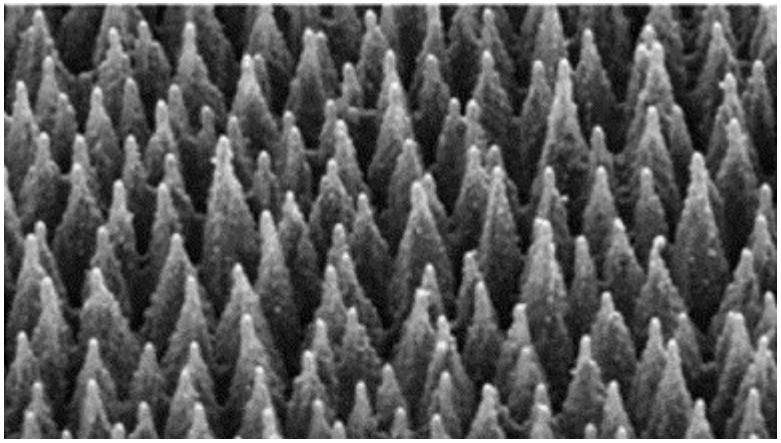

Our research group focuses on the impacts of high power lasers for industrial manufacturing, solar cell devices and photonic sensors. An NSF Industry/University Cooperative Research Center for high power laser applications was established in 2002 and has grown into a multi-university center with over 23 industrial members. We are also interested in plastics that conduct electricity and surfaces that repel water so that anti-icing and corrosion resistance properties can be realized. An image above shows a micro/nano –textured surface generated by high power laser process and has applications in solar cells for efficient light trapping, development of superhydrophobic surfaces for anti-icing and corrosion resistance, etc. Our group also works closely with the National Institute of Aerospace and NASA-Langley Research Center. We have developed collaborations with various national laboratories such as NREL, ORNL, ANL, industries and other universities.

LAM

NSF Industry/University Cooperative Research Center for Laser Applications

Mool Gupta

Langley Professor
mgupta@virginia.edu
www.faculty.virginia.edu/laser/
www.seas.virginia.edu/research/lam

Dept. of Electrical & Computer Engineering
University of Virginia
Charlottesville, VA
434.924.6167 – 757.325.6850

"Within fifteen years, nanotech will bring major, major changes."

UNIVERSITY of VIRGINIA
ENGINEERING

Photon Processing of Materials

Our group is engaged in research involving the laser processing of materials, devices, and systems. We have extensive facilities for laser processing of materials using femtosecond laser, nanosecond and long pulsed lasers, pump probe as well as spectroscopic measurement capabilities. For example, we are studying the micro/nano texturing of silicon and germanium surfaces after exposure to femtosecond and nanosecond laser irradiation. Restructuring the surface of silicon enhances the surface area and hence the effective active area of a device increases making it more useful for optoelectronic, water repellency property control and biomedical devices due to the increased surface area. Laser based manufacturing is expected to play an important role for industrial applications.

Photovoltaics

Silicon (Si) based solar cells continue to dominate the photovoltaic (PV) market, accounting for over 85% of all solar cell products in the world. The lowering of manufacturing cost of Si solar cells is extremely important in order for PV technology to be a viable alternative energy source. In recent years various high-power laser-based processes have been developed to realize the goal of lowering the cost of Si PV manufacturing. Although these processes are very attractive, their incorporation into manufacturing is highly dependent upon keeping the solar cell efficiency high while reducing manufacturing cost. We are working to develop a fundamental understanding of laser-induces defects in Si during solar cell fabrication processes and minimization of defects through control of laser process parameters and post treatment methods. We are also developing laser based solar cell manufacturing process for reduction of cost and efficiency improvement.

Nanomaterials

Our group is interested in the development and characterization of novel nanocomposite materials such as those created by mixing nanotubes, plastic and foaming agents. These materials are designed for lightweight electromagnetic shielding and making plastics electrically conducting and are relatively inexpensive to produce.

Devices and Sensors

Significant progress has been made in thermoelectric power conversion devices with efficiencies reaching over 10%. In order to realize the commercial potential of thermoelectric devices, however, further improvements in efficiency, long-term stability at high temperatures and lower cost of fabrication must be realized. A world-wide research effort is being carried out to realize the above goals. We are working to provide scientific understanding of nanograined thermoelectric materials and to achieve further enhancement in efficiency, long-term stability and reduced fabrication costs.

RECENT RESEARCH DEVELOPMENTS

- Laser micro/nanotexturing of metallic surfaces
- Applications of micro/nano textured surfaces for solar cells, superhydrophobic properties and solar thermal.
- Quantum dots for solar energy and sensing applications
- Nanostructures for solar thermophotovoltaics

RECENT GRANTS

- NASA-LaRC- several student support awards for nondestructive evaluation, laser cleaning of surfaces, Photon Sieve
- NIA – Langley Professorship Award
- NSF- Laser induced defect study for solar cells
- NSF-Laser processing of Si/Ge for thermoelectrics
- NSF – Industry University Cooperative Research Center for Lasers & Plasmas for Advanced Manufacturing
- NSF –PF_AIR award for superhydrophobic surfaces

SEAS Research Information
Pamela M. Norris,
Executive Associate Dean for Research
University of Virginia
Box 400232
Charlottesville, VA 22903
pamela@virginia.edu
434.243.7683

UNIVERSITY of VIRGINIA ENGINEERING