Stanley Shanfield

Curriculum Vitae for Stanley Shanfield

Education:

Massachusetts Institute of Technology, Ph.D., Physics, 1981

University of California, Irvine, B.S. Cum Laude, Physics, 1977

Educational Awards:

Outstanding Research Project, U.C. Regents Award, 1977

Phi Beta Kappa, 1977

Four Year Scholarship, Tuition & Research, ERDA/DOE, 1977-1981

Hands-On Professional Expertise:

Semiconductor Physics & Chemistry
Semiconductor Fabrication: Silicon and III-V Materials
Semiconductor Device & Integrated Circuit Engineering
Semiconductor Equipment: Front & Back End
Semiconductor Packaging Design and Manufacturing
Passive Component Design and Manufacturing
RF Design and Fabrication
Digital Design & Fabrication
Semiconductor Manufacturing in Silicon and III-V Materials
MEMS Design and Fabrication: Electrical, Optical, & Sensing Devices
Fiber Optic Device Design and Fabrication
Integrated Optics & Electro-Optical Devices
Plasma Physics

Specialized Training:

Global Positioning Electronics, Systems and Components
Six Sigma Semiconductor Manufacturing
Microwave Engineering
US Patent Law in Technology
Patent Application and Prosecution
Semiconductor Plasma Processing
Thin Film Physics and Technology
MEMS-based Gyroscopes and Accelerometers
Thermoelectric Materials & Technology
Phased Array Radar Engineering
Antennas and Electromagnetic Propagation
Solid State Optical Devices
Fiber Optic Communication System Operation
HALT and HAST Reliability Testing Methods

Professional Experience:

Draper Laboratory Cambridge, MA ***2003 – present***

Division Leader, Advanced Hardware Development
Distinguished Member of Technical Staff
Technical Director

Led division (about 80 staff) in re-invigorating multi-chip integrated circuit module facility, more than doubling associated revenues in two years. By most accounts, made division a viable business & technological entity again. Invented & led implementation of an ultra-miniature electronics fabrication technology which became a top laboratory priority. Led team in realization & fabrication of a newly designed precision MEMS-based gyroscope and associated ASIC. Found funding and led team in developing a miniature power source with energy density at least two orders of magnitude higher than any source previously built. Developed fabrication technology for semiconductor-based low phase noise oscillator design, allowing for receiver operation with extremely low signal strength. Many awards received, most recently, the Draper 2010 Distinguished Performance Award, and 2010 Best Patent Award.

Clarendon Photonics Newton, MA ***2001 – 2003***

Director, Packaging & Integration

30 person photonic chip startup with $18 million 2nd round funding. Invented and productized new, low cost and reliable semiconductor processing, packaging and pig-tailing technology for optical add-drop multiplexer. Established assembly and packaging process, and developed control electronics. Partner with Micron Technologies, using their R&D semiconductor facility.

AXSUN Technologies Bedford/Billerica, MA ***1999 – 2001***

Vice President, Operations
1999 – 2000

Initially three staff members with $6 million funding. Designed, fabricated and productized AXSUN's micro-electromechanical (MEM) Fabry-Perot optical filter. Patents granted on semiconductor processing and control electronics. Completed facility and semiconductor processing design, then completely equipped. Raised 2nd round funding for $36 million. Established process and fabrication facility in Belfast, Northern Ireland for producing thick oxide silicon-on-insulator material.

Director, Manufacturing & Wafer Fab Technology **2000 – 2001**

After 3rd round funding, led device manufacturing, creating wafer fab and assembly infrastructure; hired 70+ people, led production. Delivered first generation product for revenue to multiple customers. Converted pure technology to dominant company revenue with high yield.

Company purchased by Volcano Technologies, San Diego.

Raytheon Corporation Lexington/Andover, MA ***1985 - 1999***

Manager, Semiconductor Operations **1996 – 1999**

Built and led a 300 employee, $60 million revenue 24/7 semiconductor development and manufacturing operation resulting from the consolidation of a number of smaller organizations. Key player in technological development and recipient of Raytheon's 6 Sigma Leadership training. Decision maker in Texas Instrument group acquisition, providing significant expert opinion on semiconductor and design facilities. Obtained state-of-art yields using best available steppers, deep reactive ion etching, plasma assisted CVD, and ion-implantation equipment, and disciplined design-for steppers, deep reactive ion etching, plasma assisted CVD, and ion-implantation equipment, and disciplined design-for-manufacturing
circuit design and layout methodology.

Research Laboratory Manager **1992 – 1996**

Leader of a 90 employee development and contract research organization in high performance semiconductor devices and circuits, measurement, assembly and wafer fab. Led a team which invented and implemented a major revenue generating technology (.$100 million) based on semiconductor device development (pseudomorphic high electron mobility transistor). Increased outside research funding by 50% in 3 years through superior technical performance relative
to competitors.

Section Manager, Semiconductors & ICs **1985 – 1992**

Led a MM-Wave Circuit and Module Development program over 2 years, leading to production win of a satellite terminal electronics generating $320 million in sales. Developed processes for fabricating high power, high frequency multi-function integrated circuits, and combining high performance digital and analog devices in a single integrated circuit.

Spire Corporation Bedford, MA ***1981 – 1984***

Staff Scientist
Senior Staff Scientist

Developed new methods for low temperature deposition of plasma-assisted CVD epitaxial silicon. Wrote joint papers with MIT professor, and had process adopted by equipment manufacturers. Built, operated and characterized ion-assisted deposition system for making coating for semiconductor and machine tool industries. Process eventually purchased by Kennametal, Inc.

Publications

Restricted Publications & Reports

Process Sequence for Formation of Ultra-High Density Multi-Chip Modules:
A high yield, low cost method for creating a system-in-a-package consisting of numerous semiconductor die, passive components, and sensors. Process formed basis for new (2008) facility.

Design and Method of Fabrication of Ultra-High Density Radioisotope Power Source:
In test, a miniature power source that achieves energy density more than 1000X the best chemical battery. Method uses planar semiconductor processing of bulk thermoelectric materials.

Design and Method of Achieving Extremely Low Crystal Oscillator Phase Noise:
Method developed for very low power refrigeration of quartz or sapphire crystal resonators, resulting in extremely low phase noise oscillators. The low phase noise allows extremely high sensitivity in digital receivers, including GPS receivers, leading to use in extremely low signal conditions.

Design, Evaluation & Production of MEMS-based Fabry-Perot Interferometer:
Design and method for ultra-compact spectral analyzer made using semiconductor and optical thin film processing.

Design & Evaluation of Ultra-Fast Control Electronics for Integrated Optical Multiplexer:
Design and performance evaluation of silicon-based integrated optical multiplexer using chip-based local heating

Design and Fabrication of Q-band MILSTAR Communications Terminal Transmitter:
Record power and efficiency 44 GHz transmitter design using new transistor design, and combined waveguide

Key Publications (selected)

Process Characterization of PSG and BPSG Plasma Deposition, J. Electrochem. Soc., Volume 131, Issue 9, pp. 2202-2203

A double-recessed Al0.24GaAs/In0.16GaAs pseudomorphic HEMT for Ka- and Q-band power Applications, Electron Device Letters, IEEE, Volume 14, Issue 9, pp. 456 - 458

Formation of Thick Metal Structures on GaAs MMICs Using Image Reversal Lithography and Evaporated Metal Deposition, J. Electrochem. Soc., Volume 136, Issue 9, pp. 2687-2690

Contact Hole Etching in Load-Locked Hexagonal Reactive Ion Etch System, J. Electrochem. Soc., Vol. 131, No. 8, 1984

An AlGaAs/InGaAs pseudomorphic high electron mobility transistor with Improved Breakdown Voltage for X and Ku-band power applications, Microwave Theory and Techniques, IEEE Transactions on, Volume 41, Issue 5, May 1993, pp. 752 - 759

Hot-electron-induced Degradation of Metal-Semiconductor Field-Effect Transistors, Integrated Circuit Symposium, 1994. Technical Digest 1994., 16th Annual Volume , Issue , 16-19 Oct. 1994, pp. 259

Ion Beam Deposition of Cubic Boron Nitride, J. Vac. Sci. Technol. A Volume 1, Issue 2, pp. 323-325

Patents

US Patent 6504235 - **Passivation layer and process for semiconductor devices**
Method of coating semiconductor devices that prevented parametric shift in electrical performance. Solved key processing problem.

US Patent 4440108 - **Ion Beam Deposition Apparatus**
Design of equipment for deposition of thin films in the presence of ion bombardment. System produced thin films of interest for mechanical, electrical and optical properties and was sold as an equipment product.

US Patent 6525880 - **Integrated Tunable Fabry-Perot filter and Method of Making Same**

Design and method for fabricating very small, very high performance variable optical filter using semiconductor fabrication technology. In current use in fiber optical networks, chemical sensors, and 3-D medical imaging applications.

US Patent 5175020 - **Boron Nitride Films and Process of Making Same**
Ion assisted deposition of ultra-hard cubic boron nitride films for semiconductor and machine tool applications. Significant use in both areas.

US Patent 4526673 - **Coating Method**
Method for deposition of thin films used in semiconductor device fabrication. Method based on direct control of the kinetics of thin film deposition.

US Patent 7727806 - **Systems and Methods for High Density Multi-Component Modules**
Method for fabrication of electronic modules using multiple thinned integrated circuits, patterned multi-level interconnects, passive electronic components, and sensors

US Patent Application 2009/TBD - **Devices, systems, and methods for controlling the temperature of resonant elements**
Devices and systems for achieving low phase noise crystal oscillators using unique low power thermoelectric structures

Expert Witness Experience:

See attachment

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