

## Mission

To be the leader in research, development, and education, concentrating on laser and plasma applications and advanced materials.

## Working to Innovate

### What we are doing:

- Nanotechnology/quantum dots
- Thin films
- Materials characterization
- Laser micromachining
- Advanced sensors
- Ultrafast laser diagnostics
- Nanotechnology for lab-on-a-chip applications
- Electronic materials
- High-k dielectrics
- Alternative renewable energy and bioapplications
- Electron beam lithography
- VUV lithography
- Solar cells and photodetectors
- Negative electron affinity photocathodes
- Laser induced breakdown spectroscopy
- Femtosecond laser technology
- Carbon nanotubes and nanoparticles
- Surface modification with plasmas



**Dr. Hani E. Elsayed-Ali, Director**

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## Faculty

**Dr. Hani E. Elsayed-Ali**  
**Professor, Department of Electrical & Computer Engineering,**  
**Director, ODU Applied Research Center**

Ultrafast laser-based measurements; laser processing, thin film and nanocrystal fabrication; pulsed laser deposition; semiconductor surface preparation and characterization; electron emitters and electron gun design; and thin film and laser-based sensors

**Dr. Helmut Baumgart**  
**Professor, Department of Electrical & Computer Engineering**

Nanotechnology; microelectronics fabrication; high-k dielectrics for advanced gate stack engineering; atomic layer deposition (ALD) technology of electronic thin film materials; semiconductor device processing; thin film growth; ALD of ZnO for detector and sensor applications

**Dr. Abdelmageed Elmustafa**  
**Professor, Department of Mechanical & Aerospace Engineering**

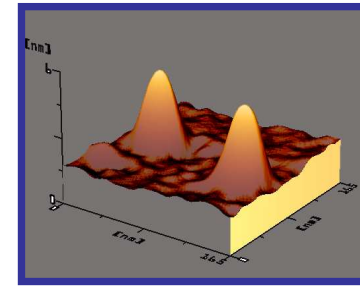
Nanoscale mechanical behavior of materials; nanoindentation (metals, polymers, alloys, interconnects); dislocation and strain gradient plasticity; thin films (mechanical properties and characterization); modeling and simulation (nanoindentation creep and contact mechanics); RF accelerators breakdown

**Dr. Sylvain Marsillac**  
**Professor, Department of Electrical & Computer Engineering**

Solar cells, new inorganic materials for renewable energy applications, innovative tools for in-situ and real-time analysis, novel architectures and techniques for the fabrication of flexible and high efficiency solar cells, materials characterization

**Dr. Gon Namkoong**  
**Professor, Department of Electrical & Computer Engineering**

Development of nitride/ZnO-based materials and devices on innovative substrate materials as well as applying new growth techniques to facilitate material and device improvements; development of organic, hybrid organic-inorganic, inorganic solar cells



**NANOTECHNOLOGY**



**THIN FILM DEPOSITION**



**MATERIALS CHARACTERIZATION**

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## In the Laboratory

ARC has established 18 labs with equipment and facilities valued in excess of \$6 million.

### MATERIALS FABRICATION & PROCESSING

- Atomic layer deposition (ALD)
- RF/DC sputtering
- Pulsed laser deposition (PLD)
- E-beam evaporation
- Thermal evaporation
- Sol-gel
- Spin coating
- Multicharged ion (MCI) system for ion implantation
- Electron beam lithography (EBL)
- Photolithography
- Rapid thermal processing (RTP)
- Reactive ion etching (RIE)
- Laser micromachining
- Laser surface treatment
- Laser/materials interaction

### MATERIALS CHARACTERIZATION

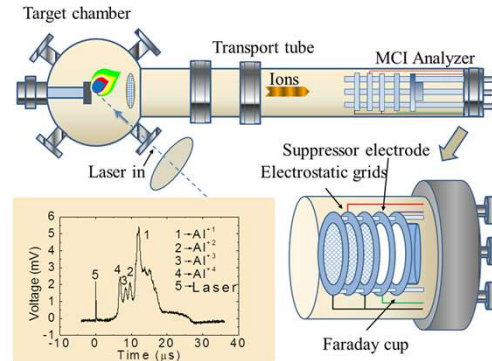
- High resolution transmission electron microscope (HRTEM)
- Scanning electron microscope (SEM)
- Energy dispersive spectroscopy (EDS)
- Atomic force microscope (AFM)
- Scanning tunneling microscope (STM)
- X-ray diffraction (XRD)
- Nanoindentation
- Lifetime fluorescence spectroscopy
- UV-Vis spectroscopy
- Probe station for electrical device testing & semiconductor device analyzer
- Optical microscope
- Time-resolved electron diffraction
- Reflection high-energy electron diffraction (RHEED)

### LASERS

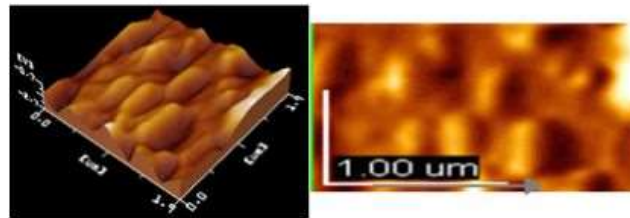
- Femtosecond Ti:sapphire laser
- Q-switched Nd:YAG laser
- Excimer laser

## Fabrication and Analysis

### Laser MCI system



### InP on GaAs (100) by PLD



### Atomic layer deposition (ALD)



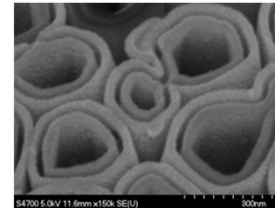
### Excimer laser



### JEOL JSM-6060LV SEM



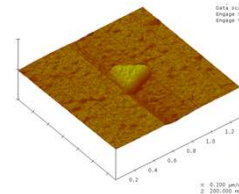
### HfO<sub>2</sub> tube-in-tube structure by ALD



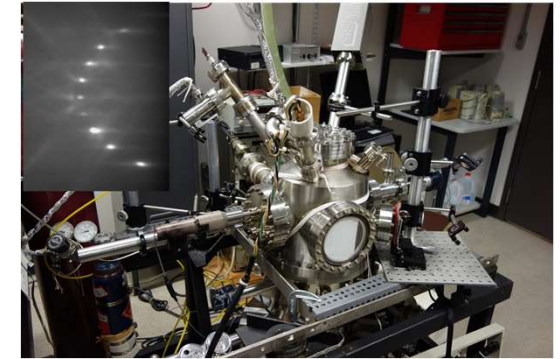
### AJA ATC Orion 5 RF/DC Sputtering System



### Triangular Ag nanoparticle fabricated by EBL



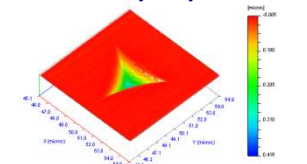
### UHV femtosecond laser PLD system with RHEED



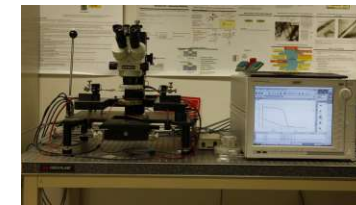
### Nanoindenter XP from MTS



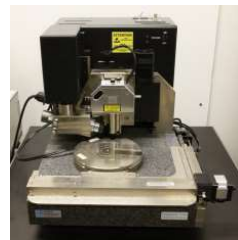
### A triangular Berkovich diamond tip impression



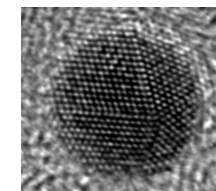
### Probe station and Agilent B1500A semiconductor device analyzer



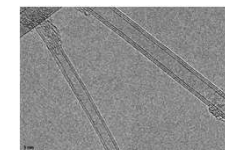
### Atomic force microscope (AFM)



### JEOL JEM-2100F field emission HRTEM



### Au nanoparticle



### BN nanotubes

