UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Canadian Solar Inc.,
Petitioner,

v.

Maxeon Solar Pte. Ltd.,
Patent Owner.

Case No. IPR2024-01194
U.S. Patent No. 11,251,315
Issued: February 15, 2022
Filed: May 18, 2020
Inventors: David D. Smith, Tim Dennis, Russelle De Jesus Tabajonda
Title: Solar Cells with Improved Lifetime, Passivation and/or Efficiency

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DECLARATION OF SYLVIA D. HALL-ELLIS
REGARDING
U.S. PATENT NO. 11,251,315

I, Sylvia D. Hall-Ellis, do hereby declare and state, that all statements made herein of my own knowledge are true 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, under Section 1001 of Title 18 of the United States Code.

Executed on: July 17, 2024

Sylvia D. Hall-Ellis

I. INTRODUCTION

1. My name is Sylvia D. Hall-Ellis. I have been retained as an expert by Counsel for Canadian Solar, Incorporated (referred to herein as "Canadian").

2. I have written this report at the request of Canadian to provide my expert opinion regarding the authenticity and public availability of several publications. My report sets forth my opinions in detail and provides the basis for my opinions regarding the public availability of these publications.

3. I reserve the right to supplement or amend my opinions, and basis for them, in response any additional evidence, testimony, discovery, argument, and/or other additional information that may be provided to me after the date of this report.

4. I am being compensated for my time spent working on this matter at my normal consulting rate of $400 per hour, plus reimbursement for any additional reasonable expenses. My compensation is not in any way tied to the content of this report, the substance of my opinions, or the outcome of this proceeding. I have no other interests in this proceeding or with any of the parties.

5. All of the materials that I considered are discussed explicitly in this report.

II. SUMMARY OF OPINIONS

6. It is my opinion that the publications described below were publicly available on the corresponding date listed in the table below, and in any event earlier than December 22, 2014:

Exhibit	Publication	Publicly Available Date
1006	King, R. R., Ronald A. Sinton, and Richard M. Swanson. "Studies of Diffused Phosphorus Emitters: Saturation Current, Surface Recombination Velocity, and Quantum Efficiency." *IEEE Transactions on Electron Devices*, vol. 37, no. 2 (February 1990): 365-371.	January 25, 1990, but no later than February 1990
1007	Marvin, D. C., and S. L. Froedge. *lnterdigitated Back Contact Silicon Solar Cell Analysis and Design Recommendations for Space Use*. Report SSO-TR-90-04. El Segundo, CA: The Aerospace Corporation, 1989.	July 1990 or within a month of July 1990
1008	Müller, Ralph, Christian Reichel, Jan Benick, and Martin Hermle. "Ion Implantation for All-Alumina IBC Solar Cells with Floating Emitter." *Energy Procedia*, vol. 55 (2014): 265 – 271.	September 19, 2014, but no later than October 15, 2014
1035	Marvin, D. C., and S. L. Froedge. "Analysis of Interdigitated Back Contact Silicon Solar Cells for Space Use." *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* (vol. 2, pp. 821-827). IECEC '89. 6 vols. New York: Institute of Electrical and Electronics Engineers, 1989.	August 6, 1989, but no later than August 6, 2002
1025	Ramappa, Deepak A., and Worth B. Henley. "Diffusion of Iron in Silicon Dioxide." *Journal of The Electrochemical Society*, vol. 146, no. 10 (October 1999): 3773-3777.	October 21, 1999, but no later than April 2003

Exhibit	Publication	Publicly Available Date
1041	Kiyota, Yukihiro, Tohru Nakamura, Kazuhiko Muraki, and Taroh Inada. "Phosphorus Direct Doping from Vapor Phase into Silicon for Shallow Junctions." *Journal of the Electrochemical Society*, vol. 141, no. 8 (August 1994): 2241-2244.	August 19, 1994 but no later than September 2, 2004
1016	Seibt, M., A. Sattler, C. Rudolf, O. Voß, V. Kveder, and W. Schröter. "Gettering in Silicon Photovoltaics: Current State and Future Perspectives." *Physica Status Solidi. A, Applications and materials science: PSS,* vol. 203, issue 4 (March 2006): 696–713.	April 17, 2006 but no later than December 2008
1018	Ferré, Rafael, Isidro Martín, Roland Trassl, Ramon Alcubilla, and Rolf Brendel. "Simultaneous Gettering and Emitter Formation in Multicrystalline-Si Wafers by Annealing Phosphorus Doped Amorphous Silicon Compounds." *Applied Physics Letters*, vol. 98, no. 2 (10 January 2011): paper no. 022102 (4 pages)	January 24, 2011 but no later than December 8, 2012
1019	Vähänissi, Ville, Antti Haarahiltunen, Marko Yli-Koski, and Hele Savin. "Gettering of Iron in Silicon Solar Cells with Implanted Emitters." *IEEE Journal of Photovoltaics*, vol. 4, no. 1 (January 2014): 142-147.	October 30, 2013, but no later than October 16, 2014
1021	Buonassisi, T., A. A. Istratov, M. D. Pickett, J.-P. Rakotoniaina, O. Breitenstein, M. A. Marcus, S. M. Heald, and E. R. Weber. "Transition Metals in Photovoltaic-Grade Ingot-Cast Multicrystalline Silicon: Assessing the Role of Impurities in Silicon Nitride Crucible Lining Material." *Journal of Crystal Growth*, vol. 287, issue 2 (25 January 2006): 402–407.	February 7, 2006 but no later than December 9, 2008
1010	*Handbook of Photovoltaic Science and Engineering*, edited by Antonio Luque and Steven Hegedus. Hoboken, NJ: Wiley, c2003.	August 7, 2003 but no later than November 1, 2004

III. QUALIFICATIONS

7. I am currently an Adjunct Professor in the School of Information at San José State University. I obtained a Master of Library Science from the University of North Texas in 1972 and a Ph.D. in Library and Information Science from the University of Pittsburgh in 1985. Over the last fifty years, I have held various positions in the field of library and information resources. I was first employed as a librarian in 1966 and have been involved in the field of library sciences since, holding numerous positions.

8. I am a member of the American Library Association ("ALA") and its Association for Library Collections & Technical Services ("ALCTS") Division, and I served on the Committee on Cataloging: Resource and Description (which wrote the new cataloging rules) and as the chair of the Committee for Education and Training of Catalogers and the Competencies and Education for a Career in Cataloging Interest Group. I also served as the Chair of the ALCTS Division's Task Force on Competencies and Education for a Career in Cataloging. Additionally, I served as the Chair for the ALA Office of Diversity's Committee on Diversity, as a member of the REFORMA National Board of Directors, and as a member of the Editorial Board for the ALCTS premier cataloging journal, *Library Resources and Technical Services,* as a Co-Chair of the Membership Committee for the Library Research Round Table (LRRT) of the American Library

Association, and as a member of the LRRT Nominating Committee. Currently I serve as a member of the CORE Margaret Mann Citation Committee.

9. I have also given over one-hundred presentations in the field, including several on library cataloging systems and Machine-Readable Cataloging ("MARC") standards. My current research interests include library cataloging systems, metadata, and organization of electronic resources.

10. I have been deposed thirty-five times: (1) *Symantec Corp. vs. Finjan, Inc.,* Petition for *Inter Partes Review* of U.S. Patent No. 7,613,926, May 26, 2016, on behalf of Symantec Corp.; (2) *Symantec Corp. vs. Finjan, Inc.,* Northern District of California, 14-cv-299-HSG, on behalf of Symantec Corp., September 14, 2017; (3) one deposition for ten matters: *Intellectual Ventures I LLC vs. AT&T Mobility LLC*; AT&T Mobility II LLC, New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Wayport, Inc., and Cricket Wireless LLC, C.A. No. 12-193 (LPS); *Intellectual Ventures II LLC vs. AT&T Mobility LLC*; AT&T Mobility II LLC, New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Wayport, Inc., and Cricket Wireless LLC, C.A. No. 13-1631 (LPS); *Intellectual Ventures I LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.,* C.A. No. 13-1632 (LPS); *Intellectual Ventures II LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.,* C.A. No. 13-1633 (LPS); *Intellectual Ventures I LLC, vs. Nextel Operations, Inc., Sprint Spectrum L.P., Boost Mobile, LLC and Virgin Mobile USA, L.P.,* C.A. No. 13-1634

(LPS); *Intellectual Ventures II LLC vs. Nextel Operations, Inc., Sprint Spectrum L.P., Boost Mobile, LLC and Virgin Mobile USA, L.P.,* C.A. No. 13-1635 (LPS); *Intellectual Ventures I LLC, vs. United States Cellular Corporation*, C.A. No. 13-1636 (LPS); *Intellectual Ventures I LLC vs. United States Cellular Corporation*, C.A. No. 13-1637 (LPS); *Intellectual Ventures II LLC vs. AT&T Mobility LLC*, *AT&T Mobility II LLC, New Cingular Wireless Services, Inc.,* C.A. No. 15-799 (LPS); *Intellectual Ventures I LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.,* C.A. No. 15-800 (LPS), on behalf of AT&T Mobility LLC; AT&T Mobility II LLC, Boost Mobile, LLC Cricket Wireless LLC, Nextel Operations, Inc., New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Sprint Spectrum L.P., T-Mobile USA, Inc., T-Mobile US, Inc., United States Cellular Corporation Virgin Mobile USA, L.P., and Wayport, Inc., November 15, 2016; (4) *Hitachi Maxell, LTD., v. Top Victory Electronics (Taiwan) Co. Ltd., et al.,* Eastern District of Texas, 2:14-cv-1121 JRG-RSP (E.D. Texas), on behalf of Top Victory Electronics (Taiwan) Co. LTD, *et. al.,* January 20, 2016; (5) *Sprint Spectrum, L.P. vs. General Access Solutions, Ltd*., Petition for *Inter Partes Review* of U.S. Patent No. 7,173,916, on behalf of Sprint Spectrum L.P., July 13, 2018; (6) *Nichia Corporation vs. Vizio, Inc*., Central District of California, 8:16-cv-00545; on behalf of Vizio, Inc., October 12, 2018; (7) *Intellectual Ventures I LLC, vs. T-Mobile USA, Inc., T-Mobile US, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson*,

Middle District of Florida, 2:17-cv-00557 (JRG), on behalf of T-Mobile USA, Inc., T-Mobile US, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson, October 19, 2018; (8) Pfizer, Inc. vs. Biogen, Inc., Petition for *Inter Partes Review* of U.S. Patent No. 8,821,873, on behalf of Pfizer, November 3, 2018; (9) *Finjan, Inc. vs. ESET, LLC and ESET SPOL. S.R.O.,* Southern District of California, 3:17-cv-00183-CAB-BGS, on behalf of ESET, January 15, 2019; (10) *Finjan, Inc. vs. Cisco Systems, Inc.,* Northern District of California, 5:17-cv-00072-BLF-SVK, on behalf of Cisco Systems, Inc., September 6, 2019; (11) *Facebook, Inc., Instagram, LLC and Whatsapp Inc. vs. Blackberry Limited*, Petition for *Inter Partes Review* of U.S. Patent No. 9,349,120 B2, on behalf of Facebook, Inc., Instagram, LLC and Whatsapp Inc. December 20, 2019; (12) *3Shape A/S and Shape Inc. v. Align Technology, Inc.,* Petition for *Inter Partes Review* of U.S. Patent No. 7,156,661, IPR2020-00222 and IPR2020-00223, August 10, 2020, on behalf of 3Shape A/S and 3Shape Inc.; (13) *Finjan Inc. v. Rapid7, Inc. and Rapid7 LLC*, District of Delaware, 1:18-cv-01519-MN, September 15, 2020; (14) *VLSI Technology LLC v. Intel Corporation*, Western District of Texas, 6:19-cv-00254, 6:19-cv-00255, 6:19-cv-00256, on behalf of Intel Corporation, September 23, 2020; (15) *Finjan Inc. v. Sonicwall, Inc.,* Northern District of California, 5:17-cv-04467-BLF-HRL, on behalf of Sonicwall, Inc., October 27, 2020; (16) *VLSI Technology, LLC v. Intel Corporation*, District of Delaware, 1:18-cv-00966-CFC-CJB, February 5, 2021, on

behalf of the Intel Corporation; (17) *Unified Patents, LLC v. Good Kaisha IP Bridge 1*, Petition for *Inter Partes Review* of U. S. Patent 7,817,868, February 11, 2021, on behalf of Unified Patents; (18) *Finjan, Inc. v. Qualsys, Inc.,* Northern District of California, 4:18-cv-07229-YGR, March 1, 2021, on behalf of Qualsys, Inc.; (19) *Qualcomm, Inc. v. Monterey Research LLC*, Petition for *Inter Partes Review* of U. S. Patent 6,534,805, May 6, 2021, on behalf of Qualcomm, Inc.; (20) *Hulu, LLC v. Sound View Innovations, LLC*, Petition for *Inter Partes Review* of U. S. Patent 5,806,062, May 14, 2021, on behalf of Hulu, LLC; (21) *VLSI Technology LLC v. Intel Corporation*, Western District of Texas, 6:19-cv-00254, 6:19-cv-00255 and 6:19-cv-00256, August 3, 2021, on behalf of Intel Corporation; (22) *Liquidia Technologies, Inc. v. United Therapeutics Corporation*, Petition for *Inter Partes Review* of U. S. Patent 10,716,793 B2, October 20, 2021, on behalf of Liquidia Technologies, Inc.; (23) *EcoFactor, Inc. v. Google, Inc.,* Western District of Texas, 6:20-cv-00075 (ADA), 6:20-0078-ADA, and 6:20-cv-00080 ADA, October 27, 2021, on behalf of Google, Inc.; (24) *Liquidia Technologies, Inc. v. United Therapeutics Corporation*, Petition for *Inter Partes Review* of U. S. Patent 10,716,793 B2, March 11, 2022, on behalf of Liquidia Technologies, Inc.; (25) *Juniper Networks, Inc. v. Swarm Technology LLC*, Petition for *Inter Partes Review* of U. S. Patent 9,852,004, May 5, 2022, on behalf of Juniper Networks, Inc.; (26) *ParkerVision, Inc. v. Intel Corporation*, Western District of Texas, 6:20-cv-108

(ADA), October 26, 2022, on behalf of the Intel Corporation; (27) *CommScope v. TQ Delta*, Petition for *Inter Partes Review* of U. S. Patents 9,094,348 and 10,833,809, February 16, 2023, on behalf of CommScope; (28) *WSOU Investments d/b/a Brazos v. Salesforce.com, Inc.* for Western District of Texas, 6:20-cv-01164-ADA and 6:20-cv-01170-ADA, April 18, 2023, on behalf of Salesforce; (29) *Regents of the University of Minnesota v. AT&T Mobility LLC*, District of Minnesota, 14:cv-4999-JRT-TNL & 14-cv-4669-JRT-TNL, May 18, 2023, on behalf of AT & T Mobility LLC; (30) *VLSI Technology LLC v. Intel Corporation*, Northern District of California, 5:17-cv-0571-BLF-NC, July 11, 2023, on behalf of Intel Corporation; (31) *Trustees of Purdue University v. ST Microelectronics*, Western District of Texas, 6:21-cv-00727-ADA, July 27, 2023, on behalf of ST Microelectronics; (32) *Advanced Micro Devices, Inc. v. Realtek Semiconductor Corp.,* Petition for *Inter Partes Review* of U. S. Patents 7,936,245 & 9,590,582, August 10, 2023, on behalf of Advanced Micro Devices, Inc.; (33) Motif Foodworks, Inc. v. Impossible Foods, Inc., Petition for *Inter Partes Review* of U. S. Patent 9,943,096, August 24, 2023, on behalf of Motif Foodworks, Inc.; (34) *Network System Technologies, LLC v. Texas Instruments, Inc.*, Eastern District of Texas, 2:22-cv-00482-RWS, March 20, 2024, on behalf of Texas Instruments, Inc.; and, (35) *Pardalis Technology Licensing, LLC v. International Business Machines, Corporation*, Eastern District of Texas, 2:22-cv-00452, May 23, 2024, on behalf of

International Business Machines, Corporation. I have testified at trial three times: (1) *Advanced Micro Devices, Inc. v. Realtek Semiconductor Corp.,* U. S. Patents 7,936,245 & 9,590,582, October 20, 2023, International Trade Commission, Washington, DC, on behalf of Advanced Micro Devices, Inc.; (2) *Trustees of Purdue University v. ST Microelectronics*, Western District of Texas, 6:21-cv-00727-ADA, November 29, 2023, on behalf of ST Microelectronics; and, (3) *Certain Power Converter Modules and Computing Systems Containing the Same*, Investigation ITC-337-TA-1370, International Trade Commission, May 1, 2024, on behalf of Delta Electronics, Inc.

11. My full *curriculum vitae* is submitted herewith as Exhibit 1024.

IV. PRELIMINARIES

12. *Scope of this report.* I am not an attorney and will not offer opinions on the law. I am, however, rendering my expert opinion on the authenticity of the documents referenced herein and on when and how each of these documents was disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, could have located the documents before December 22, 2014.

13. I am informed by counsel that an item is considered authentic if there is sufficient evidence to support a finding that the item is what it is claimed to be. I am also informed that authenticity can be established based on the contents of the

documents themselves, such as the appearance, contents, substance, internal patterns, or other distinctive characteristics of the item, taken together with all of the circumstances. I am further informed that an item is considered authentic if it is at least 20 years old, in a condition that creates no suspicion of its authenticity, and in a place where, if authentic, it would likely be. Lastly, I have been informed that a document's authenticity can be established by comparison with an authentic specimen.

14. I am informed by counsel that a printed publication qualifies as publicly accessible as of the date it was disseminated or otherwise made available such that a person interested in and ordinarily skilled in the relevant subject matter could locate it through the exercise of ordinary diligence.

15. While I understand that the determination of public accessibility under the foregoing standard rests on a case-by-case analysis of the facts particular to an individual publication, I also understand that a printed publication is rendered "publicly accessible" if it is cataloged and indexed by a library such that a person interested in the relevant subject matter could locate it (*i.e.*, I understand that cataloging and indexing by a library is sufficient, though there are other ways that a printed publication may qualify as publicly accessible). One manner of sufficient indexing is indexing according to subject matter category. I understand that the cataloging and indexing by a single library of a single instance of a particular

printed publication is sufficient, even if the single library is in a foreign country. I understand that, even if access to a library is restricted, a printed publication that has been cataloged and indexed therein is publicly accessible so long as a presumption is raised that the portion of the public concerned with the relevant subject matter would know of the printed publication. I also understand that the cataloging and indexing of information that would guide a person interested in the relevant subject matter to the printed publication, such as the cataloging and indexing of an abstract for the printed publication, is sufficient to render the printed publication publicly accessible.

16. I understand that routine business practices, such as general library cataloging and indexing practices, can be used to establish an approximate date on which a printed publication became publicly accessible.

A. Persons of Ordinary Skill in the Art

17. I am told by counsel that the subject matter of this proceeding relates generally to solar cell design and manufacturing.

18. I have been informed by counsel that a "person of ordinary skill in the art at the time of the inventions" is a hypothetical person who is presumed to be familiar with the relevant field and its literature at the time of the inventions. This hypothetical person is also a person of ordinary creativity, capable of understanding the scientific principles applicable to the pertinent field.

19. I am told by counsel that persons of ordinary skill in this subject matter or art would have been someone with an advanced degree in electrical engineering, applied physics, chemistry, or materials science, and at least two years of experience designing, developing, or researching in the field. Alternatively, that person would have had a bachelor's degree in electrical engineering, applied physics, or materials science, and at least three years of experience designing, developing, or researching in the field.

20. It is my opinion that such a person would have been engaged in research, learning through study, and practice in the field and possibly through formal instruction the bibliographic resources relevant to his or her research. By not later than the late 1990s (and more specifically, 1998), such a person would have had access to a vast array of long-established print resources in the field, as well as to a rich set of online resources providing indexing information, abstracts, and full text services for publications relevant to the field of this dispute.

B. Authoritative Databases

21. In preparing this report, I used authoritative databases, such as the OCLC WorldCat, the Library of Congress Online Catalog, and the U. S. Copyright Office database, to confirm citation details of the various publications discussed.

22. *OCLC WorldCat Database.* The OCLC was created "to establish, maintain and operate a computerized library network and to promote the evolution

of library use, of libraries themselves, and of librarianship, and to provide processes and products for the benefit of library users and libraries, including such objectives as increasing availability of library resources to individual library patrons and reducing the rate of rise of library per-unit costs, all for the fundamental public purpose of furthering ease of access to and use of the ever-expanding body of worldwide scientific, literary and educational knowledge and information."[1] Among other services, OCLC and its members are responsible for maintaining the WorldCat database,[2] used by independent and institutional libraries throughout the world.

23. *U. S. Copyright Office.* Created by Congress in 1897, the Copyright Office is responsible for administering a complex and dynamic set of laws, which include registration, the recordation of title and licenses, a number of statutory licensing provisions, and other aspects of the *1976 Copyright Act* and the *1998 Digital Millennium Copyright Act*. The public catalog in the Copyright Office includes information filed since 1978.[3] Individuals can search by title, personal or corporate name, key word, registration number, and document number. Works

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[1] Third Article, Amended Articles of Incorporation of OCLC Online Computer Library Center, Incorporated (available at https://www.oclc.org/content/dam/oclc/membership/articles-of-incorporation.pdf)

[2] http://www.worldcat.org/

[3] https://cocatalog.loc.gov/cgi-bin/Pwebrecon.cgi?DB=local&PAGE=First

filed before 1978 can be located through the Copyright Public Records Reading Room.[4] A researcher can find the date on which an item was published and deposited for copyright.

24. *ResearchGate*.[5] A social networking site designed for scientists and researchers to share papers, ask and answer questions, and find collaborators, *ResearchGate* is the largest academic social network in terms of active users. As of September 2023, ResearchGate had more than 25 million users, with its largest user-bases coming from Europe and North America.[6]

25. Features available to *ResearchGate* members include following a research interest and the work of other individual participants, a blogging feature for users to write short reviews on peer-reviewed articles, private chat rooms for sharing data, editing documents, or discussing confidential topics, and a research-focused job board. *ResearchGate* indexes self-published information on user profiles and suggests members connect with others who have similar interests. Member questions are fielded to others who have identified relevant expertise on their profiles.

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[4] https://www.copyright.gov/circs/circ23.pdf

[5] www.researchgate.net

[6] https://en.wikipedia.org/wiki/ResearchGate

26. *ResearchGate* restricts its user accounts to people at recognized institutions and published researchers. Most of *ResearchGate's* users are involved in medicine, biology, engineering, computer science, agricultural sciences, and psychology. *ResearchGate* publishes a citation impact measurement in the form of an "RG Score," which is reported to be correlated with existing citation impact measures. *ResearchGate* does not charge fees for putting content on the site and does not require peer review.

27. *Semantic Scholar.*[7] A project developed at the Allen Institute for Artificial Intelligence and publicly released in November 2015, *Semantic Scholar* is designed to be an AI-backed search engine for scientific journal articles which uses a combination of machine learning, natural language processing, and machine vision to add a layer of semantic analysis to the traditional methods of citation analysis, and to extract relevant figures, entities, and venues from papers. *Semantic Scholar* is designed to highlight important, influential papers, and to identify the connections between them.

28. As of January 2018, following a 2017 project that added biomedical papers and topic summaries, the *Semantic Scholar* corpus included more than 40 million papers from computer science and biomedicine. In March 2018, Doug Raymond, who developed machine learning initiatives for the Amazon

[7] https://www.semanticscholar.org

Alexa platform, was hired to lead the *Semantic Scholar* project. As of August 2019, the number of included papers had grown to more than 173 million after the addition of the Microsoft Academic Graph records, already used by Lens.org.

29. *IEEE Xplore.*[8] Librarians in academic, special, and large public libraries are familiar with the *IEEE Xplore* digital database. In working with undergraduate and graduate students, researchers, engineers, scientists, and the public, librarians are intimately familiar with the *IEEE Xplore* digital database and rely on its content for access to reliable, accurate publications. Established to serve as a digital database for the IEEE's ebooks, standards, conference papers, technical reports, and journal articles, and related documents dating from 1988 to the present and selectively from 1913 to 1987, *IEEE Xplore* is a scholarly research database that includes 6.3 million documents and which is known for its reputable curation and maintenance of documents and publication information. *IEEE Xplore* is and has been text searchable, such as by author, publication, title, year, and content or subject matter. The *IEEE Xplore* digital database accurately reports dates of publications and events and accurately reports locations of events in accordance with standard practices for major industry journals. Approximately

[8] https://ieeexplore.ieee.org/Xplore/home.jsp

20,000 new documents are added to *IEEE Xplore* each month. Abstracts are free to access, but access to full text requires a subscription or institutional login.

30. *IEEE Xplore* was launched in May 2000 to store IEEE publications.[9] Older publications were added to the database gradually, and hence, the date *IEEE Xplore* added a document may be later than the earliest publication date of a document (*e.g.*, a publication from 1990 could have been added to *IEEE Xplore* after 2000). Thus, while *IEEE Xplore* reliably reports the date a document was added to *IEEE Xplore* for download by the public, that date does not necessarily correspond to the first time the document was publicly available. However, the date a pre-2000 publication was added to *IEEE Xplore* demonstrates that the pre-2000 publication was publicly available and disseminated no later than the date it was added to *IEEE Xplore*.

31. *IEEE Xplore* also indicates the date of publication for a particular article published by IEEE and its partners. *IEEE Xplore* explains the date of publication shown on its website as the date of first public dissemination:

32. The Date of Publication for Journals and Standards on *IEEE Xplore* represents the very first instance of public dissemination. *IEEE Xplore* previously made distinctions between the online publication date, print publication date, etc.

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[9] https://innovate.ieee.org/ieee-xplore-reaches-5-million-documents/#:~:text=In%20May%202000%2C%20the%20IEEE,and%20views%20in%20that%20time.

This was simplified to reflect a single publication date of record as defined above. [Exhibit 1048 (page 5)].[10] The *IEEE Xplore* requires peer review before publishing content. I have used IEEE publications in print and online for nearly 50 years. Currently I have access to IEEE documents as part of the resources for faculty through the King Library at San José State University. In addition to covering material from the IEEE, the *IEEE Xplore* also covers materials from the Institution of Engineering and Technology. The *IEEE Xplore* digital library provides Web access to more than 5.3-million full-text documents from some of the world's most highly cited publications.

C. Indexing

33. A researcher may discover material relevant to his or her topic in a variety of ways. One common means of discovery is to search for relevant information in an index of periodical and other publications. Having found relevant material, the researcher will then normally obtain it online, look for it in libraries, or purchase it from a publisher, a bookstore, a document delivery service, or other provider. Sometimes, the date of a document's public accessibility will involve both indexing and library date information. However, date information for indexing entries is often unavailable. This is especially true for online indices.

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[10] https://ieeexplore.ieee.org/Xplorehelp/ieee-xplore-training/working-with-documents#publication-dates

34. Indexing services use a wide variety of controlled vocabularies to provide subject access and other means of discovering the content of documents. The formats in which these access terms are presented vary from service to service.

35. Before the widespread development of online databases to index articles in journals, magazines, conference papers, and technical reports, libraries purchased printed volumes of indices. Graduate library school education mandated that students learn about the bibliographic control of disciplines, the prominent indexing volumes, and searching strategies required to use them effectively and efficiently. Half of the courses that I studied in library school were focused on bibliography and resources in academic disciplines.

36. Librarians consulted with information seekers to verify citations, check availability in union catalogs, printed books catalogs, and the OCLC database, and make formal requests for materials, *e.g.*, books, conference proceedings, journal articles. Requests were transmitted using Telex machines, rudimentary email systems, and the United States Postal Service. During my career, I have performed and supervised staff who handled these resource sharing tasks.

37. A major firm known for the breadth of subjects and comprehensive treatment in the preparation of index volumes, the H. W. Wilson Company offered these reference resources since the firm was founded in 1898. The *Reader's Guide*

to Periodical Literature is one of the best-known titles available from H. W. Wilson. Each volume includes a comprehensive index for 300 of the most popular and important periodicals published in the United States and Canada. Information seekers have subject access expressed in plain language terminology, author access, and cross references to find the desired results from their searches. The family of index titles included *Science & Technology Index*, *Business Periodicals*, *Applied Science & Technology Index, Humanities Index, Biological & Agricultural Index*, and *Industrial Arts Index*. These printed indices have been superseded by digital database offerings available to information seekers through Ebsco.

38. Online indexing services commonly provide bibliographic information, abstracts, and full-text copies of the indexed publications, along with a list of the documents cited in the indexed publication. These services also often provide lists of publications that cite a given document. A citation of a document is evidence that the document was publicly available and in use no later than the publication date of the citing document.

V. LIBRARY CATALOGING PRACTICES

A. MARC RECORDS AND THE ONLINE LIBRARY CATALOG

39. I am fully familiar with the library cataloging standard known as the MARC standard, which is an industry-wide standard method of storing and

organizing library catalog information.[11] MARC was first developed in the 1960s by the Library of Congress. A MARC-compatible library is one that has a catalog consisting of individual MARC records for each of its items. Today, MARC is the primary communications protocol for the transfer and storage of bibliographic metadata in libraries.[12]

40. MARC is a framework into which descriptive bibliographic data are transcribed to interact with the software in online library catalogs to provide access to books, journals, and other resources in the collection. The bibliographic data provide points of access and can be searched by a person of ordinary skill in the art ("POSITA") to identify and obtain resources in the library collection. An information seeker (or POSITA) can search a local online library catalog or the

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[11] The full text of the standard is available from the Library of Congress at http://www.loc.gov/marc/bibliographic/.

[12] Almost every major library in the world is MARC-compatible. *See, e.g.*, *MARC Frequently Asked Questions (FAQ)*, Library of Congress, https://www.loc.gov/marc/faq.html (last visited June 13, 2024) ("MARC is the acronym for MAchine-Readable Cataloging. It defines a data format that emerged from a Library of Congress-led initiative that began nearly forty years ago. It provides the mechanism by which computers exchange, use, and interpret bibliographic information, and its data elements make up the foundation of most library catalogs used today."). MARC is the ANSI/NISO Z39.2-1994 (reaffirmed 2016) standard for Information Interchange Format.

holdings of a group of libraries in a state or region or in the global catalog WorldCat.

41. MARC records are not designed for public viewing. Although a significant number of libraries provide access to the MARC version of a bibliographic record, the public display is designed to show information in a succinct manner that is quickly understood and useful to the information seeker. Libraries determine the default search for the online catalog to make the entry of search terms efficient and result in a successful search. Information seekers can enter a keyword, title, author, or standard number for the item. Libraries may also provide a search capability called "Summon" that allows the information seeker to enter known information about the item to conduct a search.

42. Since at least the early 1970s and continuing to the present day, MARC has been the primary communications protocol for the transfer and storage of bibliographic metadata in libraries.[13] As explained by the Library of Congress:

> You could devise your own method of organizing the bibliographic information, but you would be isolating your library,

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[13] A complete history of the development of MARC can be found in *MARC: Its History and Implications* by Henrietta D. Avram (Washington, DC: Library of Congress, 1975) and available online from the Hathi Trust (https://babel.hathitrust.org/cgi/pt?id=mdp.39015034388556;view=1up;seq=1; last visited June 13, 2024).

> limiting its options, and creating much more work for yourself. Using the MARC standard prevents duplication of work and allows libraries to better share bibliographic resources. Choosing to use MARC enables libraries to acquire cataloging data that is predictable and reliable. If a library were to develop a "home-grown" system that did not use MARC records, it would not be taking advantage of an industry-wide standard whose primary purpose is to foster communication of information.
>
> Using the MARC standard also enables libraries to make use of commercially available library automation systems to manage library operations. Many systems are available for libraries of all sizes and are designed to work with the MARC format. Systems are maintained and improved by the vendor so that libraries can benefit from the latest advances in computer technology. The MARC standard also allows libraries to replace one system with another with the assurance that their data will still be compatible.

Why Is a MARC Record Necessary? LIBRARY OF CONGRESS, http://www.loc.gov/marc/umb/um01to06.html#part2 (last visited June 13, 2024).

43. Examining the MARC records for a specific item reveals the comprehensive data transcribed about a particular item at the time that cataloging and classification occurred. In addition to the creator, title, subjects, and standard numbers, additional information may provide additional and relevant data depending on the type of resource. Understanding the full extent of bibliographic data for an item and the points of access associated with it provides essential

information that can be used to determine the indexing and public availability for documents described in this Report.

B. MARC RECORDS

44. A MARC record comprises several fields, each of which contains specific data about the work. Each field is identified by a standardized, unique, three-digit code corresponding to the type of data that follow. For example, a work's title is recorded in field 245, the primary author or creator of the work is recorded in field 100, an item's International Standard Book Number ("ISBN") is recorded in field 020, an item's International Standard Serial Number ("ISSN") is recorded in field 022, an item's Library of Congress call number is recorded in field 050, and the publication date is recorded in field 260 under the subfield "c." *Id.*[14] If a work is a periodical, then its publication frequency is recorded in field 310, alternate publication frequency is recorded in field 321, and the publication dates (*e.g.*, the first and last publication) are recorded in field 362, which is also

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[14] In some MARC records, field 264 is used rather than field 260 to record publication information. *See* http://www.loc.gov/marc/bibliographic/bd264.html (last visited June 13, 2024) ("Information in field 264 is similar to information in field 260 (Publication, Distribution, etc. (Imprint)). Field 264 is useful for cases where the content standard or institutional policies make a distinction between functions").

referred to as the enumeration/chronology field. *See* http://www.loc.gov/marc/bibliographic/bd3xx.html (last visited June 13, 2024).

45. The library that created the record is recorded in Field 040 in subfield "a" with a unique library code. When viewing the MARC record online via Online Computer Library Center's ("OCLC") bibliographic database, hovering over this code with the mouse reveals the full name of the library. I used this method of "mousing over" the library codes in the OCLC database to identify the originating library for the MARC records discussed in this Report. Where this "mouse over" option was not available, I consulted the Directory of OCLC Libraries to identify the institution that created the MARC record.[15]

46. MARC records also include several fields that include subject matter classification information. An overview of MARC record fields is available through the Library of Congress at http://www.loc.gov/marc/bibliographic/. For example, 6XX fields are termed "Subject Access Fields." *See* http://www.loc.gov/marc/bibliographic/bd6xx.html. Among these, for example, is the 650 field; this is the "Subject Added Entry – Topical Term" field. *See* http://www.loc.gov/marc/bibliographic/bd650.html. The 650 field is a "[s]ubject added entry in which the entry element is a topical term." *Id.* These authenticated subject entries "are assigned to a bibliographic record to provide access according

[15] https://www.oclc.org/en/contacts/libraries.html

to generally accepted thesaurus-building rules (*e.g.*, *Library of Congress Subject Headings* (LCSH), *Medical Subject Headings* (MeSH))." *Id.*

47. Further, MARC records include call numbers, which themselves indicate a subject and physical location within the library collections. For example, the 050 field is the "Library of Congress Call Number." *See* http://www.loc.gov/marc/bibliographic/bd050.html (last visited April 20, 2024). A defined portion of the Library of Congress Call Number is the classification number, and "source of the classification number is *Library of Congress Classification* and the *LC Classification-Additions and Changes*." *Id.* Thus, included in the 050 field is a subject matter classification. Each item in a library has a single classification number. A library selects a classification scheme (*e.g.*, the Library of Congress Classification scheme just described or a similar scheme such as the Dewey Decimal Classification scheme or the National Library of Medicine Classification scheme) and uses it consistently. When the Library of Congress assigns the classification number, it appears as part of the 050 field. If a local library assigns the classification number, it appears in a 090 field. In either scenario, the MARC record includes a classification number that represents a subject matter classification.

48. Each item in a library has a single classification number. A library selects a classification scheme (*e.g.*, the Library of Congress Classification scheme

just described or a similar scheme such as the Dewey Decimal Classification scheme) and uses it consistently. When the Library of Congress assigns the classification number, it appears as part of the 050 field, as discussed above. For MARC records created by libraries other than the Library of Congress (*e.g.*, a university library or a local public library), the classification number may appear in a 09X (*e.g.*, 090) field. *See* http://www.loc.gov/marc/bibliographic/bd09x.html (last visited June 13, 2024).

C. OCLC

49. The OCLC was created "to establish, maintain and operate a computerized library network and to promote the evolution of library use, of libraries themselves, and of librarianship, and to provide processes and products for the benefit of library users and libraries, including such objectives as increasing availability of library resources to individual library patrons and reducing the rate of rise of library per-unit costs, all for the fundamental public purpose of furthering ease of access to and use of the ever-expanding body of worldwide scientific, literary and educational knowledge and information."[16] Among other services, OCLC and its members are responsible for maintaining the WorldCat database

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[16] Third Article, Amended Articles of Incorporation of OCLC Online Computer Library Center, Incorporated (available at https://www.oclc.org/content/dam/oclc/membership/articles-of-incorporation.pdf).

(http://www.worldcat.org/), used by independent and institutional libraries throughout the world.

50. OCLC also provides its members online access to MARC records through its OCLC bibliographic database. When an OCLC member institution acquires a work, it creates a MARC record for this work in its computer catalog system in the ordinary course of its business. MARC records created at the Library of Congress were initially tape-loaded into the OCLC database through a subscription to MARC Distribution Services daily or weekly. Once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress, the MARC record is then made available to any other OCLC members online, and therefore made available to the public. Accordingly, once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress or another library anywhere in the world, any publication corresponding to the MARC record has been cataloged and indexed according to its subject matter such that a person interested in that subject matter could, with reasonable diligence, locate and access the publication through any library with access to the OCLC bibliographic database or through the Library of Congress.

51. When an OCLC member institution creates a new MARC record, OCLC automatically supplies the date of creation for that record. The date of

creation for the MARC record appears in the fixed field (008), characters 00 through 05. The MARC record creation date reflects the date on which the item was first acquired or cataloged. Initially, field 005 of the MARC record is automatically populated with the date the MARC record was created in year, month, day format (YYYYMMDD) (some of the newer library catalog systems also include hour, minute, second (HHMMSS)). Thereafter, the library's computer system may automatically update the date in field 005 every time the library updates the MARC record (*e.g.*, to reflect that an item has been moved to a different shelving location within the library). Field 005 is visible when viewing a MARC record via an appropriate computerized interface. The initial field 005 date (*i.e.*, the date the MARC record was created) does appear. The date upon which the most recent update to field 005 occurred also appears in field 005. Thus, when an item's MARC record has been printed to hardcopy—as is the case with the exhibits to this report—the date reflected next to field 008 is necessarily on or after the date the library first cataloged and indexed the underlying item.

52. Once one library has cataloged and indexed a publication by creating a MARC record for that publication, other libraries that receive the publication do not create additional MARC records—the other libraries instead rely on the original MARC record. They may update or revise the MARC record to ensure accuracy, but they do not replace or duplicate it. This practice does more than save

libraries from duplicating labor, it also enhances the accuracy of MARC records. It also allows librarians around the world to know that a particular MARC record is authoritative. In contrast, a hypothetical system wherein duplicative records were created would result in confusion as to which record is authoritative.

53. The date of creation of the MARC record by a cataloger at an OCLC member institution reflects when the underlying item is accessible to the public. Upwards of two-thirds to three-quarters of book sales to libraries come from a jobber or wholesaler for online and print resources. These resellers make it their business to provide books to their customers as fast as possible, often providing turnaround times of only a single day after publication. Libraries purchase a significant portion of the balance of their books directly from publishers themselves, which provide delivery on a similarly expedited schedule. In general, libraries make these purchases throughout the year as the books are published and shelve the books as soon thereafter as possible in order to make the books available to their patrons. Thus, books are generally available at libraries across the country within just a few days of publication.

D. JOURNALS

54. Catalogers can create MARC records for all types of print, online, and digital resources. For example, MARC records cover serial publications, including both serially-published monographs and journals. OCLC hosts MARC records for

more than 320 million serial publications. Serial publications are those publications that have the same collective title but are intended to be continued indefinitely with enumeration such as a volume or issue number, *e.g.*, magazines and journals. In the OCLC bibliographic database, the first issue of the serial publication is typically cataloged, but the date is left open-ended with the use of a punctuation mark such as a dash. Individual issues are not cataloged according to the current national cataloging rules outlined in *RDA: Resource and Access*. Instead, MARC records for serial publication in OCLC represent the entire run of the serial title. With knowledge of the first issue published, future issues can be predicted. In my extensive professional experience, is it highly unusual for a library to stop collecting and shelving a serial publication prior to the end of its publication run. If a subscription to a serial publication ends its run or is cancelled before the end of its run, the library will denote that it has stopped receiving new volumes by filling in the end date in the local MARC record.

55. The handling of printed journal subscriptions is shown on the covers of individual issues. As was the best practice among libraries, issues arrived at a central facility and were immediately received, verified as part of a subscription, checked in, and stamped with the institution's name and date. Determining that the issue was part of the library subscription ensured that the entire set of publications for the year had been received so that they could be professionally bound and

retained. This process also verified that all of the published issues arrived so that the library staff did not have to request or claim an issue that did not arrive as expected. In large public libraries with branches and multi-campus libraries within academic institutions, the journals were sorted and delivered to the subscribing unit. The issues were frequently stamped again to acknowledge receipt. The new issue was placed in the public area; the older issue was stored so that it remained available.

56. The foregoing process has been standard library practice longer than I have been working in the profession. I first learned the steps in the process in the late 1970s and later supervised it. Although the checking in process has become automated and now links electronically to holdings records for the MARC record for each serial title, the manual stamping and placing the issue in a public area has not changed for 50 years. Unless I note otherwise below in reference to a specific serial publication, it is my expert opinion that this standard protocol was followed for each of the publications discussed below.

VI. PUBLICATIONS

A. King, R. R., Ronald A. Sinton, and Richard M. Swanson. "Studies of Diffused Phosphorus Emitters: Saturation Current, Surface Recombination Velocity, and Quantum Efficiency." *IEEE Transactions on Electron Devices*, vol. 37, no. 2 (February 1990): 365-371. ("King") [Exhibit 1006]

57. Attached hereto as Exhibit 1006 is a copy of the journal article titled "Studies of Diffused Phosphorus Emitters: Saturation Current, Surface Recombination Velocity, and Quantum Efficiency" by R. R. King, Ronald A. Sinton, and Richard M. Swanson (hereafter "King"). The King article was published in Volume 37, Number 2 of the journal titled *IEEE Transactions on Electron Devices* and was found in the Linda Hall Library of Science, Engineering & Technology (Kansas City, Missouri). The King article appears beginning on page 365 of this issue dated February 1990. Exhibit 1006 is a true and correct copy of the King article (pages 365-371). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. Exhibit 1006 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1006 is a true and correct copy in a condition that creates no suspicion about its authenticity.

58. Attached hereto as Attachment 1A is a true and correct copy of the MARC record for the journal titled *IEEE Transactions on Electron Devices* from

the Linda Hall Library of Science, Engineering & Technology online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 1A occurred on September 6, 2023, as shown in field 005 ("20230906"). I personally identified and retrieved the MARC record that is Attachment 1A.

59. Based on finding a copy of Exhibit 1006 in the Linda Hall Library of Science, Engineering & Technology and MARC record in its online library catalog attached as Attachment 1A, it is my opinion that the King article published in the journal titled *IEEE Transactions on Electron Devices* was publicly available on January 25, 1990, as shown by the library's stamp on the cover of Exhibit 1006. In common practice these stamps are applied at or around the time the volume is entered into the library's collection and the volume is made available to library patrons within a short time thereafter. Attachment 1A also shows that Exhibit 1006 was catalogued with a descriptor term reading "Electron apparatus and appliances $v Periodicals" (see Attachment 1B, Library of Congress subject heading sh2008102923) in the 650 field.

60. As noted in the holdings information (362 field), the Linda Hall Library of Science, Engineering, & Technology has received the journal titled *IEEE Transactions on Electron Devices* from 1963 and continues to receive the publication. In view of the MARC record for Exhibit 1006 and the receipt stamp

by the Linda Hall Library of Science, Engineering & Technology on the print copy of Exhibit 1006, the King article was publicly available in print on January 25, 1990 or shortly afterwards, because the serial title would have been received, cataloged, and indexed in the Linda Hall Library of Science, Engineering & Technology and made part of its online catalog database.

61. Attached hereto as Attachment 1C is a true and correct copy of the MARC record for the journal titled *IEEE Transactions on Electron Devices* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 1C, that library code is "NLM," which means that the MARC record for this serial was cataloged at the National Library of Medicine (Bethesda, Maryland). As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the National Library of Medicine created OCLC record number 935837 on July 3, 1974, as shown in field 008 ("740703"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 1C occurred on August 10, 2022, as shown in field 005 ("20220810"). I personally identified and retrieved the MARC record that is Attachment 1C. The "BLvl" entry in Attachment 1C is "s," which indicates that the journal titled *IEEE Transactions on Electron Devices* is a serial publication. Field 310 of Attachment 1C reads "Monthly, $b 1964-."

Accordingly, the MARC record for Exhibit 1006 corresponds to the journal titled *IEEE Transactions on Electron Devices* from the time the serial title adopted the current title and includes the date of the King article.

62. Attachment 1C includes an entry in field 050 ("TK7870 $b .I2")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system) and an entry in field 060 ("W1 I223E"), a subject matter consistent with the National Library of Medicine classification system (analogous to the Dewey Decimal classification system). Attachment 1C further includes two descriptor terms reading "Electron apparatus and appliances $v Periodicals" (see Attachment 1B, Library of Congress subject heading sh2008102923) and "Electronics $x instrumentation" (see Attachment 1D, National Library of Medicine subject heading D004581) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 1C was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 060 entry, and the field 650 entries. As of July 3, 1974, the MARC record attached hereto as Attachment 1C was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and

afterwards through any library with access to the OCLC bibliographic database or through an individual library.

63. The King article is also available from the *IEEE Xplore* database,[17] which indicates a February 1990 "Date of Publication," as seen in Exhibit 1049. As explained above, this "Date of Publication" refers to the date of first public dissemination by IEEE.[18] WorldCat also indicates that the journal titled *IEEE Transactions on Electron Devices* as cataloged at the National Library of Medicine is currently available from about 792 libraries.[19] This shows that the King publication was widely available in circulation. For example, the King publication has been actually cited in publications and patents by others, including, for example, by:

- U.S. Patent No. 8,124,502 that issued on February 28, 2012, as seen from Exhibit 1050 (cover, right column).
- Liou, J. J. et al., "Comparison and Optimization of the Performance of Si and GaAs Solar cells," *Solar Energy Materials and Solar Cells* (vol. 28, Issue 1, pp. 9-28) (herafter "Liou"), available online February 26, 2003, as seen from Exhibit 1051

[17] https://ieeexplore.ieee.org/document/46368

[18] https://ieeexplore.ieee.org/Xplorehelp/ieee-xplore-training/working-with-documents#publication-dates

[19] https://search.worldcat.org/title/935837

(page 3), a webpage printout from ScienceDirect, the publisher of the journal *Solar Energy Materials and Solar Cells,* through which this Liou article may be accessed.

64. In view of the above, it is my opinion that Exhibit 1006 is an authentic excerpted copy of this issue of the journal titled *IEEE Transactions on Electron Devices* containing the King publication and was publicly available on January 25, 1990 or shortly thereafter, because by that date this journal issue had been cataloged and indexed at the National Library of Medicine, made part of the OCLC bibliographic database, and received in the Linda Hall Library of Science, Engineering & Technology. Further, it would have been publicly disseminated by February 1990, as indicated by *IEEE Xplore* database. And because the King publication was actually cited, for example, by Liou which was available online on February 26, 2003 and by a patent issued in February 2012, the King publication was actually publicly disseminated no later than these dates. For these reasons, it is my opinion that Exhibit 1006 was published and accessible to the public on January 25, 1990, and no later than February 1990, and in any event before December 22, 2014.

B. Marvin, D. C., and S. L. Froedge. *Interdigitated Back Contact Silicon Solar Cell Analysis and Design Recommendations for Space Use.* Report SSO-TR-90-04. El Segundo, CA: The Aerospace Corporation, 1989. ("Marvin 1989a") [Exhibit 1007]

65. Exhibit 1007 is a technical report titled *Interdigitated Back Contact Silicon Solar Cell Analysis and Design Recommendations for Space Use* prepared by D. C. Marvin and S. L Froedge (hereafter "Marvin 1989a") at The Aerospace Corporation for the Space Systems Division of the Air Force Systems Command (Los Angeles Air Force Base, California). The technical report is also identified as Report SSO-TR-90-04 and is dated September 30, 1989. Exhibit 1007 is marked "Approved for Public Release; Distribution Unlimited," and is available from the Defense Technical Information Center (DTIC)[20] and also through the digital repository *ResearchGate*.[21] I downloaded Exhibit 1007 from the DTIC website, which indicates a selected date of April 11, 1990. Exhibit 1007 is a true and correct copy of the technical report. Specifically, the text appears to be complete; page 8 appears to be missing, but it appears to be a typographical error, as the text on each page appears to flow seamlessly from one page to the next. Alternatively, page 8 may not have been released to the public and only the other pages were

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[20] https://apps.dtic.mil/sti/citations/ADA220414

[21] https://www.researchgate.net/publication/235021730_Interdigitated_Back_Contact_Silicon_Solar_Cell_Analysis_and_Design_Recommendations_for_Space_Use

approved and released to the public. Exhibit 1007 was found within the custody of a federal government digital repository – a place where, if authentic, a copy of this technical report would likely be. Exhibit 1007 is a true and correct copy in a condition that creates no suspicion about its authenticity.

66. The public availability of the Marvin 1989a technical report is supported by a letter dated June 14, 2024, from Wayne Strickland, Associate Director of the Office of Program Management at the National Technical Information Center ("NTIS") (Exhibit 1040), which I understand was sent in response to an inquiry by counsel about the public availability of Exhibit 1007. In his letter, Mr. Strickland states "NTIS announced" the Marvin 1989a technical report (identified by ADA220414) by adding the bibliographic reference/abstract to the NTIS Bibliographic Database "on our about" July 1990, which is said to be "within a month" of the July 1990 date. Making the bibliographic reference/abstract available in the NTIS Bibliographic Database is similar to indexing and cataloguing that makes it possible for anyone interested from the public to find and retrieve the Marvin 1989a technical report. Based on the dates appearing on Exhibit 1007 and Mr. Strickland's letter, it is my opinion that the technical report titled *Interdigitated Back Contact Silicon Solar Cell Analysis and Design Recommendations for Space Use* (Exhibit 1007) is an authentic copy of the

Marvin 1989a technical report and was publicly available by July 1990 or within a month of that date, and in any event before December 22, 2014.

C. Müller, Ralph, Christian Reichel, Jan Benick, and Martin Hermle. "Ion implantation for All-Alumina IBC Solar Cells with Floating Emitter." *Energy Procedia*, vol. 55 (2014) 265 – 271. ("Müller") [Exhibit 1008]

67. Attached hereto as Exhibit 1008 is a copy of the journal article titled "Ion implantation for All-Alumina IBC Solar Cells with Floating Emitter" by Ralph Müller, Christian Reichel, Jan Benick, and Martin Hermle (hereafter "Müller"). The Müller article was published in Volume 55 of the *electronic* journal titled *Energy Procedia* and was found in the Auraria Library at the University of Colorado – Denver. The Müller article appears beginning on page 265 of this issue dated 2014. Exhibit 1008 is a true and correct copy of the Müller article (pages 265-271). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Müller article is also available from the publisher, Science Direct,[22] and the digital repository *ResearchGate*.[23] Clicking on the "Show More Information" link of the Science Direct page indicates that the Müller article was available online on

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[22] https://www.sciencedirect.com/science/article/pii/S1876610214013022

[23] https://www.researchgate.net/publication/274309111_Ion_Implantation_for_All-alumina_IBC_Solar_Cells_with_Floating_Emitter

September 19, 2014, as seen at Exhibit 1047, a printout from the publisher's webpage for the Müller article. Exhibit 1008 was found within the custody of a library – a place where an authentic copy of this electronic journal would likely be. Exhibit 1008 is a true and correct copy in a condition that creates no suspicion about its authenticity.

68. Attached hereto as Attachment 3A is a true and correct copy of the MARC record for the electronic journal titled *Energy Procedia* from the Auraria Library at the University of Colorado – Denver online catalog. As seen from field 245, this journal is identified as an "electronic resource," which means it is available electronically online. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 3A occurred on February 9, 2023, as shown in field 005 ("20230209"). Field 530 of Attachment 3A indicates that this journal is "also available in print copy." I personally identified and retrieved the MARC record that is Attachment 3A.

69. It is almost always the case that an electronic version of the journal is made available first by the publisher to the library and can be accessed by the library before receiving a print copy. Under standard practice of a library, a library's electronic copy of the journal would be indexed, catalogued, and made available as soon as the publisher makes the electronic journal available online, or

very soon afterwards, usually within a few days. Based on finding an electronic copy of Exhibit 1008 in the Auraria Library at the University of Colorado – Denver and MARC record in its online library catalog attached as Attachment 3A, it is my opinion that the Müller article published in the electronic journal titled *Energy Procedia* was publicly available on September 19, 2014 or a few days afterwards, as shown on the publisher's Science Direct website, as seen from Exhibit 1047 ("Available online 19 September 2014"). Attachment 3A also shows that Exhibit 1008 was catalogued with two descriptor terms reading "Power resources $v Congresses" (see Attachment 3B, Library of Congress subject heading sh2008109865) and "Power resources $v Periodicals" (see Attachment 3C, Library of Congress subject heading sh2008109910) in the 650 fields.

70. As noted in the holdings information (362 field), the Auraria Library at the University of Colorado – Denver has been receiving the electronic journal titled *Energy Procedia* since February 2009 and continues to receive the publication. In view of the MARC record for Exhibit 1008, the Müller article was publicly available online by September 19, 2014, because the serial title had been received, cataloged, and indexed in the Auraria Library at the University of Colorado – Denver and made part of its online catalog database.

71. Attached hereto as Attachment 3D is a true and correct copy of the MARC record for the electronic journal titled *Energy Procedia* obtained from the

OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 3D, that library code is "IWA," which means that the MARC record for this serial was cataloged in the Parks Library at Iowa State University (Ames, Iowa). As can be seen in field 008 in the MARC record for this exhibit, a cataloger in the Parks Library at Iowa State University created OCLC record number 320354560 on May 6, 2009, as shown in field 008 ("090506"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 3D occurred on January 16, 2024, as shown in field 005 ("20240116"). I personally identified and retrieved the MARC record that is Attachment 3D. The "BLvl" entry in Attachment 3D is "s," which indicates that the electronic journal titled *Energy Procedia* is a serial publication. Accordingly, the MARC record for Exhibit 1008 corresponds to the journal titled *Energy Procedia* from the time the serial title adopted the current title and includes the date of the Müller article.

72. Attachment 3D includes an entry in field 050 ("TJ163.13")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system). Attachment 3D further includes two descriptor terms reading"Power resources $v Congresses" (see Attachment 3B, Library of Congress subject

heading sh2008109865) and "Power resources $v Periodicals" (see Attachment 3C, Library of Congress subject heading sh2008109910) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 3D was indexed according to its subject matter by virtue of at least two independently sufficient classifications: the field 050 entry and the field 650 entries. As of May 6, 2009, the MARC record attached hereto as Attachment 3D was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the electronic serial, which means that the corresponding publication would have been publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

73. WorldCat indicates that the electronic journal titled *Energy Procedia* as cataloged in the Parks Library at Iowa State University is currently available from 710 libraries.[24] This shows that the Muller publication was widely available. For example, the Muller publication has been cited in several publications by others, including, for example, by:

- Yang, Xinbo et al., "Ion-Implanted Laser-Annealed p^+ and n^+ Regions: A Potential Solution for Industrially Feasible High-Efficiency N-Type Interdigitated Back-Contact Solar Cells." *IEEE*

[24] https://search.worldcat.org/title/320354560

Journal of Photovoltaics (vol 5, no. 1, pp. 87-93), with a "Date of Publication" on *IEEE Xplore* of October 15, 2014, as seen from Exhibit 1052, indicating the date of first public dissemination, as explained in the *IEEE Xplore* website (Exhibit 1048 (page 5)).

74. In view of the above, it is my opinion that Exhibit 1008 is an authentic copy of the Muller publication and was publicly available on September 19, 2014 or shortly afterwards, because by that date it had been made available online by the publisher on the Science Direct website and would have been cataloged and indexed in the Park Library at Iowa State University, made part of the OCLC bibliographic database, and received in the Auraria Library at the University of Colorado – Denver online catalog. And because it was cited by the publication Yang et al. "Ion-Implanted Laser-Annealed p^+ and n^+ Regions: A Potential Solution for Industrially Feasible High-Efficiency N-Type Interdigitated Back-Contact Solar Cells," which was first publicly disseminated by October 15, 2014 (Exhibit 1052), it is my opinion that the Muller publication (Exhibit 1008) was actually disseminated to others in the public no later than that date. For these reasons, it is my opinion that Exhibit 1008 was published and accessible to the public on September 19, 2014, and no later than October 15, 2014, and in any event before December 22, 2014.

D. Marvin, D. C., and S. L. Froedge. "Analysis of Interdigitated Back Contact Silicon Solar Cells for Space Use." *Proceedings of*

***the 24th Intersociety Energy Conversion Engineering Conference* (vol. 2, pp. 821-827). IECEC '89. 6 vols. New York: Institute of Electrical and Electronics Engineers, 1989. ("Marvin 1989b") [Exhibit 1035]**

75. Attached hereto as Exhibit 1035 is a copy of a conference paper published in the six-volume set titled *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* found in the Linda Hall Library of Science, Engineering & Technology (Kansas City, Missouri). The conference paper titled "Analysis of Interdigitated Back Contact Silicon Solar Cells for Space Use" by D. C. Marvin and S. L. Froedge (hereafter "Marvin 1989b") appears beginning on page 821 in volume 2. The 24th Intersociety Energy Conversion Engineering Conference was held on August 6-11, 1989, in Washington, DC. The Marvin 1989b conference paper was presented as part of the Space Energy Conversion Technologies II – Space Photovoltaic Technology: Cell and Array Component Performance (Exhibit 1035, page 6). Exhibit 1035 is a true and correct copy of the Marvin 1989b conference paper (volume 2, pages 821-827). I obtained this copy of the conference paper from the Linda Hall Library of Science, Engineering & Technology. Specifically, the text of the Marvin 1989b conference paper is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. Exhibit 1035 was found within the custody of a library – a place where, if authentic, a copy of this six-volume set of conference proceedings would likely

be. Exhibit 1035 is a true and correct copy in a condition that creates no suspicion about authenticity.

76. The Marvin 1989b conference paper is also available in the *IEEE Xplore* database[25] and the digital repository *ResearchGate.*[26] *IEEE Xplore* indicates that it was added to *IEEE Xplore* on August 6, 2002, as seen from Exhibit 1054 a webpage print out of the entry for the Marvin 1989b paper on *IEEE Xplore*. This means that the a digital copy of the paper was available for download from *IEEE Xplore* by August 6, 2002. *IEEE Xplore* explains the meaning of the "Date Added to IEEE Xplore" as the "date proceedings were first published," as seen from Exhibit 1048. But as I explained before, because IEEE Xplore only started in May 2000, pre-2000 publications were added gradually to the IEEE Xplore database and thus the significance of the "date added to IEEE Xplore" for pre-2000 publications would have been the date when the publication was made electronically available for download from IEEE Xplore, and not necessarily the first date of publication or dissemination.

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[25] https://ieeexplore.ieee.org/document/74564

[26] https://www.researchgate.net/publication/235021730_Interdigitated_Back_Contact_Silicon_Solar_Cell_Analysis_and_Design_Recommendations_for_Space_Use

77. Attached hereto as Attachment 4A is a true and correct copy of the MARC record for this six-volume set of conference proceedings from the Linda Hall Library of Science, Engineering & Technology online catalog. Library ownership is indicated by the presence of the library's code ("LHL") in field 049. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to the MARC record occurred on June 28, 2004, as shown in field 005 ("20040628"). I personally identified and retrieved the library catalog record which is Attachment 4A.

78. Based on finding a print copy of Exhibit 135 in the Linda Hall Library of Science, Engineering & Technology and MARC record in its online library catalog attached as Attachment 4A, it is my opinion that the six-volume set of conference proceedings titled *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* was cataloged in the Linda Hall Library of Science, Engineering & Technology using a MARC record created in the Library on June 20, 1989, as shown in field 008 ("890620"). The Marvin 1989b conference paper was publicly available at the Linda Hall Library of Science, Engineering & Technology on June 20, 1989, a couple of months before the conference.

79. Attached hereto as Attachment 4B is a true and correct copy of the MARC record for the six-volume set of conference proceedings titled *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* obtained from the OCLC bibliographic database. I personally identified and retrieved the MARC record that is Attachment 4B. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 4B, that library code is "DLC," which means that the MARC record for this conference proceedings volume was cataloged at the Library of Congress. As can be seen in the MARC record for this exhibit, a cataloger at the Library of Congress created OCLC record number 20411489 on June 20, 1989, as shown in field 008 ("890620"). The Type of Date/Publication Status is shown as "Single Date," which means that this record is for a single collection for that year, rather than a monograph serial with annual volumes. Field 500 also identifies the specific conference date as being "IECEC-89 August 6-11, 1989, Washington D.C.," which is the same title shown on the cover of Exhibit 1035. The library community continues to update this MARC record to meet current cataloging rules. The most recent enhancement to the MARC record occurred on January 18, 2024, as shown in field 005 ("20240118").

80. Attachment 4B further includes an entry in field 050 ("TJ163.7 $b .I57 1989")—as described above, a subject matter classification number consistent

with the Library of Congress classification system (analogous to the Dewey Decimal classification system) and an entry in field 082 ("621")—as described above, a subject matter classification number consistent with the Dewey Decimal classification system. Attachment 4B also shows that Exhibit 1035 was catalogued with three descriptor terms reading "Power (Mechanics) $v Congresses" (see Attachment 4C, Library of Congress subject heading sh2008109907), "Power resources $v Congresses" (see Attachment 4B, Library of Congress subject heading sh2008109865), and "Space vehicles $x Auxiliary power supply $v Congresses" (see Attachment 4D, Library of Congress subject heading sh2010114013) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 4B was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entries. Further, as of June 20, 1989, the MARC record attached hereto as Attachment 4B was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that acquired the six-volume set of conference proceedings, which means that the corresponding publication was publicly available on or before that same date through any library with access to the OCLC bibliographic database or through an individual library.

81. Further supporting my opinion that Exhibit 1035 was publicly accessible to ordinarily skilled and interested researchers in the field is the fact that the six-volume set titled *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* was registered with the U. S. Copyright Office as item TX0002655084 on September 21, 1989, and indicated a publication date of August 6, 1989 (see Attachment 4E, U. S. Copyright Office Public Catalog). As noted above, this would have provided a POSITA with keyword searching capabilities and other tools to locate this book.

82. WorldCat indicates that the six-volume set of conference proceedings titled *Proceedings of the 24th Intersociety Energy Conversion Engineering Conference* as cataloged at the Library of Congress is currently available from 352 libraries.[27] This shows that the Marvin 1989b publication was widely available. For example, the Marvin 1989b publication has been cited in patents and publications by others, including, for example, by

- July 12, 2006 International Search Report associated with PCT Publication WO 2007/022955 that was published on March 1, 2007, as seen from Exhibit 1055 (page 15).

83. In view of the above, it is my opinion that Exhibit 1035 is an authentic excerpted copy of the conference proceedings containing the Marvin 1989b

[27] https://search.worldcat.org/title/20411489

publication and its print version was publicly available no later than August 6, 1989, because that was the publication date listed by the U. S. Copyright Office. And electronically, it was also publicly disseminated no later than on August 6, 2002, when it was added to and available for download from *IEEE Xplore*. For these reasons, it is my opinion that Exhibit 1035 was published and publicly accessible on August 6, 1989, and no later than August 6, 2002. It was actually disseminated to others in the public no later than July 12, 2006, and in any event before December 22, 2014.

E. Ramappa, Deepak A., and Worth B. Henley. "Diffusion of Iron in Silicon Dioxide." *Journal of the Electrochemical Society*, vol. 146, no. 10 (1999): 3773-3777. ("Ramappa") [Exhibit 1025]

84. Attached hereto as Exhibit 1025 is a copy of the journal article titled "Diffusion of Iron in Silicon Dioxide" by Deepak A. Ramappa, and Worth B. Henley (hereafter "Ramappa"). The Ramappa article was published in Volume 146, Number 10 of the *Journal of the Electrochemical Society* and was found in the Kurt F. Wendt Engineering Library at the University of Wisconsin -- Madison. The Ramappa article appears beginning on page 3773 of this issue dated October 1999. Exhibit 1025 is a true and correct copy of the Ramappa article (pages 3773-3777). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Ramappa article is

also available from the publisher, IOP Publishing.[28] Exhibit 1025 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1025 is a true and correct copy in a condition that creates no suspicion about its authenticity.

85. Attached hereto as Attachment 5A is a true and correct copy of the MARC record for the *Journal of the Electrochemical Society* from the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 5A occurred on March 13, 2015, as shown in field 005 ("20150313"). I personally identified and retrieved the MARC record that is Attachment 5A.

86. Based on finding a copy of Exhibit 1025 in the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison and MARC record in its online library catalog attached as Attachment 5A, it is my opinion that the Ramappa article published in the *Journal of the Electrochemical Society* was publicly available on October 21, 1999, as shown by the library's stamp on the cover of Exhibit 1025. In common practice these stamps are applied at or around the time the volume is entered into the library's collection and the volume is made available to library patrons within a short time thereafter. Attachment 5A also

[28] https://iopscience.iop.org/article/10.1149/1.1392548

shows that Exhibit 1025 was catalogued with two descriptor terms reading "Electrochemistry $v Periodicals" (see Attachment 5B, Library of Congress subject heading sh2008119281) and "Electrochemistry $x Societies, etc." (see Attachment 5C, Library of Congress subject heading sh85042105 and Attachment 5D, Library of Congress subject heading sh85124175) in the 650 fields.

87. As noted in the holdings information (362 field, Attachment 5A), the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison has received the *Journal of the Electrochemical Society* from January 1948 and continues to receive the publication. In view of the MARC record for Exhibit 1025 and the stamped by the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison on the cover of this serial title, the Ramappa article was publicly available in print on October 21, 1999.

88. Attached hereto as Attachment 5E is a true and correct copy of the MARC record for the *Journal of the Electrochemical Society* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 5E, that library code is "NLM," which means that the MARC record for this serial was cataloged at the National Library of Medicine (Bethesda, Maryland). As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the National Library of Medicine created OCLC record number 1029376 on October 3, 1974, as

shown in field 008 ("741003"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 5E occurred on August 12, 2022, as shown in field 005 ("20220812"). I personally identified and retrieved the MARC record that is Attachment 5E. The "BLvl" entry in Attachment 5E is "s," which indicates that the *Journal of the Electrochemical Society* is a serial publication. Field 310 of Attachment 5E reads "14 times per year, $b 2014-." The publication was monthly during the time that the Ramappa article was published (see field 321). Accordingly, the MARC record for Exhibit 1025 corresponds to the *Journal of the Electrochemical Society* from the time the serial title adopted the current title and includes the date of the Ramappa article.

89. Attachment 5E includes an entry in field 050 ("TP250 $b .E542")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system), an entry in field 060 ("W1 JO92K"), a subject matter consistent with the National Library of Medicine classification system (analogous to the Dewey Decimal classification system), and an entry in field 082 ("541.3705"), a subject matter consistent with the Dewey Decimal classification system. Attachment 5E further includes six descriptor terms reading "Electrochemistry $v Periodicals" (see Attachment 5B, Library of Congress subject heading sh2008119281),

"Electrochemistry $x Societies, etc." (see Attachment 5C, Library of Congress subject heading sh85042105 and Attachment 5D, Library of Congress subject heading sh85124175), "Chemistry $v Periodicals" (see Attachment 5F, Library of Congress subject heading sh2008100340),"Electronics $v Periodicals" (see Attachment 5G, Library of Congress subject heading sh2008102897), "Chemistry" (see Attachment 5H, Library of Congress subject heading sh85022986), and Electronics" (see Attachment 5I, Library of Congress subject heading sh85042383) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 5E was indexed according to its subject matter by virtue of at least four independently sufficient classifications: the field 050 entry, the field 060 entry, the field 082 entry, and the field 650 entries. As of October 3, 1974, the MARC record attached hereto as Attachment 5E was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

90. WorldCat indicates that the *Journal of the Electrochemical Society* as cataloged at the National Library of Medicine is currently available from about 878

libraries.[29] This shows that the Ramppa publication was widely available. For example, the Ramappa publication has been cited in several publications by others, including, for example, by:

- Slaoui, A. et al., "Investigation of Barrier Layers on Ceramics for Silicon Thin Film Solar Cells." Conference Record of the Twenty-Ninth IEEE Photovoltaic Specialists Conference (pp. 90-93), conference date May 19-24, 2002, added to IEEE *Xplore* April 22, 2003, as seen from Exhibit 1056.

91. In view of the above, it is my opinion that Exhibit 1025 is an authentic excerpted copy of the issue of the *Journal of the Electrochemical Society* containing the Ramappa publication and was publicly available on October 21, 1999, because by that date it had been cataloged and indexed at the National Library of Medicine, made part of the OCLC bibliographic database, and received in the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison. And because the Ramappa publication was cited in the Slaoui "Investigation of Barrier Layers on Ceramics for Silicon Thin Film Solar Cells" publication available online on April 22, 2003 from *IEEE Xplore*, it was actually disseminated no later than that date. For these reasons, it is my opinion that Exhibit 1025 was published and accessible to the public on October 21, 1999, and

[29] https://search.worldcat.org/title/1029376

actually disseminated to others in the public no later than April 2003, and in any event before December 22, 2014.

F. Kiyota, Yukihiro, Tohru Nakamura, Kazuhiko Muraki, and Taroh Inada. "Phosphorus Direct Doping from Vapor Phase into Silicon for Shallow Junctions." *Journal of the Electrochemical Society*, vol. 141, no. 8 (August 1994): 2241-2244. ("Kiyota") [Exhibit 1041]

92. Attached hereto as Exhibit 1041 is a copy of the journal article titled "Phosphorus Direct Doping from Vapor Phase into Silicon for Shallow Junctions" by Yukihiro Kiyota, Tohru Nakamura, Kazuhiko Muraki, and Taroh Inada (hereafter "Kiyota"). The Kiyota article was published in Volume 141, Number 8 of the *Journal of the Electrochemical Society* and was found in the Kurt F. Wendt Engineering Library at the University of Wisconsin -- Madison. The Kiyota article appears beginning on page 2241 of this issue dated August 1994. Exhibit 1041 is a true and correct copy of the Kiyota article (pages 2241-2244). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Kiyota article is also available from the publisher, IOP Publishing.[30] Exhibit 1041 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1041 is a true and correct copy in a condition that creates no suspicion about its authenticity.

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[30] https://iopscience.iop.org/article/10.1149/1.2055096

93. Attached hereto as Attachment 6A is a true and correct copy of the MARC record for the *Journal of the Electrochemical Society* from the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 6A occurred on March 13, 2015, as shown in field 005 ("20150313"). I personally identified and retrieved the MARC record that is Attachment 6A.

94. Based on finding a copy of Exhibit 1041 in the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison and MARC record in its online library catalog attached as Attachment 6A, it is my opinion that the Kiyota article published in the *Journal of the Electrochemical Society* was publicly available on August 19, 1994, as shown by the library's stamp on the cover of Exhibit 1041. In common practice these stamps are applied at or around the time the volume is entered into the library's collection and the volume is made available to library patrons within a short time thereafter. Attachment 6A also shows that Exhibit 1041 was catalogued with two descriptor terms reading "Electrochemistry $v Periodicals" (see Attachment 5B, Library of Congress subject heading sh2008119281) and "Electrochemistry $x Societies, etc." (see Attachment 5C, Library of Congress subject heading sh85042105 and Attachment 5D, Library of Congress subject heading sh85124175) in the 650 fields.

95. As noted in the holdings information (362 field, Attachment 5A), the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison has received the *Journal of the Electrochemical Society* from January 1948 and continues to receive the publication. In view of the MARC record for Exhibit 1041, the Kiyota article was publicly available in print on August 19, 1994, because the serial title had been received, cataloged, and indexed in the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison and made part of its online catalog database.

96. Attached hereto as Attachment 6B is a true and correct copy of the MARC record for the *Journal of the Electrochemical Society* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 6B, that library code is "NLM," which means that the MARC record for this serial was cataloged at the National Library of Medicine (Bethesda, Maryland). As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the National Library of Medicine created OCLC record number 1029376 on October 3, 1974, as shown in field 008 ("741003"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 6B occurred on August 12, 2022, as shown in field 005 ("20220812"). I personally identified and retrieved the MARC record that is

Attachment 6B. The "BLvl" entry in Attachment 6B is "s," which indicates that the *Journal of the Electrochemical Society* is a serial publication. Field 310 of Attachment 6B reads "14 times per year, $b 2014-." The publication was monthly during the time that the Kiyota article was published (see field 321). Accordingly, the MARC record for Exhibit 1041 corresponds to the *Journal of the Electrochemical Society* from the time the serial title adopted the current title and includes the date of the Kiyota article.

97. Attachment 6B includes an entry in field 050 ("TP250 $b .E542")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system), an entry in field 060 ("W1 JO92K"), a subject matter consistent with the National Library of Medicine classification system (analogous to the Dewey Decimal classification system), and an entry in field 082 ("541.3705"), a subject matter consistent with the Dewey Decimal classification system. Attachment 6B further includes six descriptor terms reading "Electrochemistry $v Periodicals" (see Attachment 5B, Library of Congress subject heading sh2008119281), "Electrochemistry $x Societies, etc." (see Attachment 5C, Library of Congress subject heading sh85042105 and Attachment 5D, Library of Congress subject heading sh85124175), "Chemistry $v Periodicals" (see Attachment 5F, Library of Congress subject heading sh2008100340),"Electronics $v Periodicals" (see

Attachment 5G, Library of Congress subject heading sh2008102897), "Chemistry" (see Attachment 5H, Library of Congress subject heading sh85022986), and Electronics" (see Attachment 5I, Library of Congress subject heading sh85042383) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 6B was indexed according to its subject matter by virtue of at least four independently sufficient classifications: the field 050 entry, the field 060 entry, the field 082 entry, and the field 650 entries. As of October 3, 1974, the MARC record attached hereto as Attachment 6B was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

98. WorldCat indicates that the *Journal of the Electrochemical Society* as cataloged at the National Library of Medicine is currently available from over 850 libraries.[31] This shows that the Kiyota publication was widely available. For example, the Kiyota publication has been cited in publications by others, including, for example, by:

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[31] https://search.worldcat.org/title/1029376

- Kalkofen, Y. et al., "A Simple Two-Step Phosphorus Doping Process for Shallow Junctions By Applying a Controlled Adsorption and a Diffusion in an Oxidising Ambient." *Materials Science and Engineering: B* (vols. 114-115, pp. 362-366), available online September 2, 2004, as seen from Exhibit 1057, a print out of the webpage from the publisher Science Direct for this particular publication.

99. In view of the above, it is my opinion that Exhibit 1041 is an authentic excerpted copy of the issue of the *Journal of the Electrochemical Society* containing the Kiyota publication and was publicly available on August 19, 1994 or shortly thereafter, because by that date it had been cataloged and indexed at the National Library of Medicine, made part of the OCLC bibliographic database, and received in the Kurt F. Wendt Engineering Library at the University of Wisconsin – Madison. And because the Kiyota publication was cited in the Kalkofen "A Simple Two-Step Phosphorus Doping Process for Shallow Junctions By Applying a Controlled Adsorption and a Diffusion in an Oxidising Ambient" publicly available online on September 2, 2004, it was actually publicly disseminated no later than that date. For these reasons, it is my opinion that Exhibit 1041 was published and accessible to the public on or shortly thereafter August 19, 1994, and

actually disseminated to others in the public no later than September 2, 2004, and in any event before December 22, 2014.

G. Seibt, M., A. Sattler, C. Rudolf, O. Voß, V. Kveder, and W. Schröter. "Gettering in Silicon Photovoltaics: Current State and Future Perspectives." *Physica Status Solidi. A, Applications and materials science: PSS*, vol. 203, issue 4 (March 2006): 696–713. phys. stat. sol. (a), vol. 203, issue 4 (March 2006): 696–713. ("Seibt") [Exhibit 1016]

100. Attached hereto as Exhibit 1016 is a copy of the journal article titled "Gettering in Silicon Photovoltaics: Current State and Future Perspectives" by M. Seibt, A. Sattler, C. Rudolf, O. Voß, V. Kveder, and W. Schröter (hereafter "Seibt"). The Seibt article was published in Volume 203, Issue 4 of the journal *Physica Status Solidi. A, Applications and materials science: PSS* and was found in the Indiana University Libraries (Bloomington, Indiana). The Seibt article appears beginning on page 696 of this issue dated March 2006. Exhibit 1016 is a true and correct copy of the Seibt article (pages 696-713). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Seibt article is also available from the publisher, Wiley Online Library[32] and in the digital repository *ResearchGate*.[33] The Wiley Online Library

[32] https://onlinelibrary.wiley.com/doi/abs/10.1002/pssa.200664516

lists the date the Seibt article was first published as March 9, 2006 (Exhibit 1058). Exhibit 1016 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1016 is a true and correct copy in a condition that creates no suspicion about its authenticity.

101. Attached hereto as Attachment 7A is a true and correct copy of the MARC record for the journal *Physica Status Solidi. A, Applications and materials science: PSS* from the Indiana University Libraries online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 7A occurred on March 5, 2020, as shown in field 005 ("20200305"). I personally identified and retrieved the MARC record that is Attachment 7A.

102. Based on finding a copy of Exhibit 1016 in the Indiana University Libraries and MARC record in its online library catalog attached as Attachment 7A, it is my opinion that the Seibt article published in the journal *Physica Status Solidi. A, Applications and materials science: PSS* was publicly available on April 17, 2006, as shown by the library's stamp on the cover of Exhibit 1016. In common practice these stamps are applied at or around the time the volume is

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33 https://www.researchgate.net/publication/229927318_Gettering_in_silicon_photovoltaics_Current_state_and_future_perspectives

entered into the library's collection and the volume is made available to library patrons within a short time thereafter. Attachment 7A also shows that Exhibit 1016 was catalogued with two descriptor terms reading "Solid state physics $v Periodicals" (see Attachment 7B, Library of Congress subject heading sh2010114088) and "Solids $x Industrial applications $v Periodicals" (see Attachment 7C, Library of Congress subject heading sh85124647, Attachment 7D, Library of Congress subject heading sh87002395, and Attachment 7E, Library of Congress subject heading sh85099890) in the 650 fields.

103. As noted in the holdings information (362 field), the Indiana University Libraries has received the journal *Physica Status Solidi. A, Applications and materials science: PSS* from January 2005 and continues to receive the publication. In view of the MARC record for Exhibit 1016, the Seibt article was publicly available in print on April 17, 2006 or shortly thereafter, because the serial title had been received, cataloged, and indexed in the Indiana University Libraries and made part of its online catalog database.

104. Attached hereto as Attachment 7F is a true and correct copy of the MARC record for the journal *Physica Status Solidi. A, Applications and materials science: PSS* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 7F, that library code is "CLU," which means that the

MARC record for this serial was cataloged at the University of California – Los Angeles Libraries. As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the University of California – Los Angeles Libraries created OCLC record number 60421334 on May 22, 2005, as shown in field 008 ("050522"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 7F occurred on August 10, 2022, as shown in field 005 ("20220810"). I personally identified and retrieved the MARC record that is Attachment 7F. The "BLvl" entry in Attachment 7F is "s," which indicates that the journal *Physica Status Solidi. A, Applications and materials science: PSS* is a serial publication. Field 310 of Attachment 7F reads "Fifteen times a year." Accordingly, the MARC record for Exhibit 1016 corresponds to the journal *Physica Status Solidi. A, Applications and materials science: PSS* from the time the serial title adopted the current title and includes the date of the Seibt article.

105. Attachment 7F includes an entry in field 050 ("QC176.A1 $b P5")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system). Attachment 7F further includes two descriptor terms reading "Solid state physics $v Periodicals" (see Attachment 7B, Library of Congress subject heading sh2010114088) and "Solids $x Industrial applications $v

Periodicals" (see Attachment 7C, Library of Congress subject heading sh85124647, Attachment 7D, Library of Congress subject heading sh87002395, and Attachment 7E, Library of Congress subject heading sh85099890) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 7F was indexed according to its subject matter by virtue of at least two independently sufficient classifications: the field 050 entry and the field 650 entries. As of May 22, 2005, the MARC record attached hereto as Attachment 7F was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

106. WorldCat indicates that the journal *Physica Status Solidi. A, Applications and materials science: PSS* as cataloged at the University of California – Los Angeles Libraries is currently available from over 350 libraries.[34] This shows that the Seibt publication was widely available. For example, the Seibt publication has been cited in several publications by others, including, for example, by:

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[34] https://search.worldcat.org/title/60421334

- Haarahiltunen, A. et al., "As-Grown Iron Precipitates and Gettering in Multicrystalline Silicon." *Materials Science and Engineering* (vols 159-160, pp. 248-252), available online December 3, 2008, as seen from Exhibit 1059.
- Holt, A. et al., "Effect of Annealing of Multi Crystalline Edge Wafers and Cz Mono Crystalline Wafers Based on Metallurgical Silicon." *2008 33rd IEEE Photovoltaic Specialists Conference*, conference date May 11-16, 2008, available on IEEE *Xplore* May 12, 2009, as seen from Exhibit 1060.

107. In view of the above, it is my opinion that Exhibit 1016 is an authentic excerpted copy of the issue of the journal *Physica Status Solidi. A, Applications and materials science: PSS* containing the Seibt publication and was publicly available on April 17, 2006 or shortly thereafter, because by that date it had been cataloged and indexed at the University of California – Los Angeles Libraries, made part of the OCLC bibliographic database, and received in the Indiana University Libraries. Further, the Wiley Online Library states that the Seibt article was first published March 9, 2006. And because the Seibt publication was cited in the Haarahiltunen and Holt publications referenced above, it was actually disseminated to others in the public at least by December 2008. For these reasons, it is my opinion that Exhibit 1016 was published and accessible to the public on

April 17, 2006, and no later than December 2008, and in any event before December 22, 2014.

H. Ferré, Rafael, Isidro Martín, Roland Trassl, Ramon Alcubilla, and Rolf Brendel. "Simultaneous Gettering and Emitter Formation in Multicrystalline-Si Wafers by Annealing Phosphorus Doped Amorphous Silicon Compounds." *Applied Physics Letters*, vol. 98, no. 2 (10 January 2011): paper no. 022102 (4 pages) ("Ferré") [Exhibit 1018]

108. Attached hereto as Exhibit 1018 is a copy of the journal article titled "Simultaneous Gettering and Emitter Formation in Multicrystalline-Si Wafers by Annealing Phosphorus Doped Amorphous Silicon Compounds" by Rafael Ferré, Isidro Martín, Roland Trassl, Ramon Alcubilla, and Rolf Brendel (hereafter "Ferré"). The Ferré article was published in Volume 98, Number 2 of the journal *Applied Physics Letters* and was found in the Library of Congress. The Ferré article appears on page 02210 of this issue dated January 10, 2011. Exhibit 1018 is a true and correct copy of the Ferré article (4 pages). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Ferré article is also available from the publisher, AIP Publishing[35]

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[35] https://pubs.aip.org/aip/apl/article-abstract/98/2/022102/122556/Simultaneous-gettering-and-emitter-formation-in?redirectedFrom=PDF

and in the digital repository *Semantic Scholar*.[36] Semantic Scholar states that the Ferre article was published on January 10, 2011 (Exhibit 1061). Exhibit 1018 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1018 is a true and correct copy in a condition that creates no suspicion about its authenticity.

109. Attached hereto as Attachment 8A is a true and correct copy of the MARC record for the journal *Applied Physics Letters* from the Library of Congress online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 8A occurred on September 6, 2022, as shown in field 005 ("20220906"). I personally identified and retrieved the MARC record that is Attachment 8A.

110. Based on finding a copy of Exhibit 1018 in the Library of Congress and MARC record in its online library catalog attached as Attachment 8A, it is my opinion that the Ferré article published in the journal *Applied Physics Letters* was publicly available on January 24, 2011, as shown by the library's label on the cover of Exhibit 1018. In common practice these labels are applied at or around the

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[36] https://www.semanticscholar.org/paper/Simultaneous-gettering-and-emitter-formation-in-by-Ferre%CC%81-Mart%C3%ADn/1d060d97443c0ccad7bc812e7cc12b2c0afedbe1

time the volume is entered into the library's collection and the volume is made available to library patrons within a short time thereafter. Attachment 8A also shows that Exhibit 1018 was catalogued with a descriptor term reading "Physics $v Periodicals" (see Attachment 8B, Library of Congress subject heading sh2008109342) in the 650 field.

111. As noted in the holdings information (362 field), the Library of Congress has received the journal *Applied Physics Letters* since September 1962 and continues to receive the publication. In view of the MARC record for Exhibit 1018, the Ferré article was publicly available in print on January 24, 2011 or shortly thereafter, because the serial title had been received, cataloged, and indexed in the Library of Congress and made part of its online catalog database.

112. Attached hereto as Attachment 8C is a true and correct copy of the MARC record for the journal *Applied Physics Letters* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 8C, that library code is "DLC," which means that the MARC record for this serial was cataloged at the Library of Congress. As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the Library of Congress created OCLC record number 1580952 on August 29, 1975, as shown in field 008 ("750829"). The library community continues to update and enhance the MARC record to meet current

cataloging rules. The most recent enhancement to Attachment 8C occurred on September 12, 2022, as shown in field 005 ("20220912"). I personally identified and retrieved the MARC record that is Attachment 8C. The "BLvl" entry in Attachment 8C is "s," which indicates that the journal *Applied Physics Letters* is a serial publication. Field 310 of Attachment 8C reads "Weekly, $b 1986-." Accordingly, the MARC record for Exhibit 1018 corresponds to the journal *Applied Physics Letters* from the time the serial title began and includes the date of the Ferré article.

113. Attachment 8C includes an entry in field 050 ("QC1 $b .A74")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system) and an entry in field 082 ("530")—as described above, a subject matter classification number consistent with the Dewey Decimal classification system. Attachment 8C further includes a descriptor term reading "Physics $v Periodicals" (see Attachment 8B, Library of Congress subject heading sh2008109342) in the 650 field. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 8C was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entry. As of August 29, 1975, the MARC record attached hereto as Attachment 8C was accessible through any

library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date or afterwards through any library with access to the OCLC bibliographic database or through an individual library.

114. WorldCat indicates that the journal *Applied Physics Letters* as cataloged at the Library of Congress is currently available from over 1,000 libraries.[37] This shows that the Ferre publication was widely available. For example, the Ferre publication has been cited in several publications by others, including, for example, by:

- Paviet-Salomon, B. et al., "Investigation of Charges Carrier Density in Phosphorus and Boron Doped SiNx: H Layers for Crystalline Silicon Solar Cells." *Materials Science and Engineering: B* (vol. 178, pp. 580-585), available online December 8, 2012, as seen from Exhibit 1062.

115. In view of the above, it is my opinion that Exhibit 1018 is an authentic excerpted copy of the issue of the journal *Applied Physics Letters* containing the Ferre publication and was publicly available on January 24, 2011 or shortly thereafter, because by that date it had been received, cataloged, and indexed

[37] https://search.worldcat.org/title/1580952

at the Library of Congress and made part of the OCLC bibliographic database. Further, the Semantic Scholar webpage stated that the Ferre publication was published on January 10, 2011. And because the Ferre publication was cited in the Paviet-Salomon "Investigation of Charges Carrier Density in Phosphorus and Boron Doped SiNx: H Layers for Crystalline Silicon Solar Cells" publication available December 8, 2012, it was actually publicly disseminated no later than that date. For these reasons, it is my opinion that Exhibit 1018 was published and accessible to the public on January 24, 2011, and no later than December 8, 2012, and in any event before December 22, 2014.

I. Vähänissi, Ville, Antti Haarahiltunen, Marko Yli-Koski, and Hele Savin. "Gettering of Iron in Silicon Solar Cells with Implanted Emitters." *IEEE Journal of Photovoltaic*s, vol. 4, no. 1 (January 2014): 142-147. ("Vähänissi") [Exhibit 1019]

116. Attached hereto as Exhibit 1019 is a copy of the journal article titled "Gettering of Iron in Silicon Solar Cells with Implanted Emitter" by Ville Vähänissi, Antti Haarahiltunen, Marko Yli-Koski, and Hele Savin (hereafter "Vähänissi"). The Vähänissi article was published in Volume 4, Number 1 of the *IEEE Journal of Photovoltaic*s and was found in the Library of Congress. The Vähänissi article appears beginning on page 142 of this issue dated January 2014. Exhibit 1019 is a true and correct copy of the Vähänissi article (pages 142-147). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there

are no visible alterations to the document. The Vähänissi article is also available from the publisher, *IEEE Xplore* database[38] and in the digital repository *Semantic Scholar*.[39] The *IEEE Xplore* database indicates that the Vähänissi article was published on October 30, 2013. Exhibit 1019 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1019 is a true and correct copy in a condition that creates no suspicion about its authenticity.

117. Attached hereto as Attachment 9A is a true and correct copy of the MARC record for the *IEEE Journal of Photovoltaic*s from the Library of Congress online catalog. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 9A occurred on August 12, 2022, as shown in field 005 ("20220812"). I personally identified and retrieved the MARC record that is Attachment 9A.

118. Based on finding a copy of Exhibit 1019 in the Library of Congress and MARC record in its online library catalog attached as Attachment 9A, it is my opinion that the Vähänissi article published in the *IEEE Journal of Photovoltaic*s

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[38] https://ieeexplore.ieee.org/document/6650098

[39] https://www.semanticscholar.org/paper/Gettering-of-Iron-in-Silicon-Solar-Cells-With-Vahanissi-Haarahiltunen/6d4e42e4a8f519dc058bb20b1bb3b1aed1f07159

was publicly available on October 30, 2013, as indicated by publication date on the *IEEE Xplore* database. Attachment 9A also shows that Exhibit 1019 was catalogued with two descriptor terms reading "Photovoltaic power generation $v Periodicals" (see Attachment 9B, Library of Congress subject heading sh85101427 and Attachment 9E, Library of Congress subject heading sh85099890) and "Photovoltaic power systems $v Periodicals" (see Attachment 9C, Library of Congress subject heading sh93000144 and Attachment 7E, Library of Congress subject heading sh85099890) in the 650 fields.

119. As noted in the holdings information (362 field), the Library of Congress has received the *IEEE Journal of Photovoltaic*s since July 2011 and continues to receive the publication. In view of the MARC record for Exhibit 1019, the Vähänissi article was publicly available on October 30, 2013, because the serial title had been received, cataloged, and indexed in the Library of Congress and made part of its online catalog database.

120. Attached hereto as Attachment 9D is a true and correct copy of the MARC record for the *IEEE Journal of Photovoltaic*s obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 9D, that library code is "DLC," which means that the MARC record for this serial was cataloged at the Library of Congress. As can be seen in field 008 in the MARC record for this

exhibit, a cataloger at the Library of Congress created OCLC record number 646065012 on July 6, 2010, as shown in field 008 ("100706"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 9D occurred on August 10, 2022, as shown in field 005 ("20220810"). I personally identified and retrieved the MARC record that is Attachment 9D. The "BLvl" entry in Attachment 9D is "s," which indicates that the *IEEE Journal of Photovoltaic*s is a serial publication. Field 310 of Attachment 9D reads "Two issues per year." Accordingly, the MARC record for Exhibit 1019 corresponds to the *IEEE Journal of Photovoltaic*s from the time the serial title began and includes the date of the Vähänissi article.

121. Attachment 9D includes an entry in field 050 ("TK1087 $b .I335")—as described above, a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system) and an entry in field 082 ("621")—as described above, a subject matter classification number consistent with the Dewey Decimal classification system. Attachment 9D further includes two descriptor terms "Photovoltaic power generation $v Periodicals" (see Attachment 9B, Library of Congress subject heading sh85101427 and Attachment 7E, Library of Congress subject heading sh85099890) and "Photovoltaic power systems $v Periodicals"

(see Attachment 9C, Library of Congress subject heading sh93000144 and Attachment 7E, Library of Congress subject heading sh85099890) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 9D was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entries. As of July 6, 2010, the MARC record attached hereto as Attachment 9D was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

122. WorldCat indicates that the *IEEE Journal of Photovoltaic*s as cataloged at the Library of Congress is currently available from over 500 libraries.[40] This shows that the Vahanissi publication was widely available. For example, the Vahanissi publication has been cited in several publications by others, including, for example, by:

- Cho, E. et al., "Comparison of POCL3 Diffusion with Phosphorus Ion Implantation for Czochralski and Quasi-Mono Silicon Solar

[40] https://search.worldcat.org/title/646065012

Cells." *2014 IEEE 40th Photovoltaic Specialist Conference*, available online October 16, 2014, as seen from Exhibit 1063.

123. In view of the above, it is my opinion that Exhibit 1019 is an authentic excerpted copy of the issue of the *IEEE Journal of Photovoltaic*s containing the Vahanissi publication and was publicly available on October 30, 2013, because by that date it had been received, cataloged and that was the publication date listed on the *IEEE Explore* electronic database. And because the Vahanissi publication was cited in the Cho "Comparison of POCL3 Diffusion with Phosphorus Ion Implantation for Czochralski and Quasi-Mono Silicon Solar Cells" publication available October 16, 2014, it was actually disseminated to others in the public no later than that date. For these reasons, it is my opinion that Exhibit 1019 was published and accessible to the public on October 30, 2013, and no later than October 16, 2014, and in any event before December 22, 2014.

J. Buonassisi, T., A. A. Istratov, M. D. Pickett, J.-P. Rakotoniaina, O. Breitenstein, M. A. Marcus, S. M. Heald, and E. R. Weber. "Transition Metals in Photovoltaic-Grade Ingot-Cast Multicrystalline Silicon: Assessing the Role of Impurities in Silicon Nitride Crucible Lining Material." *Journal of Crystal Growth*, vol. 287, issue 2 (25 January 2006): 402–407. ("Buonassisi") [Exhibit 1021]

124. Attached hereto as Exhibit 1021 is a copy of the journal article titled "Transition Metals in Photovoltaic-Grade Ingot-Cast Multicrystalline Silicon: Assessing the Role of Impurities in Silicon Nitride Crucible Lining Material" by T.

Buonassisi, A. A. Istratov, M. D. Pickett, J.-P. Rakotoniaina, O. Breitenstein, M. A. Marcus, S. M. Heald, and E. R. Weber (hereafter "Buonassisi"). The Buonassisi article was published in Volume 287, Issue 2 of the *Journal of Crystal Growth* and was found in the Linda Hall Library of Science, Engineering & Technology (Kansas City, Missouri). The Buonassisi article appears beginning on page 402 of this issue dated January 25, 2006. Exhibit 1021 is a true and correct copy of the Buonassisi article (pages 402-407). Specifically, the text of the article is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. The Buonassisi article is also available from the digital repository *Semantic Scholar.*[41] The Semantic Scholar webpage states that the Buonassisi article was published in 2006. Exhibit 1021 was found within the custody of a library – a place where an authentic copy of this journal would likely be. Exhibit 1021 is a true and correct copy in a condition that creates no suspicion about its authenticity.

125. Attached hereto as Attachment 10A is a true and correct copy of the MARC record for the *Journal of Crystal Growth* from the Linda Hall Library of Science, Engineering & Technology online catalog. The library continues to

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[41] https://www.semanticscholar.org/paper/Transition-metals-in-photovoltaic-grade-ingot-cast-Buonassisia-Istratova/a635a6e36a5627ec6ea95f97ca687c9438ea4107

update this MARC record and enhanced the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 10A occurred on September 6, 2023, as shown in field 005 ("20230906"). I personally identified and retrieved the MARC record that is Attachment 10A.

126. Based on finding a copy of Exhibit 1021 in the Linda Hall Library of Science, Engineering & Technology and MARC record in its online library catalog attached as Attachment 10A, it is my opinion that the Buonassisi article published in the *Journal of Crystal Growth* was publicly available on February 7, 2006, as shown by the library's stamp on the cover of Exhibit 1021. In common practice these stamps are applied at or around the time the volume is entered into the library's collection and the volume is made available to library patrons within a short time thereafter.

127. As noted in the holdings information (362 field), the Linda Hall Library of Science, Engineering & Technology has received the *Journal of Crystal Growth* from January 1067 and continues to receive the publication. In view of the MARC record for Exhibit 1021, the Buonassisi article was publicly available in printby February 7, 2006, because the serial title had been received, cataloged, and indexed in the Linda Hall Library of Science, Engineering & Technology and made part of its online catalog database.

128. Attached hereto as Attachment 10B is a true and correct copy of the MARC record for the *Journal of Crystal Growth* obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 10B, that library code is "MUL," which means that the MARC record for this serial was cataloged ass part of the Minnesota Union List of Serials at the University of Minnesota Libraries (Minneapolis, Minnesota). As can be seen in field 008 in the MARC record for this exhibit, a cataloger at the University of Minnesota Libraries created OCLC record number 1604674 on September 7, 1975, as shown in field 008 ("750907"). The library community continues to update and enhance the MARC record to meet current cataloging rules. The most recent enhancement to Attachment 10B occurred on August 10, 2022, as shown in field 005 ("20220810"). I personally identified and retrieved the MARC record that is Attachment 10B. The "BLvl" entry in Attachment 10B is "s," which indicates that the *Journal of Crystal Growth* is a serial publication. Field 310 of Attachment 10B reads "Fifty-two no. a year, $b<2003->." Accordingly, the MARC record for Exhibit 1021 corresponds to the *Journal of Crystal Growth* from the time the serial title began and includes the date of the Buonassisi article.

129. Attachment 10B includes an entry in field 050 ("QD921 $b .J6")—as described above, a subject matter classification number consistent with the Library

of Congress classification system (analogous to the Dewey Decimal classification system). Attachment 10B further includes two descriptor terms reading "Crystal growth $v Periodicals" (see Attachment 10C, Library of Congress subject heading sh85034507 and Attachment 10E, Library of Congress subject heading sh85099890) and "Crystallography $v Periodicals" (see Attachment 10D, Library of Congress subject heading sh2009122624) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 10B was indexed according to its subject matter by virtue of at least two independently sufficient classifications: the field 050 entry and the field 650 entries. As of September 7, 1975, the MARC record attached hereto as Attachment 10B was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that subscribed to the serial, which means that the corresponding publication was publicly available on or before that same date and afterwards through any library with access to the OCLC bibliographic database or through an individual library.

130. WorldCat indicates that the *Journal of Crystal Growth* as cataloged at the University of Minnesota Libraries is currently available from 1,020 libraries.[42] This shows that the Buonassisi publication was widely available. For example, the

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[42] https://search.worldcat.org/title/1604674

Buonassisi publication has been cited in several publications by others, including, for example, by:

- Reimann, C. et al., "About the Formation and Avoidance of C and N Related Precipitates During Directional Solidification of Multi-Crystalline Silicon from Contaminated Feedstock." *Journal of Crystal Growth*, available online February 10, 2010, as seen from Exhibit 1064.
- Bentzen, A. et al., "Overview of Phosphorus Diffusion and Gettering in Multicrystalline Silicon." *Materials Science and Engineering*, available online December 9, 2008, as seen from Exhibit 1065.

131. In view of the above, it is my opinion that Exhibit 1021 is an authentic excerpted copy of the issue of the *Journal of Crystal Growth* containing the Buonassisi publication and was publicly available on February 7, 2006, because by that date it had been cataloged and indexed at the University of Minnesota Libraries, made part of the OCLC bibliographic database, and received in the Linda Hall Library of Science, Engineering & Technology. Further, the Semantic Scholar webpage states that the Buonassisi publication was published in 2006. And because the Buonassisi publication was cited in the Reimann and Bentzen publications available at least by December 9, 2008, it was actually disseminated

no later than that date. For these reasons, it is my opinion that Exhibit 1021 was published and accessible to the public on February 7, 2006, and no later than December 9, 2008, but in any event before December 22, 2014.

K. *Handbook of Photovoltaic Science and Engineering*, edited by Antonio Luque and Steven Hegedus. Hoboken, NJ: Wiley, c2003. ("Luque") [Exhibit 1010]

132. Attached hereto as Exhibit 1010 is a copy of excerpts from a book titled *Handbook of Photovoltaic Science and Engineering* edited by Antonio Luque and Steven Hegedus (hereafter "Luque") and issued by Wiley and Sons with a 2003 copyright date. Exhibit 1010 is a true and correct copy of excerpts from Luque that include the title page, copyright page, table of contents, pages 107-109 and Chapter 7, "Crystalline Silicon Solar Cells and Modules" by Ignacio Tobías, Carlos del Cañizo, and Jesús Alonso on pages 255-306. I obtained this excerpted copy from the Library of Congress. The text in the full version from which Exhibit 1010 is excerpted is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. Exhibit 1010 is a true and correct copy of excerpts of a book in a condition that creates no suspicion about its authenticity.

133. Attached hereto as Attachment 11A is a true and correct copy of the MARC record for this monograph from the Library of Congress online catalog. Library ownership is indicated by the presence of the library's code ("DLC") in the

049 field. The library continues to update and enhance this MARC record to meet current cataloging rules. The most recent enhancement to the MARC record occurred on April 5, 2014, as shown in field 005 ("20140405"). I personally identified and retrieved the library catalog record which is Attachment 11A.

134. For Attachment 11A, the library code "DLC" means that the MARC record for this book was created at the Library of Congress as part of the Cataloging in Publication (CIP) Program.[43] A cataloger prepares basic information about the forthcoming book which is included on the verso of the title page (also called the copyright page). The information is provided to save time needed for the cataloging process at the library after the book is purchased. The CIP data includes the author (field 100), title and subtitle (field 245), ISBN (field 022), suggested subject headings (field 650), classification numbers for the Library of Congress classification number (field 050), and the Dewey Decimal classification number (field 082). These data elements are included in the MARC record that the Library of Congress contributes to the OCLC bibliographic database. In field 955 of Attachment 11A, the MARC record for this exhibit, the text "2003-07-29 1 copy rec'd., to CIP ver." means a copy of the exhibit was received and sent to CIP at the Library of Congress for verification. Field 955 also states "2003-08-07 to BCCD, copy 1," which means a copy of the exhibit was sent to Bindings and Collections

[43] https://www.loc.gov/publish/cip/.

Care (BCCD) at the Library of Congress and was available for review by the public on that date or shortly thereafter.

135. Based on finding a print copy of the Luque book in the Library of Congress and MARC record in its online library catalog attached as Attachment 11A, it is my opinion that the book titled *Handbook of Photovoltaic Science and Engineering* was publicly available on August 7, 2003 or shortly after. The International Standard Book Number (ISBN) on Exhibit 1010 (0-471-49196-9) matches the ISBN in the first field 020 of Attachment 11A. Therefore, Exhibit 1010 contains excerpts of Luque, which are identical to the copy the cataloger at the Library of Congress used to create the MARC record that is Attachment 11A.

136. Attached hereto as Attachment 11B is a true and correct copy of the MARC record for the book *Handbook of Photovoltaic Science and Engineering* obtained from the OCLC bibliographic database. I personally identified and retrieved the MARC record that is Attachment 11B. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Attachment 11B, that library code is "DLC," which means that the MARC record for this book was created at the Library of Congress. As can be seen in the "Date Entered on File" field in the MARC record for this exhibit, a cataloger at the Library of Congress created OCLC record number 50912809 on October 25, 2002, as shown infield 008 ("021025"). This reflects the date the record was created

prior to the Library of Congress receiving a copy, which, as shown by Attachment 11A at field 955, occurred by July 29, 2003, with the copy sent to BCCD for availability on or shortly after August 7, 2003. The library continues to update and enhance this MARC record to meet current cataloging rules. The most recent enhancement to Attachment 11B occurred on February 2, 2024, as shown in field 005 ("20240202").

137. Attachment 11B further includes an entry in field 050 ("TK8322 $b .H33 2003")—as described above, this includes a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system) and an entry in field 082 ("621.31/244"), a subject matter consistent with the Dewey Decimal classification system. Attachment 11B further includes two descriptor terms reading "Photovoltaic cells $v Handbooks, manuals, etc." (see Attachment 11C, Library of Congress subject heading sh89006119 and Attachment 11D, Library of Congress genre heading gf2014026109) and "Photovoltaic power generation $v Handbooks, manuals, etc." (see Attachment 11E, Library of Congress subject heading sh2010106196 and Attachment 11D, Library of Congress genre heading gf2014026109) in the 650 fields. Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 11B was indexed according to its subject matter by virtue of at least three independently

sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entries. This means that the book was indexed and catalogued at the Library of Congress no later than October 25, 2002. Further, as of October 25, 2002, the MARC record attached hereto as Attachment 11B was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that added this book to its collection, which means that the corresponding publication was publicly available on or before that same date through any library with access to the OCLC bibliographic database or through an individual library.

138. WorldCat indicates that the Luque book as cataloged at the Library of Congress is currently available from 1,210 libraries.[44] This shows that the Luque book was widely available. For example, the Luque book has been cited in several publications by others, including, for example, by:

- Mutoh, N., et al., "A Controlling Method for Charging Photovoltaic Generation Power Obtained by a MPPT Control Method to Series Connected Ultraelectric Double Layer Capacitors." *Conference Record of the 2004 IEEE Industry Applications Conference, 2004. 39th IAS Annual Meeting* (available online November 1, 2004), as seen from Exhibit 1066.

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[44] https://search.worldcat.org/title/50912809

- Bello, M., et al., "Dynamics of a Solar-Powered Fractional Horse Power Motor." *2005 2nd International Conference on Electrical and Electronics Engineering* (available online November 14, 2005), as seen from Exhibit 1067.
- Stavrides, A., et al., "Chalcogen Incorporation in Cu(InGa)(SeS)/sub 2/Coevaporated Thin Films." *Conference Record of the Thirty-first IEEE Photovoltaic Specialists Conference* (available online August 8, 2005), as seen from Exhibit 1068.

139. In view of above, it is my opinion that Exhibit 1010 is an authentic excerpted copy of the Luque monograph, and the Luque monograph was publicly available on or shortly after August 7, 2003, because by that date it had been received, cataloged, and indexed at the Library of Congress, and sent to BCCD at the Library of Congress for public availability. And because the Luque monograph was cited in the Mutoh, Bello, and Stavrides publications available online as early as November 1, 2004, it was actually disseminated to others in the public no later than that date. For these reasons, it is my opinion that Exhibit 1010 was published and accessible to the public on or shortly after August 7, 2003, and no later than November 1, 2004, and in any event before December 22, 2014.

140. In signing this Report, I recognize that the Report will be filed as evidence in a case before the Patent Trial and Appeal Board of the United States

Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

141. I hereby declare that all statements made herein of my own knowledge are true 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.