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Education:

RETS Electronics Institute, Birmingham, Al.	Electronics Engineering	A.A.S., 1986

Professional Experience:

2006–Present	Lead Cleanroom Engineer, Lab Space Manager, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory
2006	Equipment Maintenance Manager, Ion Implant/Diffusion, Intel Corp., Fab 23, Colorado Springs, CO
2003–2006	Mechanical Engineering Vacuum Group, Spallation Neutron Source, Oak Ridge National Laboratory
1997–2003	Equipment Engineering Manager, Equipment Engineer, Ion Implant/Diffusion/CVD**,** Vitesse Semiconductor, Fab 2, Colorado Springs, CO
1990–1997	Equipment Engineering, Technician Diffusion/CVD, Atmel Semiconductor Corp., Fab 3, 4, and 5, Colorado Springs, CO
1986–1990	Equipment Engineering Technician, Diffusion/CVD**,** Texas Instruments, DMOS-IV, Dallas, TX

Research Synopsis

1. *Sustaining Process Engineering*
   - Growth of high purity thermal silicon dioxide (SiO_2) thin films on silicon substrates in an atmospheric horizontal tube furnace.
   - LPCVD deposition of stoichiometric silicon nitride (Si_3N_4) or low stress non-stoichiometric silicon nitride. Film stress and/or stoichiometry tuned for specific applications.
   - LPCVD deposition of intrinsic poly-silicon, doped poly-silicon (N-Type), amorphous silicon, low temperature silicon oxide (LTO), and doped oxides such as borophosphosilicate glass (BPSG) and phosphosilicate glass (PSG).
   - PECVD deposition of silicon oxide, oxy-nitride, and silicon nitride thin films on single wafer samples. Film stress and/or stoichiometry tuned for specific applications.
   - Atomic Layer Deposition (ALD): The ALD process is a true “nano” technology allowing for precise deposition of ultra-thin films of a few nanometers in thickness. The two defining characteristics of ALD are self-limiting layer by layer growth and highly conformal coating of extreme high aspect ratio topography. Plasma capability allows for ALD processing temperatures as low as 30^oC.

2. *Process Development*

- ALD deposition of ultra-thin highly conformal stoichiometric vanadium dioxide (VO_2) thin films.
- Rapid Thermal Processor (RTP) process development.
    - This is a relatively new addition to the cleanroom. This tool is an infrared lamp heating system capable of controlled ramp rates or rapid maximum ramp rates approaching 100^{o}C per second. Samples can be heated in excess of 1200^{o}C in various ambient conditions and pressures ranging from 10mTorr to atmospheric pressure. The RTP can be used to modify the functional properties of substrates and thin films.
- **S**pecific Examples Include:
    - Growth of nanomaterials on lithographically defined metal thin-films.
    - Modulation of thin film stress.
    - Modulation of as deposited thin film stoichiometry via reduction and/or oxidation.
    - Reflow of materials during annealing.
    - Driving of dopants into materials to control electrical behavior and/or etch sensitivity.

3. *Equipment Engineering / Operations*

- Assist with all aspects of daily operation of the NRL cleanroom.
- Emphasis on cleanroom startups, process gas distribution design and layout, equipment layout, equipment procurement, installation, modification, repair and maintenance.