is classified in class 438, subclass 157, with a cross-reference in class 438, subclass 282. Pham is classified in class 438, subclass 151,

with cross-references in class 438, subclasses 152, 157, 166, 482, 486, 585, 587, and 588.

20. It is notable that neither Yu nor Pham have an original or cross-reference classification in any subclass of class 257, while the examiner searched only subclasses in class 257. Given that these references were found and applied as prior art yet were not found in the areas searched (subclasses of class 257), this should have alerted the examiner that a classification search of only class 257, subclasses 192 and 331 through 369, was inadequate since two of the three cited references that the examiner apparently believed to be relevant were not even within this class 257.

Unduly Narrow Keyword Search Queries

21. The examiner's keyword searching was almost exclusively limited to searches for patents that had themselves cited one or more of four other prior art patents (*i.e.*, a "forward citation" query). Specifically, the examiner's keyword search in January of 2005 involved 17 queries: 15 of these queries were forward citation searches of patents that had cited to one or more of U.S. Patents Nos. 6764884 ("884 patent"), 4996574 ("574 patent"), 5338959 ("959 patent"), or 6838322 ("322 patent") alone or in combination with additional terms. Moreover, twelve of these searches (out of 17) retrieved no or relatively few documents (nine

retrieved zero results), which should have alerted the examiner that the search queries were unduly narrow.

22. A forward citation search can be useful; *e.g.*, when an examiner is aware of an earlier pertinent U.S. patent, a forward citation search of that earlier patent might retrieve later U.S. patents citing the earlier U.S. patent that could also be pertinent. A forward citation search, however, is a supplement to a complete search and is not a substitute for a complete search.⁷ The forward citation queries in January of 2005 for the '181 patent—most of the keyword searching being conducted—were not likely to retrieve pertinent or material prior art references.

23. First, it was not realistic for the examiner to expect a forward citation search conducted on January 5, 2005 to retrieve patents citing either the '322 patent or the '884 patent. Specifically, the forward citation search of the '322 patent on January 5, 2005 (L17) was pointless since the '322 patent issued on January 4, 2005:

⁷ Patent examiners are trained on forward and backward citation searches.

Nonetheless, MPEP chapter 900 sets out the USPTO's instructions on the USPTO's search tools (MPEP § 902) and how to conduct a search (MPEP § 904), and does NOT describe forward citation searches as part of a complete search or have any discussion of forward citation searches.

i.e., any patent citing the '322 patent would need to have issued on the same day as the '322 patent—an impossibility. Similarly, the forward citation search of the '884 patent on January 5, 2005 (L1) was virtually pointless since the '884 patent issued on July 20, 2004: *i.e.*, the '884 patent would need to have been cited in an application and then that application would need to have been issued as a patent by January 5, 2005—in less than six months after the '884 patent was issued—for that patent to have been retrieved in this search.

24. Second, forward citation searches of databases other than the U.S. patent database on January 5, 2005 were not going to produce additional documents citing the '884 patent, meaning that the forward citation searches of the '884 patent on January 5, 2005 in the U.S. Patent Application Publications (PGPB), pre-1971 U.S. Patents (USCO), EPO Abstracts (EPAB), and JPO Abstracts (JPAB), Derwent World Patent Index (DWPI), and IBM Technical Disclosure Bulletins (TDBD) databases (*i.e.*, searches L4 through L9) were futile. This is because U.S. patent application publications, EPO patent application abstracts, and JPO patent application abstracts **do not contain citations of U.S. patents** (or of other references).

25. In addition, even if an application or patent contained a citation to the '884 patent or the patent number “6764884” in its specification (or abstract),

applications are published eighteen months after filing. This means that a reference to a patent (*i.e.*, the '884 patent) issued in July 2004 could not have been included in an application filed in or before July of 2003 (eighteen months before January 5, 2005). Similarly, any reference to a patent (like the '884 patent) issued in July 2004 also could not have been included in a patent issued before 1971. Finally, any reference to a patent (again the '884 patent) issued in July 2004 could not have been included in an IBM technical disclosure as the IBM Technical Disclosure program was discontinued before 2000. Therefore, these forward citation searches of databases other than the U.S. patent database on January 5, 2005 (searches L4 through L9) would never have produced additional documents citing the '884 patent. A reasonable examiner would have understood that forward citation searches of these other databases (*i.e.*, databases beyond the U.S. patent database) on January 5, 2005 (such as in searches L4 through L9) were not going to produce any additional documents citing the '884 patent.

26. The forward citation keyword searches in January of 2005 (searches L3 and L13 to L15) were likewise ill-conceived because they would capture only documents that happen to cite to one or more of the four chosen patents. But it is an unsupported and unsupportable assumption that material prior art will necessarily cite to one of these patents. Thus, the forward-citation restrictions used by the

examiner were unduly narrow because they necessarily missed material prior art that did not cite to at least one of the four patents, and there was simply no basis to implement such a requirement in roughly 90% (15 out of 17) of the searches the examiner conducted in January 2005.

27. Regarding the only two searches (L2 and L16) not restricted to a forward citation of one of these four patents, these were also deficient because (1) these two queries were limited to the U.S. patent database (USPT) and *did not* include a search of U.S. patent application publications or any foreign patents or nonpatent literature; and (2) one of these two queries (L2) contained a misspelling of a material keyword.

28. In sum, the overall search strategy employed by the examiner leading to allowance of the '181 patent was materially deficient. The examiner missed obvious cues that the searches were inadequate given that a majority of the examiner-cited references did not even fall within the class searched by the examiner, and that a majority of the keyword searches resulted in zero hits. As discussed in more detail below, this deficient search strategy led to missing pertinent prior art. Not only that, the examiner also failed to adequately review the documents that were retrieved by the searches conducted, causing additional pertinent prior art to be overlooked.

B. These Errant Searches and Reviews Resulted in the Examiner Not Uncovering Certain Prior Art References for the '181 Patent

29. A complete and proper search—or even a proper review of the results from the searches that were conducted—would have uncovered pertinent prior art that was missed by the searches or overlooked during review of the search results. Here, such pertinent prior art was not applied by the examiner before allowing the '181 patent because the examiner:

- did not search limitations viewed as defining the claims over the prior art;
- focused almost exclusively on forward citation searches that effectively excluded an important database (*i.e.*, the USPTO's U.S. patent application publication database (PGPB));
- misspelled a material keyword in a search query; and
- overlooked multiple patents/application publications that were in the subclasses in which examiner conducted a classification search and thus would have been retrieved by those searches, but were overlooked in the examiner's review of the results despite their pertinence (as explained in the IPR petition).

Each of these deficiencies are discussed in turn below.

1. Inadequate Search of Limitations Defining over the Prior Art

30. The Office action of September 7, 2004 allowed claim 1, but rejected claim 6. Claim 1 includes the limitations of claim 6, except that claim 1 requires: “a composite fin structure consisting of a silicon germanium core and a strained silicon epitaxy layer grown from surface of said silicon germanium core.” In addition, claim

6 was allowed in the notice of allowance of January 13, 2005, when the following limitation (from claim 7) was added: “said semiconductor core ha[ving] a first lattice constant that mis-match[es] a second lattice constant of said strained epitaxy layer.” This record makes apparent what the examiner viewed as the key distinguishing features of the claims, namely concepts including: “silicon germanium,” “strained” alone or with “silicon,” “epitaxy,” and “lattice constant,” contained in claims 7 and 8 (which the examiner indicated as allowable over rejected claim 6). Based on my experience, it is my opinion that a reasonable patent examiner in 2004/2005 would have included these concepts in crafting a keyword search strategy for the claim at issue. MPEP § 902.02 (explaining that “[t]he search should cover the claimed subject matter”).

31. However, there is no indication in the file history that the examiner conducted keyword searches for key terms such as “silicon germanium,” “SiGe,” “strained,” “silicon,” or “lattice constant,” either alone or in combination. This failure caused the examiner to miss the three 35 U.S.C. § 102 prior art references relied on in the IPR petition (or their corresponding publications having the same disclosure). Specifically, if the examiner’s January 2005 search had included a keyword search for “silicon germanium” (or SiGe), “strained” with “silicon” (or Si), “lattice constant,” and either epitax\$7 or epitax\$5—either alone or in combination—

in the USPTO's U.S. patent and patent application publication databases (USPT and PGPB) such a search *would have retrieved Lee'647, Sugiyama, and Dakshina:*

(19) **United States**
(12) **Patent Application Publication** (10) Pub. No.: US 2004/0256647 A1
Lee et al. (43) Pub. Date: Dec. 23, 2004

enhancing drive current. The silicon fin channel of the disclosed finFET device is a **strained silicon fin** channel, comprising a strained silicon layer deposited on a seed fin having **different lattice constant**, for example, a silicon layer deposited on a **silicon germanium seed fin**, or a carbon doped silicon layer deposited on a silicon seed fin. The **lattice mismatch** between the silicon layer and the seed fin generates the strained silicon fin channel in the disclosed finFET device to improve hole and electron mobility enhancement, in addition to short channel effect reduction characteristic inherently in a finFET device.

...

[0041] The **epitaxial** channel **silicon** layer 11 or 11' grown on the relaxed **silicon germanium** seed fin 10 will be tensilely **strained** because the **lattice constant** of **silicon** is smaller than that of **silicon germanium**. Due to this tensile

United States Patent
Sugiyama et al.

(10) Patent No.: US 6,774,390 B2
(45) Date of Patent: Aug. 10, 2004

The present invention has been made to solve this problem, relates to a MISFET using, as a channel layer, a second semiconductor layer such as a **strained Si layer** which is joined to a first semiconductor layer such as a **SiGe** crystal layer formed on an insulating layer, has a **lattice constant different** from that of the first semiconductor layer, and has a stress strain in crystal lattices, and also relates to a CMIS circuit which is combined with the MISFET.

...

As shown in FIG. 8, the mask 13 and thermal oxide layer 14 are removed by wet etching or the like. After surface processing, a Si layer is grown to a thickness of 7 nm on the surface of the **SiGe** crystal layer 30 by **epitaxial growth**. The **Si layer is a strained Si layer 40** as the second semiconductor layer. The thickness of the **strained Si layer 40** is desirably

United States Patent
Dakshina-Murthy et al.

(10) Patent No.: US 6,803,631 B2
(45) Date of Patent: Oct. 12, 2004

DISCLOSURE OF THE INVENTION

Consistent with the present invention, a FinFET transistor is provided that uses a vertically formed **strained channel** layer that is self-aligned to the fin channel. The strained channel layer may include a crystalline material that is **lattice constant mismatched** with the crystalline material of the fin of the FinFET. The **lattice constant mismatch** induces tensile strain within the **strained channel layer** that increases carrier mobility. Increasing the carrier mobility, in turn, increases the drive current of the FinFET transistor, thus, improving FinFET performance.

...

appropriately selected. One skilled in the art will recognize that crystalline materials other than **Si_xGe_(1-x)** may be used such that the material's **lattice constant** is larger than the **lattice constant** of the crystalline material selected for the **strained channel** layer. In some embodiments, substrate 100 may be formed by wafer bonding **epitaxial Si_xGe_(1-x)** to an oxide/Si substrate wafer. One skilled in the art will

Fin channel layer 105 may include a crystalline material with a **lattice constant larger than the lattice constant** of a crystalline material selected for a strained channel layer (described with respect to FIGS. 3A and 3B below). If, for example, **silicon is selected for the strained channel layer**, fin channel layer 105 may include a crystalline material with a **lattice constant large than the lattice constant of silicon**. Fin channel layer 105 may include, for example, **Si_xGe_(1-x)** with x approximately equal to 0.7. Other values of x may be

TSMC-1039 (Lee'647), Abstract, ¶[0041]; TSMC-1005 (Sugiyama), 5:36-43, 9:44-49; TSMC-1006 (Dakshina), 1:30-40, 3:19-27, 3:28-34.

32. Similarly, if the examiner had conducted such a keyword search in September 2004 (TSMC-1002, 47-48), Lee'647, Sugiyama, and Dashina'019 would

have been retrieved—the same patents or their corresponding publications as advanced in the IPR petition as 35 U.S.C. § 102 prior art.

2. Inadequate Search and Errors in Searching “Triple Gate or Tri-Gate”

33. The examiner’s search in January 2005 for “fin” within the same paragraph as either “tripple gate” or “tri-gate” retrieved no documents (L2):

DB=USPT; PLUR=YES; OP=OR

<u>L3</u>	11 and epitax\$5	0	<u>L3</u>
<u>L2</u>	"fin" same ("tripple gate" or "tri-gate")	0	<u>L2</u>
<u>L1</u>	6764884	1	<u>L1</u>

“tripple” misspelling → “0” search results

TSMC-1002, 22. This search contained **two significant flaws**. First, the search included a misspelling of “triple gate.” This would unreasonably limit search results to those U.S. patents having “tri-gate” or the same misspelling of the word triple (“tripple”). Second, this search was conducted *only* in the U.S. patent (USPT) database, while excluding the U.S. patent application publication database (PGPB) database. However, as noted previously (*supra*, ¶ 14), absent a justified reason, the U.S. patent application publication database (PGPB) must be searched along with searching the U.S. patent (USPT) database.

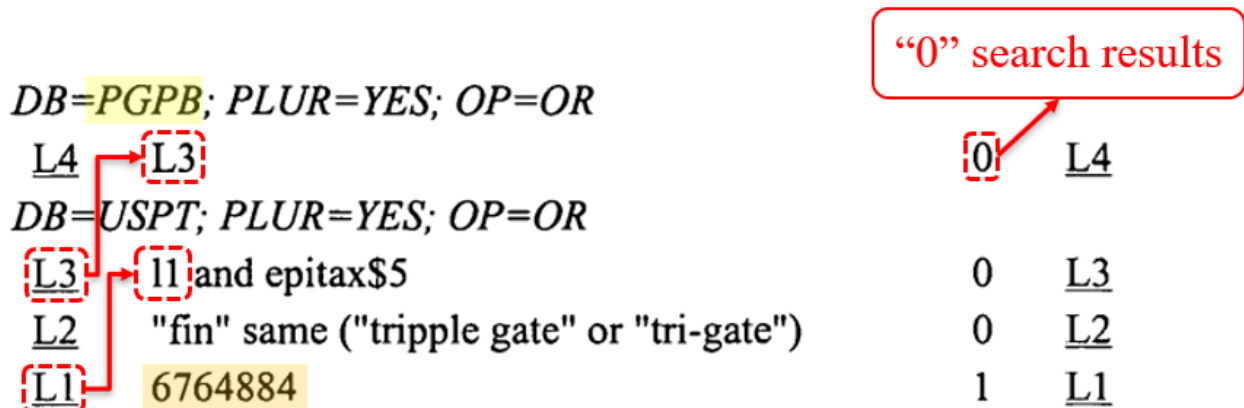
34. These errors are material here because a search for “fin” within the same paragraph as either “*triple* gate” or “tri-gate” (*i.e.*, with the correct spelling of

“triple”) in the U.S. patent application publication database (PGPB) *would have retrieved Lee’647*, because “triple gate” and “fin” are in the same paragraph, as demonstrated below:

[0093] FIG. 14 further shows the cross section BB', cutting through the triple gate 103 of the finFET structure. The cross section BB' cuts through the seed fin layer 105 on a insulator layer 102 and a substrate 101, the strained silicon channel 104 and the gate dielectric 110. The triple gate 103 also covers the top section of the fin structure, with the spacer 109 to isolate the triple gate 103 from the silicon channel 104.

TSMC-1039, ¶[0093]; *see also id.*, ¶¶[0037], [0091], [0092].

35. Furthermore, in the January 2005 search, the only search in the USPTO’s U.S. patent application publication database (PGPB) was limited to those documents citing the ’884 patent (6764884) (search L4). U.S. patent application publications, however, do not cite prior art, which virtually assured that this search query (epitax\$5 and 6764884 in the PGPB database) *would retrieve no documents*:



TSMC-1002, 22. Based on the available record, I also did not find any non-forward citation searches in the PGPB database in the September 2004 search, which is a significant omission.

3. Inadequate Review of the Search Results for “FINFET”

36. The examiner’s search in January 2025 for “finfet” retrieved 88 patent documents (see search L16). TSMC-1002, 21. These 88 results are not a large number of documents to review when compared to the number of patent documents that must be reviewed typically during a classification search. Moreover, the documents for review by an examiner during a keyword search have the search query terms or keywords highlighted. Dakshina would have been retrieved by this keyword search for “finfet.” Specifically, Dakshina has numerous occurrences of the keyword “finfet,” including in its title:

United States Patent
Dakshina-Murthy et al.

(10) Patent No.: **US 6,803,631 B2**
(45) Date of Patent: **Oct. 12, 2004**

(54) **STRAINED CHANNEL FINFET**

DISCLOSURE OF THE INVENTION

Consistent with the present invention, a **FinFET** transistor is provided that uses a vertically formed strained channel layer that is self-aligned to the fin channel. The strained channel layer may include a crystalline material that is lattice constant mismatched with the crystalline material of the fin of the **FinFET**. The lattice constant mismatch induces tensile strain within the strained channel layer that increases carrier mobility. Increasing the carrier mobility, in turn, increases the drive current of the **FinFET** transistor, thus, improving **FinFET** performance.

TSMC-1006, Cover Page, 1:30-41. Even a cursory review of the 88 patent documents retrieved in the search for “finfet” (L16) should have brought Dakshina to the attention of the examiner, particularly given its title of “Strained Channel FinFET.”

4. Failure to Locate Multiple U.S. Patent Documents in the Classification Search

37. The examiner’s searches of class 257, subclasses 192, 347, and 349 would have retrieved Sugiyama and Dakshina/Dakshina’019 as results, but the examiner failed to recognize and apply either Sugiyama or Dakshina/Dakshina’019. Specifically, Sugiyama issued in August 2004 and is cross-referenced in class 257, subclass 347, a subclass searched by the examiner in September 2004:

SEARCHED			
Class	Subclass	Date	Examiner
257	331-369	9/3/2004	FA

United States Patent
Sugiyama et al.
(10) Patent No.: US 6,774,390 B2
(45) Date of Patent: Aug. 10, 2004
(52) **U.S. Cl.** 257/19; 257/15; 257/18;
257/20; 257/347

TSMC-1002, 45; TSMC-1005, 1.

38. Similarly, Dakshina’019 published in July 2004 and is classified in class 257, subclass 349, which the examiner searched in September 2004. Dakshina

issued in October 2004 and is classified in class 257, subclass 192, which the examiner searched in January 2005. This is illustrated as follows:

SEARCHED			
Class	Subclass	Date	Examiner
257	331-369	9/3/2004	FA

United States
Patent Application Publication
Dakshina-Murthy et al.
(52) U.S. Cl. 257/349

(10) Pub. No.: US 2004/0145019 A1
(43) Pub. Date: Jul. 29, 2004

SEARCHED			
Class	Subclass	Date	Examiner
257	192	[Sic: 1/5/2005] 1/5/2004	FA

United States Patent
Dakshina-Murthy et al.
(52) U.S. Cl. 257/349; 257/192

(10) Patent No.: US 6,803,631 B2
(45) Date of Patent: Oct. 12, 2004

TSMC-1002, 18, 45; TSMC-1006, 1; TSMC-1038, 1. The “1/5/2004” should be “1/5/2005” as otherwise shown for the WEST search. TSMC-1002, 18. Indeed, the ’181 application was first filed on 3/18/2004, such that it would have been impossible for the examiner to conduct the search on 1/5/2004.

39. Thus, the examiner (1) overlooked Sugiyama during the search of class 257, subclass 347 in September 2004, (2) overlooked Dakshina’019 during the search of class 257, subclass 349 in September 2004, and (3) overlooked Dakshina during the search of class 257, subclass 192 in January 2005. The failure to recognize any of Sugiyama or Dakshina’019/Dakshina during the classification searches for the ’181 patent was not a one-off occurrence, but rather three instances of overlooking pertinent prior art during the classification searches for the ’181 patent. Overlooking these disclosures was material error given that, according to the IPR

petition, Sugiyama and Dakshina are 35 U.S.C. §102 prior art references that each discloses the limitations of at least nine out of the ten the challenged claims.

VIII. CONCLUSION

40. The U.S. patent application publications to Lee and Dakshina (Lee'647, Dakshina'019), and the U.S. patents to Sugiyama and Dakshina were not cited during the examination of the application resulting in the '181 patent. The Lee patent application publication and the Sugiyama and Dakshina patents would have been uncovered if the examiner had, instead of overly focusing on forward citation searches, conducted a complete and proper keyword search: a search of at least the U.S. patent (USPT) (also referenced as "US Patents Full-Text Database" in file histories such as the '181 patent) and U.S. patent application (PGPB) (also referenced as "US Pre-Grant Publication Full-Text Database" in file histories such as the '181 patent) databases with a query or queries directed to the claim elements viewed as defining the '181 patent claims over the prior art. Moreover, the Lee patent application publication would even have been uncovered if the examiner had simply conducted the January 2005 L2 search with the correct spelling of "triple" in the U.S. patent application database (PGPB). And Dakshina would have been uncovered by a review of the patent documents retrieved by the January 2005 L16 search. Finally, Sugiyama and/or Dakshina (Dakshina'019 and Dakshina, respectively)

would have been uncovered if not overlooked during the classified searches conducted in September 2004 and January 2005.

I hereby declare that all the statements made herein of my own knowledge are true and are the whole truth, and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,



November 20, 2025

Robert W. Bahr