

DECLARATION OF JUNE ANN MUNFORD

1. My name is June Ann Munford. I am over the age of 18, have personal knowledge of the facts set forth herein, and am competent to testify to the same.
2. I earned a Master of Library and Information Science (MLIS) from the University of Wisconsin-Milwaukee in 2009. I have over ten years of experience in the library/information science field. Beginning in 2004, I have served in various positions in the public library sector including Assistant Librarian, Youth Services Librarian and Library Director. I have attached my Curriculum Vitae as Appendix CV.
3. During my career in the library profession, I have been responsible for materials acquisition for multiple libraries. In that position, I have cataloged, purchased and processed incoming library works. That includes purchasing materials directly from vendors, recording publishing data from the material in question, creating detailed material records for library catalogs and physically preparing that material for circulation. In addition to my experience in acquisitions, I was also responsible for analyzing large collections of library materials, tailoring library records for optimal catalog

search performance and creating lending agreements between libraries during my time as a Library Director.

4. I am fully familiar with the catalog record creation process in the library sector. In preparing a material for public availability, a library catalog record describing that material would be created. These records are typically written in Machine Readable Catalog (herein referred to as “MARC”) code and contain information such as a physical description of the material, metadata from the material’s publisher, and date of library acquisition. In particular, the 008 field of the MARC record is reserved for denoting the date of creation of the library record itself. As this typically occurs during the process of preparing materials for public access, it is my experience that an item’s MARC record indicates the date of an item’s public availability.
5. Typically, in creating a MARC record, a librarian would gather various bits of metadata such as book title, publisher and subject headings among others and assign each value to a relevant numerical field. For example, a book’s physical description is tracked in field 300 while title/attribution is tracked in field 245. The 008 field of the MARC record is reserved for denoting the creation of the library record itself. As this is the only date reflecting the inclusion of said materials within the library’s collection, it is my experience

that an item's 008 field accurately indicates the date of an item's public availability.

6. I have reviewed Exhibit EX-1067, "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide" by Florian Werner, et al as published in Applied Physics Letters October 2010.
7. Attached hereto as Appendix WERNER01 is a true and correct copy of the MARC record for Applied Physics Letters as held by the Penn State University Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix WERNER01 accurately describes the title, publisher and ISSN number of Applied Physics Letters. The Showing Results field present on page 4 of this record indicates the library's collection includes the October 2010 issue of Applied Physics Letters containing "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide".
8. Attached hereto as Appendix WERNER02 is a true and correct copy of "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide" as published in

Applied Physics Letters as held by the Penn State University Library. These scans were secured from the library's collection. In comparing Exhibit EX-1067 to Appendix WERNER02, it is my determination that Exhibit EX-1067 is a true and correct copy of "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide" by Florian Werner, et al as published in Applied Physics Letters.

9. The 008 field of the MARC record in Appendix WERNER01 indicates the date of record creation. The 008 field of Appendix WERNER01 indicates the Penn State University Library first acquired Applied Physics Letters as of May 24, 1996 and held the journal in perpetuity until the publication of "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide". Considering this information, it is my determination that Applied Physics Letters October 2010 and therefore "Very low surface recombination velocities on p- and n-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide" was made available to the public shortly after its initial publication in October 2010.

10.I have been retained on behalf of the Petitioner to provide assistance in the above-illustrated matter in establishing the authenticity and public availability of the documents discussed in this declaration. I am being compensated for my services in this matter at the rate of \$200.00 per hour plus reasonable expenses. My statements are objective, and my compensation does not depend on the outcome of this matter.

11.I declare under penalty of perjury that the foregoing is true and correct. 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 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.

Dated: 4/11/2025

A handwritten signature in black ink, appearing to read 'June Ann Munford', written in a cursive style.

June Ann Munford



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588 a| Latest issue consulted: Vol. 17, issue 11 (Sept. 15, 1997).

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1077-3118

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LASERS, OPTICS, AND OPTOELECTRONICS

Dual band terahertz waveguiding on a planar metal surface patterned with annular holes ✓

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Low voltage and high transmittance blue-phase liquid crystal displays with corrugated electrodes ✓

Meizi Jiao; Yan Li; Shin-Tson Wu

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Monte Carlo study of carrier-light coupling in terahertz quantum cascade lasers ✓

Christian Jirauschek

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Hybrid mode-locking in a 40 GHz monolithic quantum dot laser ✓

G. Fiol; D. Arsenijević; D. Bimberg; A. G. Vladimirov; M. Wolfrum; E. A. Viktorov; Paul Mandel

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Epitaxial growth of one-dimensional GaN nanostructures with enhanced near-band edge emission by chemical vapor deposition ✓

Taeseup Song; Won Il Park; Ungyu Paik

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Electric field induced biaxiality and the electro-optic effect in a bent-core nematic liquid crystal ✓

Mamatha Nagaraj; Y. P. Panarin; U. Manna; J. K. Vij; C. Keith; C. Tschierske

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Electrically driven quantum dot-micropillar single photon source with 34% overall efficiency ✓

T. Heindel; C. Schneider; M. Lerner; S. H. Kwon; T. Braun; S. Reitzenstein; S. Höfling; M. Kamp; A. Forchel

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Optical resonances created by photonic transitions

Zongfu Yu; Shanhui Fan

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Ultrafast gated imaging of laser produced plasmas using the optical Kerr effect

D. R. Symes; U. Wegner; H.-C. Ahlswede; M. J. V. Streeter; P. L. Gallegos; E. J. Divall; R. A. Smith; P. P. Rajeev; D. Neely

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STRUCTURAL, MECHANICAL, THERMODYNAMIC, AND OPTICAL PROPERTIES OF CONDENSED MATTER

Time-resolved photoluminescence spectroscopy of an InGaAs/GaAs quantum well-quantum dots tunnel injection structure

M. Syperek; P. Leszczyński; J. Misiewicz; E. M. Pavelescu; C. Gilfert; J. P. Reithmaier

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Influence of density on N—H bond stretch vibration in plasma enhanced chemical vapor deposited SiN_x: H

H. F. W. Dekkers; Nagendra Babu Srinivasan; G. Pourtois

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Effect of thermal annealing on the blueshift of energy gap and nitrogen rearrangement in GaAsSbN

[Yan-Ting Lin](#); [Ta-Chun Ma](#); [Hao-Hsiung Lin](#); [Jiun-De Wu](#); [Ying-Sheng Huang](#)

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Micro-Raman spectroscopy of Si nanowires: Influence of diameter and temperature

[A. Torres](#); [A. Martín-Martín](#); [O. Martínez](#); [A. C. Prieto](#); [V. Hortelano](#); [J. Jiménez](#); [A. Rodríguez](#); [J. Sangrador](#); [T. Rodríguez](#)

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Characteristic length scales governing plasticity/brittleness of bulk metallic glasses at ambient temperature

[Y. Yang](#); [J. C. Ye](#); [J. Lu](#); [P. K. Liaw](#); [C. T. Liu](#)

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[X. Liu](#); [S. MacNaughton](#); [D. B. Shrekenhamer](#); [H. Tao](#); [S. Selvarasah](#); [A. Totachawattana](#); [R. D. Averitt](#); [M. R. Dokmeci](#); [S. Sonkusale](#); [W. J. Padilla](#)

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Effects of subconduction band excitations on thermal conductance at metal-metal interfaces

[Patrick E. Hopkins](#); [Thomas E. Beechem](#); [John C. Duda](#); [Justin L. Smoyer](#); [Pamela M. Norris](#)

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ELECTRONIC TRANSPORT AND SEMICONDUCTORS

Graded composition and valence states in self-forming barrier layers at Cu–Mn/SiO₂ interface 

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A polarity-controllable graphene inverter 

[Naoki Harada](#) (原田直樹); [Katsunori Yagi](#) (八木克典); [Shintaro Sato](#) (佐藤信太郎); [Naoki Yokoyama](#) (横山直樹)

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Unipolar resistive switching effect in YMn_{1- δ} O₃ thin films 

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Blinking suppression of single quantum dots in agarose gel 

[H. C. Ko](#); [C. T. Yuan](#); [S. H. Lin](#); [Jau Tang](#)

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Metal-organic chemical vapor deposition of high-dielectric-constant praseodymium oxide films using a cyclopentadienyl precursor ✓

Hiroki Kondo; Shinnya Sakurai; Mitsuo Sakashita; Akira Sakai; Masaki Ogawa; Shigeaki Zaima

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Influence of heavy doping on Seebeck coefficient in silicon-on-insulator ✓

H. Ikeda; F. Salleh

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Fabrication and characterization of metal-insulator-semiconductor structures by direct nitridation of InP surfaces ✓

T. Haimoto; T. Hoshii; S. Nakagawa; M. Takenaka; S. Takagi

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MAGNETISM AND SUPERCONDUCTIVITY

Efficient spin injection into semiconductor from an Fe/GaO_x tunnel injector ✓

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Dependence of magnetic susceptibility on stress in textured polycrystalline $\text{Fe}_{81.6}\text{Ga}_{18.4}$ and $\text{Fe}_{79.1}\text{Ga}_{20.9}$ Galfenol alloys ✓

A. Mahadevan; P. G. Evans; M. J. Dapino

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Adjust the resonance frequency of $(\text{Co}_{90}\text{Nb}_{10}/\text{Ta})_n$ multilayers from 1.4 to 6.5 GHz by controlling the thickness of Ta interlayers ✓

Guozhi Chai (柴国志); Yuancai Yang (阳远才); Jingyi Zhu (朱静怡); Min Lin (林敏); Wenbo Sui (隋文波); Dangwei Guo (郭党委); Xiling Li (李喜玲); Desheng Xue (薛德胜)

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Tiejun Zhou; S. H. Leong; Z. M. Yuan; S. B. Hu; C. L. Ong; B. Liu

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[X. L. Wang](#); [H. Y. Shi](#); [X. W. Yan](#); [Y. C. Yuan](#); [Z.-Y. Lu](#); [X. Q. Wang](#); [T.-S. Zhao](#)

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Ferromagnetic ordering of silicon vacancies in N-doped silicon carbide

[Mingwen Zhao](#); [Fengchun Pan](#); [Liangmo Mei](#)

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DIELECTRICS AND FERROELECTRICITY

Twinning rotation and ferroelectric behavior of epitaxial BiFeO_3 (001) thin film

[Huajun Liu](#); [Ping Yang](#); [Kui Yao](#); [John Wang](#)

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[A. Dimoulas](#); [D. Tsoutsou](#); [Y. Panayiotatos](#); [A. Sotiropoulos](#); [G. Mavrou](#); [S. F. Galata](#); [E. Golias](#)

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Temperature induced change in the hysteretic behavior of the capacitance-voltage characteristics of Pt–ZnO–Pb (Zr_{0.2}Ti_{0.8})O₃–Pt heterostructures ✓

L. Pintilie; C. Dragoi; R. Radu; A. Costinoia; V. Stancu; I. Pintilie

Appl. Phys. Lett. 96, 012903 (2010) <https://doi.org/10.1063/1.3284659>

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Structure and electrical properties of Bi_{3.15}Nd_{0.85}Ti₃O₁₂ nanofibers synthesized by electrospinning and sol-gel method ✓

M. Liao; X. L. Zhong; J. B. Wang; S. H. Xie; Y. C. Zhou

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Systematic variations in structural and electronic properties of BiFeO₃ by A-site substitution ✓

Zhen Zhang; Ping Wu; Lang Chen; Junling Wang

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Border traps in Al₂O₃/In_{0.53}Ga_{0.47}As (100) gate stacks and their passivation by hydrogen anneals ✓

Eun Ji Kim; Lingquan Wang; Peter M. Asbeck; Krishna C. Saraswat; Paul C. McIntyre

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A complete set of material properties of single domain $0.26\text{Pb}(\text{In}_{1/2}\text{Nb}_{1/2})\text{O}_3$ – $0.46\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ – 0.28PbTiO_3 single crystals ✓

Xiaozhou Liu; Shujun Zhang; Jun Luo; Thomas R. Shrout; Wenwu Cao

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Nanoscale domain growth dynamics of ferroelectric poly(vinylidene fluoride-*co*-trifluoroethylene) thin films ✓

Yunseok Kim; Wooyoung Kim; Hyunwoo Choi; Seungbum Hong; Hyungsoo Ko; Heechul Lee; Kwangsoo No

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Oxygen concentration and its effect on the leakage current in BiFeO_3 thin films ✓

H. Yang; Y. Q. Wang; H. Wang; Q. X. Jia

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Improved ferroelectric properties of $\text{Pb}(\text{Zr}_{0.52}\text{Ti}_{0.48})\text{O}_3$ thin film on single crystal diamond using CaF_2 layer ✓

Meiyong Liao; Kiyomi Nakajima; Masataka Imura; Yasuo Koide

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NANOSCALE SCIENCE AND DESIGN

Assembly of gold nanoparticles of different diameters between nanogap electrodes ✓

Donguk Cheon; Sanjeev Kumar; Gil-Ho Kim

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Exchange bias in large three dimensional iron oxide nanocomposites

[J. R. Morales](#); [S. Tanju](#); [W. P. Beyermann](#); [J. E. Garay](#)

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Very low surface recombination velocities on *p*- and *n*-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide ✓

Florian Werner; Boris Veith; Veronica Tiba; Paul Poodt; Fred Roozeboom; Rolf Brendel; Jan Schmidt



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Very low surface recombination velocities on *p*- and *n*-type c-Si by ultrafast spatial atomic layer deposition of aluminum oxide

Florian Werner,^{1,a)} Boris Veith,¹ Veronica Tiba,² Paul Poedt,³ Fred Roozeboom,^{3,4}
Rolf Brendel,¹ and Jan Schmidt¹

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Using aluminum oxide (Al_2O_3) films deposited by high-rate spatial atomic layer deposition (ALD), we achieve very low surface recombination velocities of 6.5 cm/s on *p*-type and 8.1 cm/s on *n*-type crystalline silicon wafers. Using spatially separated reaction zones instead of the conventional time-sequenced precursor dosing enables growth rates up to 70 nm/min, whereas conventional ALD limits the growth rate to <2 nm/min. The excellent passivation level is predominantly assigned to a high negative fixed charge density of $Q_f = -(4 \pm 1) \times 10^{12} \text{ cm}^{-2}$ in the Al_2O_3 films. We demonstrate an excellent thermal stability of the passivation quality. © 2010 American Institute of Physics. [doi:10.1063/1.3505311]

Amorphous aluminum oxide (Al_2O_3) films have been demonstrated to provide an excellent level of surface passivation on lightly doped *n*- and *p*-type as well as highly doped *p*⁺-type silicon surfaces due to a high *negative* fixed charge density Q_f in the range of $-(10^{12} - 10^{13}) \text{ cm}^{-2}$ in combination with a moderate interface state density D_{it} of $(10^{10} - 10^{12}) \text{ eV}^{-1} \text{ cm}^{-2}$ (Ref. 1 and references therein). Various deposition techniques, such as plasma-assisted and thermal atomic layer deposition (ALD),²⁻⁵ plasma-enhanced chemical vapor deposition (PECVD),⁶ and rf-sputtering,⁷ have been employed. So far the best passivation quality was obtained using ALD, where both plasma-assisted and thermal ALD led to surface recombination velocities $<10 \text{ cm/s}$.⁸

The ALD process is divided in two self-limiting half-reactions, leading to a saturation of the growth surface by exactly one monolayer of precursor molecules during each half-reaction. A controlled monolayer-by-monolayer deposition over large areas is achieved, leading to highly conformal coatings with very low pinhole densities.³ Trimethylaluminum [TMA , $\text{Al}_2(\text{CH}_3)_3$] is commonly used as precursor gas for aluminum. Either O_2 activated by a remote plasma (plasma-assisted ALD) or water vapor at elevated temperatures (thermal ALD) is used to oxidize the TMA for growth of an amorphous Al_2O_3 layer. In a conventional ALD process, the separation of the half-reactions is implemented by alternate dosing of the process gases. Exposure times of only a few milliseconds are sufficient to ensure complete saturation of the growth surface. In between both precursor doses, however, the reactor chamber is purged by an inert gas and subsequently pumped to remove the residual process gas and reaction products. To prevent parasitic CVD processes and ensure a true ALD process, pumping times of the order of a few seconds are required, which severely limits the growth rate to approximately 2 nm/min and makes conventional ALD unsuitable for high-throughput industrial manufacturing of, e.g., silicon solar cells.

In this work, we investigate the surface passivation quality and thermal stability of aluminum oxide layers deposited by fast-rate spatially separated ALD,⁹ allowing a deposition rate of 70 nm/min. In contrast to the conventional sequential separation, both half-reactions are *spatially* separated, thus eliminating the need for intermediate pumping steps. In a proof-of-principle tool the spatial separation is achieved by rotating the wafer underneath a round reactor head incorporating gas inlets for TMA and water vapor, separated by gas bearing curtains formed by a flow of pressurized nitrogen. Since both reaction zones are sealed off by nitrogen flow, any unintentional interaction of the process gases is prevented and the deposition can be performed under atmospheric conditions. In this concept, one rotation of the wafer constitutes one full ALD cycle. Figure 1 shows the thickness of an Al_2O_3 film as a function of the number of reactor head rotations. The film thickness scales linearly with the number of rotations, corroborating an ALD process at a growth per cycle of 0.12 nm/cycle. In the rotating proof-of-principle tool the Al_2O_3 film is deposited in a 3 cm wide ring-shaped track. So far, the concept has been tested up to a rotation speed of 600 rpm, corresponding to a deposition rate of 70 nm/min, constituting a significant improvement over deposition rates of <2 nm/min achieved in conventional ALD reactors. The experimental setup and deposition process have been described in more detail elsewhere.⁹

Characterization of the Al_2O_3 layers was performed on both *p*- and *n*-type 6-in. float-zone silicon (FZ-Si) wafers. The *p*-type samples were boron-doped $1.3 \Omega \text{ cm}$ shiny-etched silicon wafers of 300 μm thickness. The *n*-type samples were phosphorus-doped $1.0 \Omega \text{ cm}$ wafers, which had been etched in an aqueous potassium hydroxide (KOH) solution for 10 min to remove the saw damage, resulting in a thickness of 210 μm . To obtain symmetric test samples, each wafer was deposited on both sides by spatial ALD at a deposition rate of 14.4 nm/min. After deposition the wafers were laser-cut in $4 \times 4 \text{ cm}^2$ pieces, each containing a sufficient proportion of the 3 cm wide ring-shaped track of Al_2O_3 . The effective carrier lifetimes τ_{eff} were measured as a

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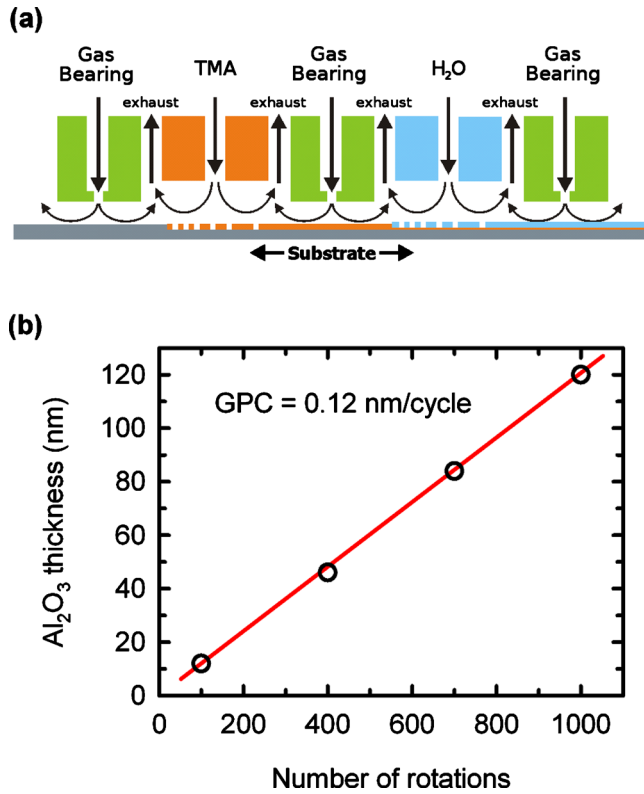


FIG. 1. (Color online) (a) Schematic drawing of the spatial ALD reactor concept, where the TMA and water half-reaction zones are separated by gas bearings. By moving the substrate underneath the reactor, the two half-reactions proceed alternately, forming an Al₂O₃ monolayer. (b) Al₂O₃ film thickness as a function of the number of reactor head rotations, showing a linear increase at a growth per cycle of 0.12 nm/cycle.

function of injection density Δn using a Sinton Instruments WCT-120 lifetime tester in the transient mode. The maximum effective surface recombination velocity (SRV) $S_{\text{eff,max}}$ is calculated from τ_{eff} using the following equation:¹⁰

$$S_{\text{eff,max}} = \frac{W}{2\tau_{\text{eff}}}, \quad (1)$$

where W is the wafer thickness. The bulk lifetime was assumed to be infinite. Accordingly, the calculated $S_{\text{eff,max}}$ value marks an upper limit to the effective SRV.

The as-deposited Al₂O₃ layers already showed a moderate level of surface passivation on p - and n -type c-Si, yielding effective lifetimes τ_{eff} ranging from 20 to 150 μs , similar to what has been observed for conventional thermal ALD.^{5,8} To study the full potential for surface passivation and the thermal stability of the Al₂O₃ layers deposited in this study, we exposed the samples to a postdeposition anneal in nitrogen atmosphere, with temperatures ranging from 300 to 425 °C. Figure 2 shows the measured effective lifetime τ_{eff} at an injection level of $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$ as a function of the applied thermal treatment. A “mild” anneal for 15 min at 350 °C was found to yield optimal results on the p -type as well as on the n -type silicon wafers. Figure 3 shows the injection-dependent effective lifetimes measured on p - and n -type c-Si wafers, respectively. The maximum achieved lifetimes at $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$ were $\tau_{\text{eff}} = 2.3 \text{ ms}$ for the p -type and $\tau_{\text{eff}} = 1.3 \text{ ms}$ for the n -type wafers, corresponding to $S_{\text{eff,max}}$ values of 6.5 cm/s and 8.1 cm/s, respectively. The measured effective lifetimes show virtually no injection level

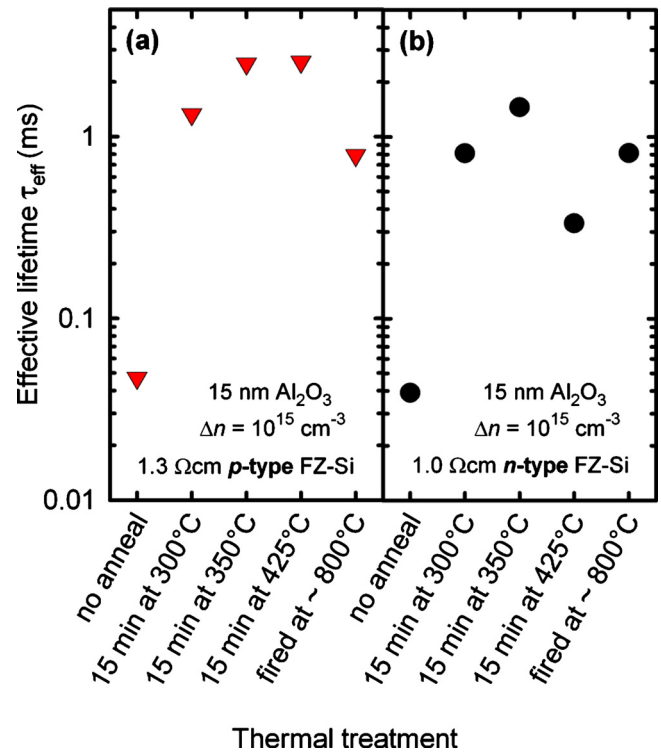


FIG. 2. (Color online) Effective lifetimes at an injection level $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$ measured after different thermal treatments on p - (a) and n -type (b) FZ-Si samples for an Al₂O₃ layer thickness of 15 nm. During the firing step the wafers are kept above 600 °C for $\sim 6 \text{ s}$. A “mild” anneal for 15 min at 350 °C yields optimal results.

dependence in the injection range from 10^{13} to 10^{15} cm^{-3} , which is significant for 1 sun operation of typical solar cells. As can be seen from Fig. 2, a good level of surface passivation is also achieved if the postdeposition anneal is replaced by a firing step. The Al₂O₃ layers were fired in an industrial conveyor belt furnace (Centrotherm Contact Firing Furnace DO 8.600-300-FF), as used in the production of solar cells, at a belt speed of 5.9 m/min and a set peak temperature of 920 °C, corresponding to an actual peak temperature of about 800 °C and a dwell time of $\sim 6 \text{ s}$ above 600 °C. The

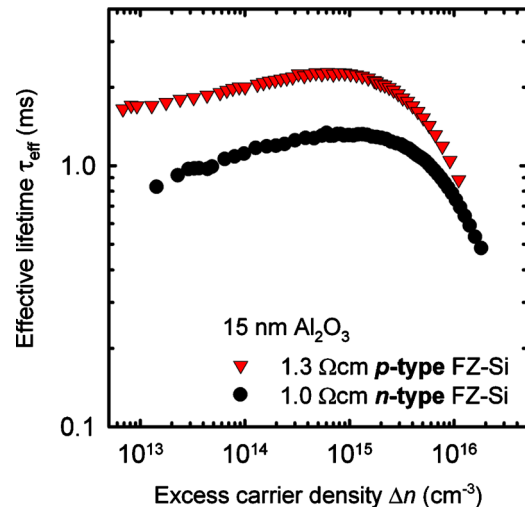


FIG. 3. (Color online) Injection-level dependent effective lifetimes τ_{eff} measured on 1.3 Ωcm p -type and 1.0 Ωcm n -type silicon samples passivated by spatial ALD. The samples were annealed for 15 min at 350 °C, the Al₂O₃ layer thickness is 15 nm.

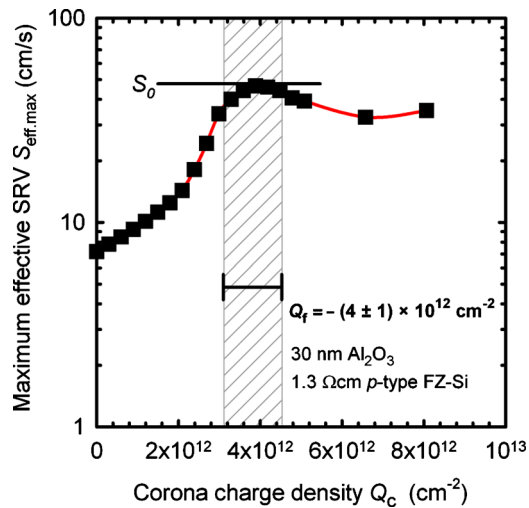


FIG. 4. (Color online) Maximum SRV $S_{\text{eff,max}}$ as a function of deposited positive Corona charge density Q_c for a 30 nm Al_2O_3 film on p -Si, measured at an injection density of $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$. A high negative fixed charge density $Q_f = -(4 \pm 1) \times 10^{12} \text{ cm}^{-2}$ and a SRV parameter of $S_0 = 47 \text{ cm/s}$ are deduced. The line is a guide to the eye.

achieved lifetimes at $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$ after firing were $\tau_{\text{eff}} = 790 \text{ } \mu\text{s}$ for the p -type and $\tau_{\text{eff}} = 815 \text{ } \mu\text{s}$ for the n -type wafers, corresponding to $S_{\text{eff,max}}$ values of 19.0 cm/s and 12.9 cm/s, respectively.

The very low surface recombination velocities routinely obtained on p - and n -type c-Si using laboratory-type ALD reactors are predominantly attributed to a strong field effect passivation³ caused by a high negative fixed charge density in the Al_2O_3 film, located close to the interface. The fixed oxide charge density Q_f in our Al_2O_3 layers deposited by spatial ALD was extracted from Corona charge measurements.¹¹ Figure 4 shows the measured $S_{\text{eff,max}}$ as a function of the applied positive Corona charge density Q_c . A peak in the effective SRV occurs for flat band conditions, where Q_f in the Al_2O_3 layer is compensated by the deposited Q_c . We extract a high negative fixed charge density of $Q_f = -(4 \pm 1) \times 10^{12} \text{ cm}^{-2}$, which is comparable to Q_f values measured in Al_2O_3 layers deposited by conventional thermal

ALD.¹ The excellent field effect passivation is accompanied by a good interface quality leading to a SRV parameter of $S_0 = 47 \text{ cm/s}$ at $\Delta n = 1 \times 10^{15} \text{ cm}^{-3}$, as determined from the $S_{\text{eff,max}}$ peak in Fig. 4.

In conclusion, aluminum oxide layers were deposited by spatial ALD on low-resistivity ($1.3 \text{ } \Omega \text{ cm}$ and $1.0 \text{ } \Omega \text{ cm}$, respectively) p - and n -type FZ-Si wafers. Effective surface recombination velocities of 6.5 cm/s were measured on p -type c-Si and 8.1 cm/s on n -type c-Si. The outstanding passivation performance was predominantly assigned to a high negative fixed charge density of $Q_f = -(4 \pm 1) \times 10^{12} \text{ cm}^{-2}$, as deduced from Corona charge experiments. The excellent firing stability and the weak injection dependence of the passivation quality makes the studied Al_2O_3 layers deposited by fast-rate spatial ALD well suited for future generations of industrial high-efficiency silicon solar cells.

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⁹P. Poedt, A. Lankhorst, F. Roozeboom, K. Spee, D. Maas, and A. Vermeer, *Adv. Mater. (Weinheim, Ger.)* **22**, 3564 (2010).

¹⁰A. B. Sproul, *J. Appl. Phys.* **76**, 2851 (1994).

¹¹S. Dauwe, J. Schmidt, A. Metz, and R. Hezel, *Proceedings of the 29th IEEE Photovoltaic Specialists Conference*, New Orleans, LA (IEEE, New York, 2002), p. 162.

June A. Munford
Curriculum Vitae

Education

University of Wisconsin-Milwaukee - MS, Library & Information Science, 2009
Milwaukee, WI

- Coursework included cataloging, metadata, data analysis, library systems, management strategies and collection development.
- Specialized in library advocacy, cataloging and public administration.

Grand Valley State University - BA, English Language & Literature, 2008
Allendale, MI

- Coursework included linguistics, documentation and literary analysis.
- Minor in political science with a focus in local-level economics and government.

Professional Experience

Researcher / Expert Witness, October 2017 – present
Freelance ● Pittsburgh, Pennsylvania & Grand Rapids, Michigan

- Material authentication and public accessibility determination. Declarations of authenticity and/or public accessibility provided upon research completion. Experienced with appeals and deposition process.
- Research provided on topics of public library operations, material publication history, digital database services and legacy web resources.
- Past clients include Alston & Bird, Arnold & Porter, Baker Botts, Fish & Richardson, Erise IP, Irell & Manella, O'Melveny & Myers, Perkins-Coie, Pillsbury Winthrop Shaw Pittman and Slayden Grubert Beard.

Library Director, February 2013 - March 2015
Dowagiac District Library ● Dowagiac, Michigan

- Executive administrator of the Dowagiac District Library. Located in Southwest Michigan, this library has a service area of 13,000, an annual operating budget of over \$400,000 and total assets of approximately \$1,300,000.

- Developed careful budgeting guidelines to produce a 15% surplus during the 2013-2014 & 2014-2015 fiscal years while being audited.
- Using this budget surplus, oversaw significant library investments including the purchase of property for a future building site, demolition of existing buildings and building renovation projects on the current facility.
- Led the organization and digitization of the library's archival records.
- Served as the public representative for the library, developing business relationships with local school, museum and tribal government entities.
- Developed an objective-based analysis system for measuring library services - including a full collection analysis of the library's 50,000+ circulating items and their records.

November 2010 - January 2013

Librarian & Branch Manager, Anchorage Public Library ● Anchorage, Alaska

- Headed the 2013 Anchorage Reads community reading campaign including event planning, staging public performances and creating marketing materials for mass distribution.
- Co-led the social media department of the library's marketing team, drafting social media guidelines, creating original content and instituting long-term planning via content calendars.
- Developed business relationships with The Boys & Girls Club, Anchorage School District and the US Army to establish summer reading programs for children.

June 2004 - September 2005, September 2006 - October 2013

Library Assistant, Hart Area Public Library

Hart, MI

- Responsible for verifying imported MARC records and original MARC cataloging for the local-level collection as well as the Michigan Electronic Library.
- Handled OCLC Worldcat interlibrary loan requests & fulfillment via ongoing communication with lending libraries.

Professional Involvement

Alaska Library Association - Anchorage Chapter

- Treasurer, 2012

Library Of Michigan

- Level VII Certification, 2008
- Level II Certification, 2013

Michigan Library Association Annual Conference 2014

- New Directors Conference Panel Member

Southwest Michigan Library Cooperative

- Represented the Dowagiac District Library, 2013-2015

Professional Development

Library Of Michigan Beginning Workshop, May 2008

Petoskey, MI

- Received training in cataloging, local history, collection management, children's literacy and reference service.

Public Library Association Intensive Library Management Training, October 2011

Nashville, TN

- Attended a five-day workshop focused on strategic planning, staff management, statistical analysis, collections and cataloging theory.

Alaska Library Association Annual Conference 2012 - Fairbanks, February 2012

Fairbanks, AK

- Attended seminars on EBSCO advanced search methods, budgeting, cataloging, database usage and marketing.

Depositions

2019 • Fish & Richardson

Apple v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282 and 39521-00421IP2)

2019 • Erise IP

Implicit, LLC v. Netscout Systems, Inc (Case No. 2:18-cv-53-JRG)

2019 • Perkins-Coie

Adobe Inc. v. RAH Color Technologies LLC (Case No. IPR2019-00627, IPR2019-00628, IPR2019-00629 and IPR2019-00646)

2020 ● O'Melveny & Myers

Maxell, Ltd. v. Apple Inc. (Case No. 5:19-cv-00036-RWS)

2021 ● Pillsbury Winthrop Shaw Pittman LLP

Intel v. SRC (Case No. IPR2020-1449)

2022 ● Perkins-Coie

Realtek v. Future Link (Case No. IPR2021-01182)

2023 ● Fish & Richardson

Neuroderm Ltd. v. Abbvie, Inc (Case No. PGR2022-00040)

2023 ● Fish & Richardson

Nearmap US Inc. v. Pictometry International Corp. (Case No. IPR2022-00735)

2023 ● Fish & Richardson

Samsung Electronics v. MemoryWeb LLC (Case No. 39843-0136PS1)

2023 ● Pillsbury Winthrop Shaw Whitman LLP

Gravel Rating Systems v. Costco Wholesale Corp. (Case No. 4:21-cv-149-ALM)

2024 ● Willkie-Farr

Netflix, Inc. v. VideoLabs. Inc. (Case No. IPR2023-00628)

2024 ● Quinn Emanuel Urquhart & Sullivan

Purdue University v. Wolfsped (Case No. 1:21-CV-840)

2024 ● Fish & Richardson

Dish Network v. Entropic Communications (Case No. IPR2024-00393)

2025 ● Perkins Coie

Amazon.com, Inc. v. Nokia Technologies Oy (Case No. IPR2024-00572)

2025 ● Fish & Richardson

Dish Network v. Entropic Communications (Case No. IPR2024-00373)

Limited Case and Clientele History

Alston & Bird

- Ericsson

v. Collision Communications (Case No. IPR2022-01233)

- Nokia

v. Neptune Subsea, Xtera (Case No. 1:17-cv-01876)

- Universal Electronics Inc

v. Roku Inc (Case No. IPR2022-00818)

Alavi & Anaipakos PLLC

- Stingray Group Inc. and Stingray Music USA, Inc.

v. Edwin A. Hernandez-Mondragon and Eglia Corp. (Case No. 1:24-cv-21226-RAR)

Arnold & Porter

- Ivantis

v. Glaukos (Case No. 8:18-cv-00620)

- Samsung

v. Jawbone (Case No. 2:21-cv-00186)

Benesch Friedlander Coplan & Aronoff

- Voyis

v. Cathx (Case No. 5:21-cv-00077-RWS)

Buchanan, Ingersoll & Rooney PC

- Google LLC, AT&T Service Inc., T Mobile USA Inc., Cellco Partnership, Ericsson Inc. & Nokia of America Corp.

v. KT Corp & Pegasus Wireless Innovation LLC (Case No. IPR2025-00293)

Deschert LLP

- Smaxtec Animal Care

v. ST Reproductive Technologies, LLC (Case No. IPR2024-00885)

Duane Morris

- Kangxi Communication Technologies

v. Skyworks Solutions Inc. (Case No. IPR2025-00373)

- Microsoft

v. Edge Networking Systems LLC (Case No. 1:24-cv-00215)

Erise I.P.

- Apple

v. Ericsson Inc. (Case No. IPR2022-00715)

v. Future Link Systems (Case No. IPRs 6317804, 6622108, 6807505, and 7917680)

v. INVT (Case No. 20-1881)

v. Navblazer LLC (Case No. IPR2020-01253)

v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)

- v. Quest Nettech Corp (Case No. 2:19-cv-00118-JRG)
- v. Telefonaktiebolaget LM Ericsson (Case No. IPR2022-00275)
- v. Theta IP, LLC (Case No. IPR2024-00818)
- v. THL Holding Company LLC (Case No. 1:23-cv-00548)

- Fanduel

- v. CGT (Case No. 19-1393)

- Garmin

- v. Phillips North America LLC (Case No. 2:19-cv-6301-AB-KS)

- Netscout

- v. Longhorn HD LLC (Case No. 2:20-cv-00349)
 - v. Implicit, LLC (Case No. 2:18-cv-53-JRG)

- Sony Interactive Entertainment LLC

- v. Bot M8 LLC (Case No. IPR2020-01288)
 - v. Infernal Technology LLC (Case No. 2:19-CV-00248-JRG)

- Tesla

- v. Charge Fusion Technologies LLC (Case No. IPR2025-00032)

- Unified Patents

- v. GE Video Compression (Case No. 2:19-cv-248)

Fish & Richardson

- Apple

- v. AliveCor (Case No. 3:21-cv-03958)
 - v. LBS Innovations (Case No. 2:19-cv-00119-JRG-RSP)
 - v. Koss Corporation (Case No. IPR2021-00305)

v. Masimo (Case No. IPR 50095-0012IP1, 50095-0012IP2, 50095-0013IP1, 50095-0013IP2, 50095-0006IP1, 50095-0135IP1)

v. Neonode (Case No. 21-cv-08872-EMC)

v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)

v. Resonant Sys. (Case No. 7:23-cv-00077-ADA)

- AsusTek Computer Inc.

v. Videolabs, Inc. (Case No. 22-CV-00720-ADA)

- Dell

v. Neo Wireless (Case No. IPR2022-00616)

- Dish Network

v. Entropic Communications, LLC (Case No. 2:2023-CV-01043)

v. Entropic Communications LLC (Case No. IPR2024-00393)

v. Realtime Adaptive Streaming (Case No. 1:17-CV-02097-RBJ)

v. TQ Delta LLC (Case No. 18-1798)

- Evapco Dry Cooling

v. SPG Dry Cooling (Case No. IPR2021-00688)

- Genetec

v. Sensormatic Electronics (Case No. 1:20-CV-00760)

- Huawei

v. Bell Northern Research LLC (Case No. IPR2019-01174)

- Kianxis

v. Blue Yonder (Case No. 3:20-cv-03636)

- LG Electronics
 - v. Bell Northern Research LLC (Case No. 3:18-cv-2864-CAB-BLM)
- MediaTek
 - v. MOSAID (Case No. IPR2024-00718)
- Metaswitch
 - v. Sonus Networks (Case No. IPR2018-01719)
- Microsoft
 - v. Throughputer Inc (Case No. IPR2022-00757)
- Mom Enterprises
 - v. Ddrops Company (Case No. 1:22-cv-00332)
- MLC Intellectual Property
 - v. MicronTech (Case No. 3:14-cv-03657-SI)
- Nearmap Inc
 - v. EagleView Technologies (Case No. IPR2022-01009)
- Neuroderm Ltd.
 - v. Abbvie, Inc (Case No. PGR2022-00040)
- Posco Co Ltd.
 - v. Pascal Drillet et al. (Case No. IPR2025-00370)
- Realtek Semiconductor
 - v. Future Link (Case No. IPR2021-01182)

- Quectel
 - v. Koninklijke Philips (Case No. 1:20-cv-01710)
- Samsung
 - v. Aire Technology (Case No. IPR2022-00877)
 - v. Bell Northern Research (Case No. 2:19-cv-00286-JRG)
 - v. Communication Technologies Inc (Case No. IPR2022-01221)
 - v. Jawbone Innovations (Case No. IPR2022-00865)
 - v. MemoryWeb LLC (Case No. IPR2022-00885)
 - v. Dodots Licensing Solutions (Case No. IPR2023-00701)
 - v. Telefonaktiebolaget LM Ericsson (Case No. IPR2021-00615)
- Texas Instruments
 - v. Vantage Micro LLC (Case No. IPR2020-01261)
- Xilinx
 - v. Sentient Sensors LCC (Case No. 1:22-cv-00173)

Goodwin Proctor

- Intel
 - v. Proxense, LLC (Case No. 6:24-cv-00283)
- Samsung Electronics
 - v. Mobile Data Technologies (Case No. 2:24-cv-00435)
- Taiwan Semiconductor Manufacturing Company Ltd.
 - v. Advanced Integrated Circuit Process LLC (Case No. 2:24-cv-00623)

Groombridge Wu

- Nearmap

v. Eagle View Technologies Inc. and Pictometry International Corp. (Case No. 2:21-cv-00283-TS-DAO)

Irell & Manella

- Curium

Latham & Watkins LLP

- Apple

v. Advanced Coding Research LLC

Leydig, Voit & Mayer, Ltd.

- Public Availability Consultancy

O'Melveny & Myers

- Apple

v. Maxell (Case No. 5:19-cv-00036-RWS)

- Disney Media & Entertainment Distribution LLC

v. Digital Media Technology Holdings, LLC (Case No. 2:22-cv-01642)

- Micron Technology Inc.

v. Besang Inc (Case No. IPR2023-00900)

- Samsung

v. Daedalus Prime LLC (1335 Investigation)

Perkins-Coie

- Amazon
 - v. Nokia (Case No. IPR2024-00847 and IPR2024-00848)
 - v. Nokia Technologies Oy (Case No. IPR2024-00572)
- Heru Industries
 - v. The UAB Research Foundation (Case No. IPR2022-01148)
- Intel Corporation
 - v. BeSang Inc. (Case No. IPR2023-00991)
 - v. BitMICRO (Case No. 5:23-cv-00625)
 - v. Telefonaktiebolaget L M Ericsson (Case No. IPR2024-00610)
- Realtek Semiconductor
 - v. Future Link (Case No. IPR2021-01182)
- r-pac
 - v. Adasa, Inc. (Case No. 1:2024cv06102)
- Twitter Inc
 - v. VOIP-Pal.com (Case No. 3:20-cv-02397-JD)
- TCL Industries
 - v. Koninklijke Philips NV (Case No. IPR2021-00495, IPR2021-00496 and IPR2021-00497)
- VusionGroup
 - v. Hanshow (Case No. IPR2024-00857)

Pillsbury Winthrop Shaw Pittman

- Intel

- v. FG SRC LLC (Case No. 6:20-cv-00315)

- Gravel Rating Systems

- v. Costco (Case No. 4:21-cv-149)

- v. Lowe's Home Centers (Case No. 4:21-cv-150)

- v. T-Mobile USA (Case No. 4:21-cv-152)

- v. Kohl's Inc. (Case No. 4:21-cv-258)

- v. Under Armor (Case No. 4:21-cv-356)

Quinn Emanuel

- Exact Sciences Corporation

- v. Geneoscopy, Inc. (Case No. IPR2024-00459 and IPR2024-1330)

- ServiceNow, Inc.

- v. InQusient, Inc. (Case No. 22-900-CJB)

- Wolfsped

- v. The Trustees of Purdue University (Case No. 1:2021-cv-00840)

Sheppard, Mullin, Richter & Hampton LLP

- Advanced Micro Devices, Inc and Pensando Systems, Inc.

- v. Concurrent Ventures LLC and Xtreamedge, Inc. (Case No. IPR2025-00478)

- Cadence Design Systems Inc.

- v. Semiconductor Design Technologies (Case No. 3:23-cv-01001)

Shook, Hardy & Bacon LLP

- HP Inc.

v. Universal Connectivity Technologies (Case No. 1:23-cv-01177)

Stern, Kessler, Goldstein & Fox

- Preliminary Research

Wilmer, Cutler, Pickering, Hale and Dorr

- Apple

v. Shunock (Case No. 1:23-cv-08598)

- Quest Diagnostics Inc., Haystack Oncology Inc. and Haystack Oncology GmbH

v. Natera, Inc. (Case No. 1:23-cv-08598)

- Roche Diabetes, Inc.

v. Trividia Health, Inc. (Case No. 1:24-cv-00668)

Willkie, Farr & Gallagher LLP

- Lenovo, Dell, HP

v. Universal Connectivity Technologies Inc. (Case No. 2:2023cv00449)

- Neurent

v. The Foundry, LLC (Case No. IPR2024-00669)

- Netflix, Inc.

v. VideoLabs, Inc. (Case No. IPR2023-00628)