Texas Tech University
Edward E. Whitacre Jr.
College of Engineering

Department of Chemical Engineering

Who we are

Harchander Gill
Assistant Professor
Ph. D. Georgia Institute of Technology

Gregory B. McKenna
Ph. D. Harvard Professor
Lee R. Bowden Chair in Engineering
Ph. D. University of Utah

Sindel L. Simon
Professor
Ph. D. Massachusetts Institute of Technology

M. Nazmul Karim
Professor and Chair
Ph. D. University of Maryland

Mark W. Vaughn
Professor
Ph. D. Texas A&M University

Uzi Mirel
Professor
Ph. D. University of Wisconsin (Madison)

Ronald C. Hedden
Associate Professor
Ph. D. Purdue University

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Department of Chemical Engineering

What we do

POLYMERS, RHEOLOGY & ADVANCED MATERIALS

Gregory B. McKenna
RHEOLOGY

1. Nanorheology
   - The TU bubble inflation method is used to study the creep response of ultrafine polymer films. From the temperature dependence of the creep, we can obtain the glass transition in films below 10 nm in thickness. We are also developing rheology of ultrafine films using the liquid dewetting method. We have the first evidence of Tg reductions in films floating on glycerol.

2. Molecular Rheology
   - The group is also doing mechanical rheology at the nanoscale in model molecular architectures from rings to bottle brushes.

3. Dynamics of Collodial Glasses
   - We are using multiplexed diffusing wave spectroscopy to study the glassy behavior of thermo-responsive and battery-responsive colloidal systems. Rheological measurements are used to investigate the aging responses of thermo-responsive colloids near the glass concentration.

ADVANCED MATERIALS

Brandon Weeks
ENERGETIC MATERIALS

- Focus is on fundamental understanding of energetic materials and how nanoscale features contribute to bulk properties including thermodynamic/kinetic and mechanical properties.

- Current work is based on in situ spectroscopy of energetic materials which will lead to a fundamental understanding of ignition and detonation properties and eventually to safer energetic materials.

- Blast effects and mitigation of explosives for homeland security.

- Synthesis of novel energetic materials.

Siva A. Vanapalli
SOFT MATERIAL MECHANICS

- We seek to understand the fundamental physical principles governing the mechanical behavior of soft materials by probing their microstructures and dynamics. We also manipulate these materials using microfluidic devices.

- The focus of our research is to develop microfluidic tools that can be used for high-throughput single cell and biomolecular analysis. We anticipate these tools will find broad applications in the field of life sciences, biomedical diagnostics and drug discovery.

- Currently we are engineering droplet-based microfluidic processors for biomolecule analysis and also addressing fundamental physics associated with droplet behavior in microfluidic networks.

MICROFLUIDICS

- Compositional control of nanoscopic structures of biological membrane models can be achieved using these domains on membrane properties.

- Conformations and behavior of polymers, proteins and gel at solid/liquid and liquid/liquid interfaces.

- Mechanical strain and its influence on the chemical behavior of the biological interfaces.

- Microfluidic devices for nanoscale cell structure

Mark W. Vaughn

Karlene A. Hoo

BIOENGINEERING

M. Nazmul Karim

Renewable Energy

Siva A. Vanapalli

Biotechnology

Harvinder Gill

- Micro and nanosystems for drug and vaccine delivery; biomaterials; medical implantation; immunomodulation.

- Synthesis of novel energetic materials.

- Development of residual stresses.

- Properties of nanocomposites.

- Development of environmental and reactor processes.

- Properties of polymers and condensed matter physics.

- Nanoscale features contribute to bulk properties including thermodynamic/kinetic and mechanical properties.

- Blast effects and mitigation of explosives for homeland security.

- Synthesis of novel energetic materials.

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