

## Curriculum Vitae



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

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Expertise (partial)

<ul style="list-style-type: none"><li>• <b>Materials Science Engineering, Thin Films &amp; Equipment, Semiconductor</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Mechanical Engineering</b></li></ul>
<ul style="list-style-type: none"><li>• Semiconductor Equipment and processing: CVD, Etch, RIE, CMP, SOD, EPI, MBE, RTP, and others</li></ul>	<ul style="list-style-type: none"><li>• Licensed Professional Engineer (PE) in California, Mechanical Engineering</li></ul>
<ul style="list-style-type: none"><li>• Chemical vapor deposition (CVD): plasma, ICP, thermal, MOCVD, LPCVD and others</li></ul>	<ul style="list-style-type: none"><li>• CAD, drafting standards, and related.</li></ul>
<ul style="list-style-type: none"><li>• Thin film processing for solar, LED, and optics.</li></ul>	<ul style="list-style-type: none"><li>• Computation Fluid Dynamics (CFD) Fluid flow, radiation analysis</li></ul>
<ul style="list-style-type: none"><li>• Diamond Like Carbon (DLC), Fluorinated amorphous carbon (FLAC)</li></ul>	<ul style="list-style-type: none"><li>• Finite Element Analysis (FEA), multi-physics and event simulation</li></ul>
<ul style="list-style-type: none"><li>• Dielectric Deposition: Low k dielectric films, SiO<sub>2</sub> (glass), fluorinated glass (FSG), BPSG, USG</li></ul>	<ul style="list-style-type: none"><li>• Product Design &amp; Testing</li></ul>
<ul style="list-style-type: none"><li>• Excimer Laser Sources</li></ul>	<ul style="list-style-type: none"><li>• Project management and turnaround</li></ul>
<ul style="list-style-type: none"><li>• Laboratory analysis: SEM, TEM, FTIR, SIMS, AES, and others.</li></ul>	<ul style="list-style-type: none"><li>• Ultra High Purity Gas and Chemical Delivery Systems</li></ul>
<ul style="list-style-type: none"><li>• Materials processing</li></ul>	<ul style="list-style-type: none"><li>• Piping, valve, and chemical systems</li></ul>
<ul style="list-style-type: none"><li>• Metal deposition and sputtering (PVD)</li></ul>	<ul style="list-style-type: none"><li>• Metrology: Flow, pressure, optical properties, thin film properties ...</li></ul>
<ul style="list-style-type: none"><li>• Plasma and Thermal Processes</li></ul>	<ul style="list-style-type: none"><li>• Reverse Engineering</li></ul>
<ul style="list-style-type: none"><li>• Thin Film Characterization: stress, strain, thickness, optical and dielectric properties, structure, composition ...</li></ul>	<ul style="list-style-type: none"><li>• Safety analysis, interlocks, failure mode effects, standards and code analysis.</li></ul>

**IP Bridge Exhibit 2008  
TSMC v. Godo Kaisha IP Bridge 1  
IPR2017-01841**

# Curriculum Vitae

## Employment History

From: 1997  
To: Present  
Position: **Glew Engineering Consulting, Inc.**  
Mountain View, California  
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  
To: Jan 1997  
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 • Received patent for improved tungsten (W) CVD deposition.  
Jan 1997 • 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 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.  
Supplier Quality Engineering Manager  
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

## Curriculum Vitae

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:

## Curriculum Vitae

- 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)

From	Sept. 2017	UNICO
To	Jan 2018	Finite element analysis of new product concepts.
From	July 2017	Elwood National Forge
To	Dec 2017	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.

## Curriculum Vitae

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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