Characterization Capabilities

- ◊ **Tribometers**
  - ◊ Coefficient of friction (COF)
  - ◊ Wear rate

Universal Materials Tester (UMT) Micro-tribometer

- ◊ **Surface Science Suite**
  - ◊ Dip coating
  - ◊ Water contact angle measurements
  - ◊ Surface profilometry
- ◊ **Nanoindentation**
  - ◊ Non-destructive elastic modulus and hardness
  - ◊ Nano-scratch

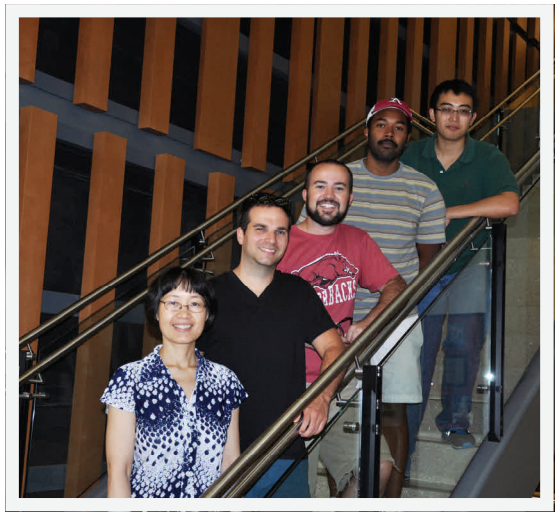
Instrumented Nanoindenter

- ◊ **Atomic Force Microscopy**
  - ◊ Nanoscale surface imaging
  - ◊ Quantitative nanoscale adhesion and modulus mapping
- ◊ **Thin Film Optics**
  - ◊ Transmittance and reflectance
  - ◊ Film thickness
  - ◊ Optical constants

Atomic Force Microscope with Quantitative Nanomechanics Package

Access to User Facilities

- ◊ **High Density Electronics Center (HiDEC)**
  - ◊ Thin film processing
  - ◊ Micro/nanofabrication
- ◊ **Arkansas Nano-Bio Materials Characterization Facility**
  - ◊ Transmission and scanning electron microscopes
  - ◊ X-ray microanalysis tools



Dr. Min Zou (front) and research group, Fall 2014

Nanomechanics and Tribology Laboratory

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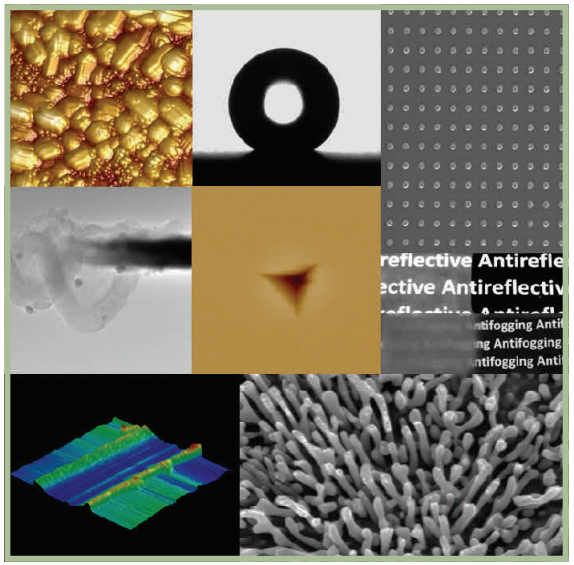
Nanomechanics and Tribology Laboratory



Research, Education, Commercialization

Surface Engineering at the Nanoscale

The Nanomechanics and Tribology Laboratory (NMTL) at the University of Arkansas excels in three areas:

Research, Education, Commercialization

- **Research**
  - Nanoscale surface engineering
  - Polymeric nanoparticle composite films
  - Aluminum-induced crystallization of amorphous silicon
  - Nanomechanics and nanotribology
- **Education**
  - Outreach
  - Nanotechnology Undergraduate Education (NUE) in Engineering
- **Commercialization**
  - Entrepreneurship
  - Patents
  - SBIR/STTR proposals

Group Snapshot

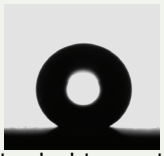
As of Fall 2014, student researchers from NMTL have received the following honors and awards:

- 2 NSF Graduate Research Fellowships
- University of Arkansas Doctoral Academy Fellowship
- Most Innovative Business Plan from Arkansas Governor's Cup
- Al Sonntag Award from STLE
- Numerous other individual honors from NSF, ASME, STLE, IEEE, etc., including best paper and poster awards, scholarships, fellowships, and entrepreneurship awards
- Multiple SURF and Honors College Research Grants to support undergraduate research

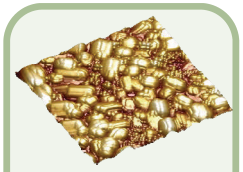
Research Interests

Nanoscale surface engineering

- Micro-electro-mechanical systems (MEMS)
- Mechanical face seals and bearings
- Self-cleaning, anti-fogging, anti-icing, anti-corrosion, and antireflective surfaces
- Dental implants and biomedical devices



Water droplet on water-repellant surface for self-cleaning and antimicrobial applications



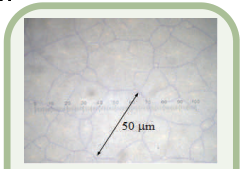
Low friction and highly wear resistant Teflon and silica nanoparticle composite

Polymeric nanoparticle composite films

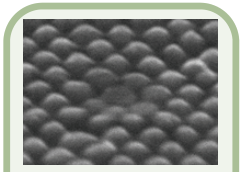
- Durable low friction surfaces
- Increased wear resistance of polymer films
- Bio-inspired coatings

Aluminum-induced crystallization of amorphous silicon

- Large grain single-crystal silicon films grown from amorphous silicon
- Si nanowires and nanostructures for solar cell applications
- Wetting modification by surface texturing



50 micron single-crystal silicon grains grown from amorphous silicon film



Nanoindentation of nickel nanodot patterned surface for MEMS applications

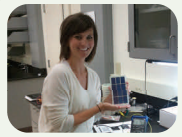
Nanomechanics and nanotribology

- Mechanical properties of nanostructures for MEMS devices
- Designing core-shell nanostructures with novel mechanical properties
- Adhesion and wear at the nanoscale

Education

Outreach

- Mentoring students in the Freshman Engineering Program Honors Research Experience
- Hosting summer Research Experience for Undergraduates (REU) and Research Experience for Teachers (RET) interns



Local middle school teacher demonstrating solar panel she created during RET intership at NMTL

Nanotechnology Undergraduate Education (NUE) in Engineering

- Development of an interdisciplinary nanotechnology laboratory course, providing hands-on training for the next generation of nanotechnologists
- Optional minor in nanotechnology gives students formal recognition of their training in the field

Undergraduate students inspect a solution of gold nanoparticles synthesized during the NUE nanotechnology laboratory course

Commercialization

Entrepreneurship

- WattGlass, LLC formed around technology developed at NMTL
- $20k in winnings from business plan competitions, plus additional $24k from state agencies

Graduate student team led by NMTL student accepting awards at the Arkansas Governor's Cup

Patents

- Growth of large grain single-crystal silicon from amorphous silicon films
- Antireflective and self-cleaning glass coatings
- Bio-inspired adhesion layer for PTFE low friction coatings

Licensed by Arkansas high-tech startups

SBIR/STTR proposals

- SBIR Phase I grant awarded by NSF
- Actively seeking additional funding opportunities