

Curriculum Vitae



Alexander D. Glew, Ph.D., P.E.

Expertise

• Materials Science Engineering, Thin Films & Equipment, Semiconductor	• Mechanical Engineering
• Semiconductor Equipment and processing: CVD, Etch, RIE, CMP, SOD, EPI, MBE, RTP, and others	• Licensed Professional Engineer (PE) in California, Mechanical Engineering
• Chemical vapor deposition (CVD): plasma, ICP, thermal, MOCVD, LPCVD and others	• CAD, drafting standards, and related.
• Thin film processing for solar, LED, and optics.	• Computation Fluid Dynamics (CFD) Fluid flow, radiation analysis
• Diamond Like Carbon (DLC), Fluorinated amorphous carbon (FLAC)	• Finite Element Analysis (FEA), multi-physics and event simulation
• Dielectric Deposition: Low k dielectric films, SiO₂ (glass), fluorinated glass (FSG), BPSG, USG	• Product Design & Testing
• Excimer Laser Sources	• Project management and turnaround
• Laboratory analysis: SEM, TEM, FTIR, SIMS, AES, and others.	• Ultra High Purity Gas and Chemical Delivery Systems
• Materials processing	• Piping, valve, and chemical systems
• Metal deposition and sputtering (PVD)	• Metrology: Flow, pressure, optical properties, thin film properties ...
• Plasma and Thermal Processes	• Reverse Engineering
• Thin Film Characterization: stress, strain, thickness, optical and dielectric properties, structure, composition ...	• Safety analysis, interlocks, failure mode effects, standards and code analysis.

ASM Ex. 1004
IPR Petition - USP 7,808,396

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Employment History

From:	1997	Glew Engineering Consulting, Inc.
To:	Present	Mountain View, California
Position:		President
		Clients include companies from semiconductor equipment, plasma generation, vacuum systems, fluid delivery systems, flow and pressure component suppliers, laser manufacturers, consumer electronics, industrial electronics, vehicle, telecommunications, and others. Consulting work includes thin film characterization, process development, project turn-around/rescue, gas flow and vacuum metrology, design of experiments, corrosive gas applications, finite element analysis and related market analysis.
From:	Aug 1987	Applied Materials, Inc.
To:	Jan 1997	Santa Clara, California
	Titles	Engineering Manager, Core-Technologist
	Project Mgr.	Sat on corporate engineering/technology (ET) council, one of 15 council members. Responsible for corporate direction in gas delivery technology for all divisions, including CVD, EPI, PVD, RTP, etch, thermal and others. Also, qualified gas and vacuum component selections. Consulted with all divisions on gas and vacuum systems, liquid source delivery systems, components, and supplier selections.
	Jan 1996 to Jan 1997	- Received patent for improved tungsten (W) CVD deposition. - Successfully proposed and executed a project that SEMATECH S100 funded. The goal was to develop industry methods to determine the effects of trace chemicals on semiconductor processing and equipment reliability. This resulted in two SEMATECH Technology Transfers listed below.
	CVD Supplier Quality Engineering Manager	First, ppb levels of impurities were introduced into both a Tungsten CVD deposition process and an aluminum etching process. The effect on particle generation, deposition rate, uniformity, selectivity and incorporation into the film were examined. This work resulted in a 30% increase in deposition rate. Similarly, ppb-ppm levels of impurities were introduced into HBr gas systems and accelerated lifetime tests were conducted at three sites across the country. Measured by quadrapole mass spectrometry gas composition in situ of Tungsten CVD and Al Etch process.
	Core Technologist	Responsible for gas, vacuum and chemical components evaluation, testing and supplier quality management. Managed an engineering group that tested and recommended gas, vacuum

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CVD
Engineering
Manager

and chemical components for the CVD division, and developed process controls at suppliers. Supervised laboratory and trained individuals to develop specialized testing capabilities to characterize gas delivery and vacuum components. Also supported Etch, PVD and other divisions with common suppliers including vacuum pumps, vacuum transducers, flow controllers, valves and similar.

- Managed group of engineers and support personnel who developed gas panels and liquid source delivery systems for dielectric deposition. Delivered TEOS, TMP, TMB and many other organometallic precursors for SG, BPSG dielectric deposition. Developed organometallic CVD systems extensively. Designed multiple liquid source delivery systems for organometallic chemical precursors, i.e. bubblers, boilers, injectors.

Systems
Engineer

- Managed CVD division design support group: CAD designers, drafters and CAD systems for division. Brought in first 3D CAD systems. Brought in first FEA program.
- Established and managed the customer engineering special group for the CVD division, which engineered all equipment modifications to meet customer specifications. These modifications included changes across the entire system, including process chambers, vacuum systems, gas delivery, power distribution, safety and robotics.
- Worked on the development and release of the landmark product, Precision 5000 CVD, one of which is now in the Smithsonian Institute. This was the first cluster tool for semiconductor manufacturing.
- Developed dielectric layers of silicon dioxide (glass or USG), boron phosphorous silicon glass (BPSG), phosphorous silicon glass (PSG), nitride, oxy-nitride, and others.
- Responsible for flow and vacuum equipment suppliers for company including MFC, valves, mechanical vacuum pumps, cryo-pumps, dry pumps, and others. Supported multiple divisions on these matters.

Doctoral Dissertation:

From: 1996 Stanford University
To: 2002 Stanford, California
Ph.D.

Completed a dissertation in the department of Materials Science & Engineering leading to the Ph.D. degree.
Research includes:

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- Plasma Deposition of Diamond-Like Carbon and Fluorinated Amorphous Carbon and the Resultant Properties and Structure
 - Characterized stress, strain and hardness of films. Related the stress energy state to the diamond like nature of the thin films.
 - Investigation of deposition mechanism fluorinated amorphous carbon (FLAC) and diamond-like carbon (DLC), low k dielectric materials.
 - Modeled and conducted experiments on mechanism of ion energy, momentum and flux dependence for FLAC and DLC film synthesis in radio-frequency plasma discharges, including competing mechanisms of sub-plantation, ion-peening, sputtering, and etching.
 - Constructed and instrumented a multi-purpose processing chamber for CVD, etch, and sputtering with measurement capability.
 - Fabricated MIS capacitors to investigate the dielectric properties of fluorinated amorphous carbon (FLAC). Performed all wafer processing to construct MIS capacitors, including lithography, etch, CVD and PVD.
 - Conducted thin film analysis including UV absorption spectroscopy, spectral ellipsometry, multi incident angle ellipsometry, Fourier transform infrared spectroscopy, profilometry, nano-indentation, and gravimetric measurements.
 - Modeled dielectric properties and dispersion relationship of fluorinated amorphous carbon (FLAC), and compared spectral ellipsometric measurements to results of electrical CV tests and thickness measurements by profilometry using MIS structures.

Consulting History (Partial before 2010)

From	Sept. 2017	UNICO
To	present	Finite element analysis of new product concepts.
From	July 2017	Elwood National Forge
To	present	Professional Engineering review of capital equipment. Finite element analysis.
From	April 2017	Jon Richards Co. (for Disneyland)
To	May 2017	Professional Engineering review of electric vehicle used as float at Disneyland.
From	2017	Licensed Mechanical Engineering
To	Ongoing	Professional Engineering letters and calculations for submission to building and environmental health departments. Miscellaneous clients.

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From	2016	Confidential Client
To:	Ongoing	Reverse engineering of OLED display technology.
From	2016	VWR
To:	2017	Review of new semiconductor technologies for etching and particle reduction in semiconductor processing chambers.
From	2016	TDA Research
To:	2017	Finite element analysis of effluent treatment system for power plant carbon reduction treatments.
From	2016	Champion Telecom
To:	Ongoing	Engineering support, Finite element analysis, and design of “Cell Towers on Wheels” (COWs). Multiple projects. Analysis of trucks used to support emergency telecommunications.
From	2016	CarbonTech
To:	Ongoing	Pursue UL listing for thin film carbon heaters. Help productize the technology. Review codes for domestic use.
From	2015	Phiston Engineering
To:	2016	Review ability of equipment to destroy flash memory. Generate report to submit to NSA.
From	2015	United States Air Force
To:	2015	Concluded
	Duties	Advanced semiconductor process equipment engineering for Air Force Laboratory.
From	2013	United States Department of Justice, Antitrust Division
To:	2014	
	Duties	Served as the industry expert for the DOJ in their investigation of the proposed merger between Applied Materials and Tokyo Electron.
From	2015	VADA
To:	Ongoing	
	Duties	Fluid analysis of venting device.
From	2014	Chemithon
To:	Completed	
	Duties	Finite element analysis (FEA) and computational fluid dynamics (CFD) analysis of thermal and stress analysis of large industrial

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sized heat exchangers. Redesign to meet structural and performance needs.

From	2013	Barrick Cortes Mines
To:	2013	
	Duties	Analysis of equipment using in mining operations.
From	2013	Life Technologies
To:	2013	
	Duties	Concept design for a portion of a medical device: centrifuge assembly for separation in PCR DNA application.
From	2012	Light failures
To:	2012	
	Duties	Reliability analysis of thermal issues causing light sealing failures for glass metal interface.
From	2012	Legion Industries
To:	2012	
	Duties	Review of electrical surge issues at Google campus.
From	Dec. 2011	CareFusion
To:	2012	
	Duties	Chemical compatibility/reliability analysis of medical device.
From	June 2011	Watlow
To:	2012	
	Duties	Heater and chuck assembly design for use in semiconductor processing.
From	June 2011	Limited Brands
To:	June 2012	
	Duties	Design review of prototype consumer electronics products. Perform engineering analysis of weaknesses and risks in product design.
From	April 2011	EFCI/Environmental Protection Agency
To:		
	Duties	Subject matter expert for green house gas emissions from the electronics industry.
From	June 2011	Intrimed
To:	Current	
	Duties	Consult for Exec. VP on thin film technology in medical devices.
From	April 2010	Zoll Circulation

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To: June 2010
Duties Analysis of electrical contacts in a medical device, cardiac life support pump.

From: June 2008 Teardown and analysis of IC packaging.
To: Sept. 2008

From: Oct 2008 VModa
To: Feb 2009
Duties Engineering analysis of headset/earbuds used for iPhone. Performed finite element analysis (FEA) of plug to determine why the plug/cable contacts were breaking. Reviewed designs of a number of competing earbuds, and other musical equipment plugs, and their respective designs for plug reliability improvements.

From: Sep 2008 Malema Sensor
To: Oct 2008
Duties Safety Analysis of Fluid dispense system for semiconductor equipment.

From: Dec 2007 Damage analysis for insurance valuation.
To: Jan 2008
Duties Analysis of damage to equipment from a chemical leak.

From: Apr 2007 Epicrew
To: Oct 2008
Duties Finite element analysis of temperature distribution in process chamber, and leading to safety issues and analysis of emergency conditions in epitaxial equipment. Multi-physics transient radiation, conduction and convection analysis.

From: Apr 2007 Unicor
To: Oct 2007
Duties Analysis by FEA and approval of automotive lifting devices as a licensed mechanical engineer.

From: 2007 Altcatel
To: 2008
Duties: Consulting on semiconductor foundry processes, low-k spin on dielectrics, that lead to IC failures.

From: 2002
To: Present Consulting with financial analysts on semiconductor industry through Gerson Lehrman Group.
Duties: Provided on the spot analysis of new technologies, companies, and products within the semiconductor and related industry.

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From:	March 2004	AIU (Now Chartis Insurance.)
To:	2009	Hsinchu, Taiwan
Duties:		Analysis of complete destruction of FAB due to facility design, equipment design, installation, process monitoring and control, etc. International Arbitration.
From:	June 2004	Rosemont Process, Division of Emerson Electric, Inc.
To:	Nov 2004	Minneapolis, MN.
Duties:		Market analysis of process monitoring and control needs.
From:	Oct 2000	Brooks Instrument, Division of Emerson Electric, Inc.
To:	March 2001	Hattfield, PA, and Minneapolis, MN.
Duties:		Market analysis of semiconductor equipment needs with respect to fluid handling components.
From:	Apr 2000	Lebar, Inc.
To:	Oct 2000	Sunnyvale, CA
Duties:		System design and fluid delivery system design for plasma based photoresist strip (photoresist removal).
From:	Dec 1999	High Speed Industries, Inc.
To:	2000	Lake Elsinore, CA
Duties:		Market analysis of semiconductor equipment needs with respect to fluid handling components.
From:	May 1999	Aeroquip (Division of Eaton Corp.) Ann Arbor, MI
Duties:		Reviewed new product entry (semiconductor fluid handling) prior to product engineering.
From:	Sep 1999	Steag RTP Systems, Inc.
To:	Nov 1999	San Jose, CA.
Duties:		Materials evaluation and testing for metallic reduction in thermal SiO ₂ films produced by rapid thermal processing (RTP) with steam.
From:	Sep 1998	Cymer, Inc.
To:	Aug 1999	San Diego, CA
Duties:		Project manager responsible for leading team through concept and feasibility studies for major product enhancement to Excimer laser used in deep ultraviolet lithography.
From:	Jan 1997	Millipore, Inc.
To:	Sep 1998	Rancho Bernardo, CA

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- Duties:
- Established a metrology group responsible for vacuum and flow measurements. The metrology is used in the manufacture and service of instruments for semiconductor process equipment. Established statistical process control for production metrology equipment. Established statistical process control on factory floor.
 - Led development team for new mass flow control device.

Testimony in the Last Six Years

Client	IP Bridge (Ropes and Gray)
Case	BROADCOM LIMITED, BROADCOM CORPORATION, AVAGO TECHNOLOGIES, LTD., AVAGO TECHNOLOGIES U.S., INC., and LSI CORPORATION, Case No. 2:16-cv-134, Eastern District of Texas, and IPR2016-1376, 1377 and 1379.
Project	Interconnect and back end of line patents.
Dates	Spring 2015 – Spring 2017
Status	Submitted expert reports and testified at deposition.
Client	Elm 3DS Innovations (Mintz, Levin, Cohn, Ferris, Glovsky and Popeo PC)
Case	Elm v. Samsung Electronics, Hynix and Micron Inter Partes Review (IPR) at the USPTO: IPR2016-00386, IPR2016-00387, IPR2016-00388, IPR2016-00389, IPR2016-00390, IPR2016-00391, IPR2016-00392, IPR2016-00393, IPR2016-00394, IPR2016-00395, IPR2016-00687, IPR2016-00691, IPR2016-00708, IPR2016-00770, and IPR2016-00786 Cooke
Project	Patent infringement involving thinned and stacked wafers, low stress dielectric materials and other topics of IC memory.
Dates	2016 - 2017
Status	Submitted declarations in IPR and gave testimony at deposition.
Client	Semcon, (Russ, August & Kabat)
Case	Semcon v. Micron Inc. CASE NO. 12-532-RGA UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
Project	Advanced process control and metrology in semiconductor processing patent case regard CMP.
Dates	2013
Status	Submitted expert reports and testified at deposition.

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Client	Caterpillar Inc., (Baker & Hostetler)
Case	Miller UK Limited v. Caterpillar Inc. CASE NO. 10-cv-3770 UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF ILLINOIS EASTERN DIVISION
Project	Trade secret case.
Dates	2013
Status	Submitted expert reports and testified at deposition and at trial. Completed.
Client	Carr & Farrell (LAM Research)
Case	LAM RESEARCH CORPORATION v. XYCARB CERAMICS CASE NO. 3:03-cv-1335 CRB UNITED STATES DISTRICT COURT NORTHERN DISTRICT OF CALIFORNIA SAN FRANCISCO DIVISION
Project	Review product for patent infringement.
Dates	2013
Status	Submitted reports and was deposed. Settled
Client	Schwegman, Lundberg & Woessner, P.A. (Amkor)
Case	Tessera v. Amkor. Petition for <i>inter partes</i> review of U.S. patent at USPTO
Project	Semiconductor manufacturing technology.
Dates	2013 – present
Status	Submitted declarations in IPR and gave testimony at deposition.

Patents

Patent Number	Date Issued	Title
7,118,090	Jan 20, 2007	Control Valves
6,679,476	Jan. 20, 2004	Control Valves
6,204,174	Mar. 20, 2001	Method and Apparatus Rate Deposition of Tungsten.
9,224,626	Dec. 29, 2015	Composite Substrate for Layered Heaters

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Education

2003	Stanford University	Ph.D., Materials Science and Engineering
1995	Stanford University	M.S., Materials Science and Engineering
1987	University of California, Berkeley	M.S., Mechanical Engineering
1985	University of California, Berkeley	B.S., Mechanical Engineering

Publications and Conference Presentations (selected).

A.D. Glew, M.A. Cappelli, "Characterization and dielectric properties of fluorinated amorphous carbon measured by capacitance-voltage versus spectral ellipsometry", *Materials Research Society Symposium Proceedings*, **593**, Boston, MA, 1999, pp. 341-346.

A.D. Glew, M.A. Cappelli, "In situ plasma analysis, fluorine incorporation, thermostability, stress, and hardness comparison of fluorinated amorphous carbon and hydrogenated amorphous carbon thin films deposited on Si by plasma enhanced chemical vapor deposition", *Material Research Society Symposium Proc.*, **565**, San Francisco, CA 1999, pp 285-290.

A.D. Glew, R. Saha, M.A. Cappelli and J.S. Kim, "Ion Energy and Flux Dependence of Diamond Like Carbon Film Synthesis in Radio-Frequency Discharges", *International Conference on Metal Coatings and Thin Films*, Surface and Coatings Technology 114 (1999) 224-229.

A. Glew, R. Saha, M. Cappelli and J. Kim, "Ion Energy and Flux Dependence of Diamond Like Carbon Film Synthesis in Radio-Frequency Discharges", *International Conference on Metal Coatings and Thin Films*, San Diego, CA, April 1998

A. Glew, J. Ammenheuser, M. Crockett, A. Johnson, W. Dax, R. Binder, J. Riddle, "SEMASPEC 97043272A Accelerated Life Tests of Gas System Performance and Reliability," <http://www.sematech.org/public/docubase/abstract/3272atr.htm>.

A. Glew, J. Ammenheuser, J. Riddle, A. Johnson, "SEMASPEC 96083175A-XFR Determining the Effects of Impurities on Semiconductor Thin Film Processing," <http://www.sematech.org/public/docubase/abstract/3175axfr.htm>.

A Glew, "Selecting Gas Purity and Materials of Construction in High Purity Gas Systems," *Semicon West Symposium on Corrosion*, July 1997

Glew, J. Kim, K. Lee, M. Cappelli, "On the Characteristics of Diamond Like Carbon",
A. *International Conference on Metal Coatings and Thin Films*, San Diego, CA, April 1997

A. Glew, D. Porter, "Gas System Reliability Testing in Chlorine", *Semiconductor Fabtech*, May 1996.

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Professional Associations

American Society of Mechanical Engineers (ASME)
International Microelectronics and Packaging Society
Materials Research Society (MRS)
IEEE
SEMI

Professional License

Licensed Mechanical Engineer, State of California, M26690

Laboratory analysis

On site: Microscopy, Vis and Near IR spectroscopy, thermal measurements, electrical-mechanical measurements.

Other Laboratory analysis may be provided through supervised third party laboratories: SEM, TEM, ESCA, AES, SIMS, FTIR, AFM

Technical Software Packages and Programming Languages (Selected):

Autodesk Simulation Mechanical™ (Algor™ and Nastran™) 2018
Autodesk Simulation CFD (CF Design™) 2018
Autodesk Inventor™, Computer Aided Design 2018
Autodesk AutoCAD™, Computer Aided Design 2018
PTC Creo™ 4.0
Mathematica™ 11: mathematical analysis
Solidworks™ 2018

Civic Duties

Chairman & Commissioner of the Design Review Commission, Los Altos, CA.

Volunteer and Service Activities

Los Altos Rotary Club
Board of Director: Responsible for Operations
Veterans Committee and others

University of California Alumni Association (UC Berkeley)
Alumni Awards Committee 2015
Alumni Awards Committee 2014
Alumni Awards Committee 2013

NorCal Golden Retriever Club

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For more information please contact:

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