11th Annual Texas Soft Matter Meeting

Friday, August 5, 2022

Mulva Auditorium
Engineering Education and Research Building
University of Texas at Austin

Sponsors:

Anton Paar

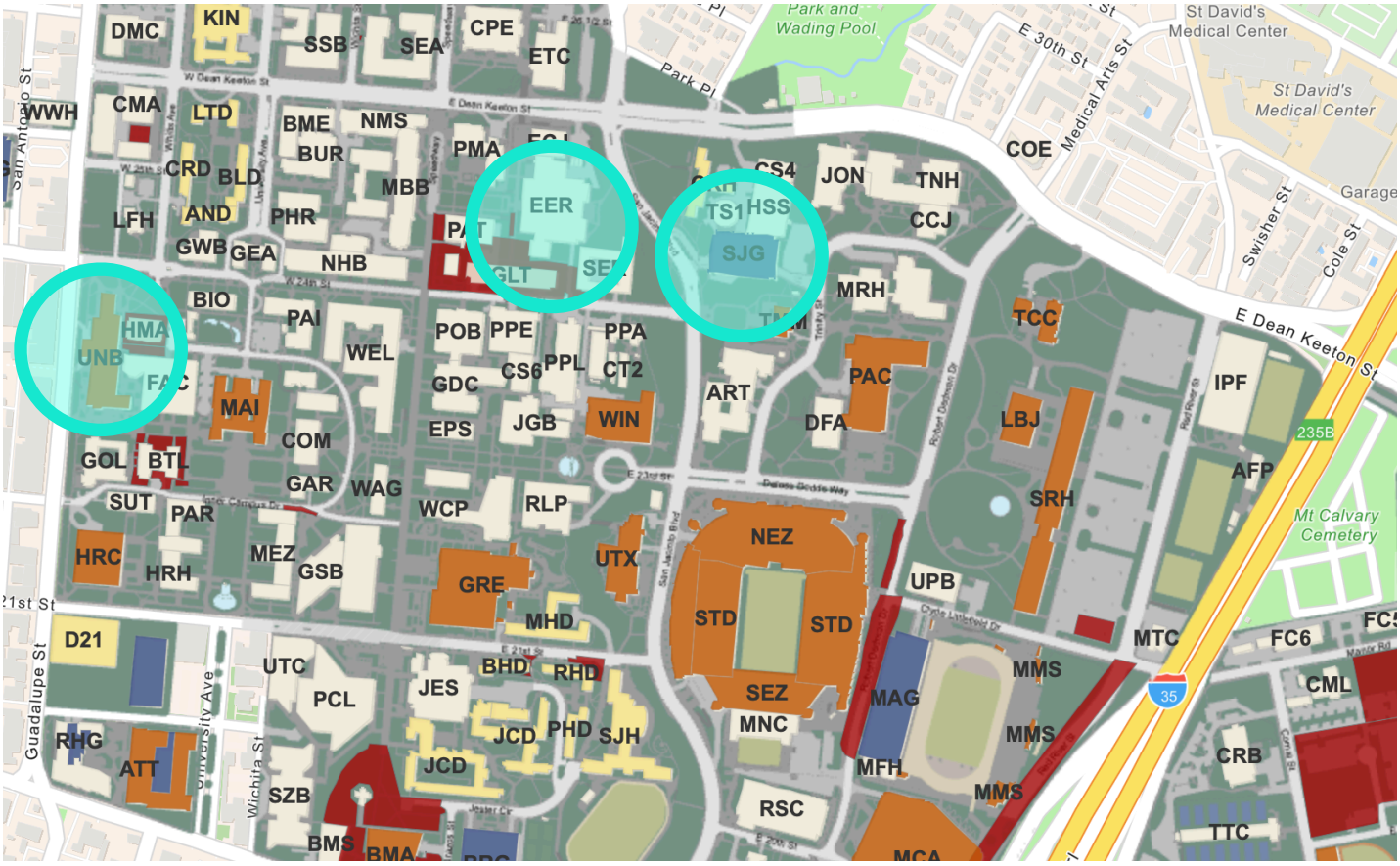
APS physics™

The University of Texas at Austin
College of Natural Sciences

CENTER FOR NONLINEAR DYNAMICS
UNIVERSITY OF TEXAS AT AUSTIN

11th Texas Soft Matter Meeting Schedule

From	To	
7:30	**8:30**	Breakfast available
8:00	**8:30**	Registration opens
8:30	**8:40**	Opening remarks
8:40	**9:20**	**Session A:** Invited talk: Nikhil Verghese
9:20	**10:00**	**Session B:** Contributed session: Biological and Synthetic Polymers I
10:00	**10:30**	Morning break and group photo
10:30	**11:10**	**Session C:** Invited talk: Orrin Shindell
11:10	**11:55**	**Session D:** Contributed session: Biological and Active Matter
11:55	**13:00**	Lunch
13:00	**13:40**	**Session E:** Invited talk: Gabriela Romero Uribe
13:40	**14:20**	**Session F:** Contributed session: Biological and Synthetic Polymers II
14:20	**15:00**	**Session G:** Invited talk: Tim Chen
15:00	**15:25**	Afternoon break
15:25	**16:15**	**Session H:** Contributed session: Composite Matter
16:15	**16:55**	**Session I:** Invited Talk: Delia Milliron
16:55	**17:00**	Closing remarks
17:00	**open**	Optional: Happy Hour at the Texas Union Underground



Parking:
San Jacinto Garage (SJG)
2401 San Jacinto Blvd.
Austin, TX 78705
Directions: Take I-35 to Dean Keeton. Please note that I-35 splits into upper (express) and lower (local) lanes around UT. You will need to take the lower lanes of I-35 (left two lanes) to access the Dean Keeton exit.
Parking instructions: upon arriving at SJG, take a parking ticket. When you arrive at the conference registration desk, trade in your parking ticket for a printed parking permit with QR code. You will need this QR code to exit the garage at no cost. Please do not share your QR code with anyone else, otherwise you may be charged upon exit.

Conference Venue:
Engineering Education and Research Center (EER)
Mulva Auditorium, Ground Floor of EER
2501 Speedway
Austin, TX 78712
Entrance: on E 24th St., between SER and GLT buildings.
Alternate entrance: on San Jacinto Blvd., North of SER building.
Alternate entrance: on West side of EER, between PMA and PAT buildings.

Happy Hour Venue:
Union Building (UNB)
Texas Union Underground, First Floor of UNB
https://universityunions.utexas.edu/food-fun/texas-union-underground
2308 Whitis Ave.
Austin, TX 78712

Session A: Invited talk: Nikhil Verghese

Corporate Fellow, Sabic and Adjunct Faculty, Rice University

Thermoplastic Composite Solutions for Mass Markets: Opportunities and Challenges

Thermoplastic composites are increasingly being considered for large volume applications that involve replacing incumbent materials such as metals. The Automotive and Consumer Electronics space in particular, offers an interesting opportunity to capitalize on the performance of fiber-reinforced composites because of the general need to go to lighter, thinner and reduce assembly costs. These applications tend to lean towards a large part build volume, typically in the range of a 50k to 1 Million parts per year. In the case of consumer electronics, the model platform also tends to be short lived, which means there is a constant need to stay on top of what the customer's perceived needs are and adapt accordingly with new models. This makes the designed flexibility of the manufacturing line very important. All of this creates the perfect opportunity to explore automation driven production approaches. The development challenges however for this automation driven production approach were identified to be: high speed production, with minimal scrap and minimal human intervention resulting in low conversion costs, while still maintaining a high degree of flexibility.

In this presentation, we will take a holistic view on what it will take to deliver thermoplastic composites to mass markets and lay the foundation by accounting for the "trifecta" concept of balancing clever part design, materials development and creative part processing technologies.

Session C: Invited talk: Orrin Shindell

Department of Physics, Trinity University

Optimal Energy Consumption in Bacterial Flagellar Motility

Flagellate bacteria propel themselves through their low Reynolds number environment by rotating a helical appendage with ion-driven rotary nanomotors. Using computational fluid dynamics and experimental data, we determine the energy cost of bacterial flagellar motility over a range of bacterial body geometries. The computational model is calibrated using large-scale dynamically similar fluid dynamics experiments to ensure quantitatively accurate results. The experimentally measured motion of bacteria is input into the

calibrated simulations to determine the forces exerted over the bacteria models. Combining the measured motion and the computed forces enables a determination of the energy cost for bacterial motility. We find the cellular geometries and the torque-speed response of flagellar motors in real bacteria are poised near optimal energy cost values.

Session E: Invited talk: Gabriela Romero Uribe

Departments of Biomedical Engineering & Chemical Engineering, University of Texas at San Antonio

Stimuli-Responsive Soft Biomedical Materials for Programmable Drug Delivery

Despite the growing evidence supporting the use of biocompatible materials as vehicles to deliver therapeutics, their clinical application is often limited by challenging biological environments such the blood-brain barrier (BBB). The BBB hinders most molecules from entering the central nervous system from the blood stream, limiting the delivery of molecules into the brain to treat brain malfunctions. We investigate soft biomedical materials as minimally invasive and transgene-free alternatives for the treatment of brain disorders, including safer strategies to bypass the blood brain barrier, and the development of new technologies for wireless neuromodulation and gene-editing therapies. We take advantage of hysteresis power loss of magnetic nanoparticles under alternating magnetic fields to control the thermodynamic phase transition of thermo-responsive polymer brushes nanocoatings to release neuromodulatory compounds in multiple microdoses. This chemomagnetic hybrid system allow us to modulate on-demand neural activity, which is critical for the treatment of neurological disorders and psychiatric conditions. In the other hand, pH sensitive biocompatible block co-polymers are used to fabricate artificial viruses. Gene-editing systems have become an important tool in biological engineering and genome editing, providing programmable platforms for precision gene targeting. These tools have great potential as therapeutics that could potentially correct disease-causing mutations. Most of the gene-editing approaches use viral vectors to deliver the therapeutic tools, limiting clinical applications due to safety concerns. We investigate stimuli-responsive soft biomedical platforms that enable a synthetic, non-invasive strategy for the delivery of gene- editing tools. Our non-viral delivery approach focuses on mimicking biological organisms' functionalities and engineering them into a synthetic polymeric carrier. Specifically, we develop polymeric technologies for the delivery of gene-editing tools across the BBB for the treatment of glioblastoma and other brain cancers.

Session G: Invited talk: Tim Chen

Department of Mechanical Engineering, University of Houston

Design of elastic surfaces using conformal mapping

Elastic surfaces that can transform between multiple geometrical configurations is of great engineering value, with applications ranging from deployment of space-based PV arrays, erection of temporary shelters, realization of flexible displays, to understanding the encapsulation and release of viral RNAs. In general, it is not a trivial problem to ensure that a shape with a planar rest configuration can geometrically transform into a target 3D shape. This is compounded with the difficulty of physically realizing the local deformations necessary to achieve such global transformation. Here, we focus on the application of conformal mapping to abstract and rationalize the geometrical transformation of a number of microstructure designs. A conformal map is a function that preserves angles (and shape) locally, but not lengths. This differential geometry technique is often used by cartographers to map a globe to the plane. One observation of such mapping is that some regions are scaled (enlarged or shrunk) more than others. Conversely, to globally transform a physical surface to 3D, we can implement such local scalings as mechanical deformations. While it is difficult to control the relative deformations of natural materials, numerous meta-materials with designed microstructures exhibit such behavior regularly. We discuss several meta-materials with tunable yet isotropic expansion and contractions. They employ a wide spectrum of techniques ranging from kirigami, origami, hydrogel, linkages, serpentine, chirality, and so on. The design and fabrication of conformal transformable structures is a transdisciplinary challenge involving input from advanced manufacturing, computational design, material science, and mechanics. By recognizing that many natural and artificial materials exhibit isotropic deformation behavior, we hope to inspire researchers to adopt conformal mapping in the design of next generation surface-based engineering systems.

Session I: Invited Talk: Delia Milliron

Department of Chemical Engineering, University of Texas at Austin

Colloidal nanocrystal gels

Controlling the arrangement of inorganic nanocrystals in assemblies allows realization of materials whose properties depend both on the distinct

characteristics of their nanoscale building blocks and on their organization. Nanocrystal gel assemblies are interesting because their porous, percolating structures can in principle lead to tunable (valence-dependent) material properties with dynamic reconfigurability. Their porosity, tunability, and reversibility represent a compelling complement to properties of nanocrystal superlattices that typically form dense packings in largely irreversible assembly processes. However, strategies for assembling nanocrystal gels with controlled valence and without irreversible fusion have been challenging to advance. We have developed gelation strategies based on reversible interactions between nanocrystals, including dynamic covalent bonding and depletion attraction. Metal oxide nanocrystals resist fusion upon assembly, so tin-doped indium oxide nanocrystals allow us to achieve switchable infrared optical properties based on coupling between their localized surface plasmon resonance when networked in gels.

Session B: Contributed session: Biological and Synthetic Polymers I

B01: Understanding the Effect of Ionic Supernatant on Stability and Size of Coacervates: A Simulation Study
Atanu Baksi, Department of Chemical and Biomolecular Engineering, University of Houston

B02: Strain-induced critical slowing of stress relaxation in elastic networks
Jordan Shivers, Department of Chemical and Biomolecular Engineering, Rice University

B03: Mechanical Properties of Multilayer Biopolymer Thin-Film Composites Prepared by Interlayer Infusion
Justin Smith, Department of Chemical and Biomolecular Engineering, University of Houston

B04: Sustainable Chitosan Thin Film Based Humidity Sensor
Wafa Tonny, Department of Materials Science and Engineering, University of Houston

B05: Critical evaluation of implicit solvent hydration free energies from EEF1, ABSINTH, and GB/SA versus explicit solvent molecular-QCT calculations
Rohan Adhikari Sridhar, Department of Chemical and Biomolecular Engineering, Rice University

B06: Charge Sequence Dependent Conformation and Solution Behavior of Polyampholyte Polypeptides
Winnie Shi, Department of Chemical and Biomolecular Engineering, Rice University

B07: Influence of charge fraction on transport of penetrants through polyelectrolyte brushes
Shahryar Ramezani Bajgiran, Department of Chemical and Biomolecular Engineering, Rice University

B08: Effect of molecular substitutions, pH, and shear on the mechanical properties of thia- conjugate addition hydrogels
Anne Crowell, Department of Chemical Engineering, University of Texas at Austin

B09: Molecular Design of Nanoparticles for Nucleic Acid Delivery
Alexander Marras, Department of Mechanical Engineering, University of Texas at Austin

B10: Drug-loaded polymersomes for image-guided drug delivery
Ceren Atila Dincer, Department of Chemical Engineering, University of Texas at Austin

B11: Effect of charge density and sequence on physical properties of

salt-free polyelectrolyte solutions
Mohammad Samani, Department of Chemical and Biomolecular Engineering, Rice University

B12: Simulation of Weak Polyelectrolyte Brush
Xin Yuan, Department of Chemical Engineering, University of Houston

B13: Tunable Functionalization and Repurposing of Polyolefin Waste to Value Added Polyurethanes
Ronard Herrera, Department of Chemical and Biomolecular Engineering, University of Houston

Session D: Contributed session: Biological and Active Matter

D01: The role of amphiphilicity on the orientation distribution of Janus particles at the air-water surface
Elton Lima Correia, Department of Chemical, Biological, and Materials Engineering, University of Oklahoma

D02: Rheology of Composite Biopolymer Networks Under Shear
Anupama Gannavarapu, Department of Chemical and Biomolecular Engineering, Rice University

D03: Characterizing interactions between EPS components of Pseudomonas Aeruginosa biofilms and glycoside hydrolases
Bikash Bhattarai, Department of Mechanical Engineering, Texas Tech University

D04: Atomistic and Coarse-Grained MD simulations of FUS-LCD for reproducing thermodynamic properties of biomolecular condensates
Ayush Gupta, Department of Chemical and Biomolecular Engineering, University of Houston

D05: A Computational Study for Predicting Stability Differences in Multiple Conformations of the Sars-Cov-2 Frameshifting RNA Element
Karim Malekzadeh, Department of Chemical and Biomolecular Engineering, University of Houston

D06: Comparison of Advanced Sampling Techniques for Atomistic Scale RNA Folding
Kosar Rahimi Nasrabadi, Department of Chemical and Biomolecular Engineering, University of Houston

D07: Can Over-expression of type 1 Fimbriae Enhance the Adhesion of Bacteria to Hydrocarbons?
Udayanidhi Ramesh Kumar, Department of Chemical and Biomolecular Engineering, University of Houston

D08: Dynamics of filamentous viruses in polyelectrolyte solutions
Farshad Safi, Department of Chemical Engineering, University of Houston

D09: TBA
Zixu Huang, Department of Mechanical Engineering, University of Houston

D10: Coupling of Strain and Energy Consumption in Actomyosin Active Gels
Francis Cavanna, Department of Physics, University of Texas at Austin

D11: Thermal Noise Imaging: From single microtubule to higher order structure mechanics
Ilya Beskin, Department of Physics, University of Texas at Austin

D12: Analyzing energy economy of conventional and bioinspired actuators with equal power outputs
Jake McGrath, Department of Physics, University of Texas at Austin

D13: Pulsed Contractile Actomyosin Gels
James Clarke, Department of Physics, University of Texas at Austin

D14: An integrability technique for fluid flow induced deformation of a boundary hair
Jonas Smucker, Department of Physics, University of Texas at Austin

Session F: Contributed session: Biological and Synthetic Polymers II

F01: Enhancing Polyolefin Recycling with Cellulose Nanocrystals
Ibrahim Kamara, Department of Materials Science and Engineering, University of Houston

F02: Dynamics, Structure, and Rheological Behavior of Polymer-Mediated Interactions
Mariah Gallegos, Department of Chemical and Biomolecular Engineering, University of Houston

F03: Impact of processing effects on surface segregation of bottlebrush polymer additives
Dongjoo Lee, Department of Chemical and Biomolecular Engineering, Rice University

F04: Sustainable Thermoplastic Elastomers with Ionic Interactions
Josiah Hanson, Department of Chemical and Biomolecular Engineering, University of Houston

F05: Morphology Dependent Microstructural Deformation and Structure-Property Relationship Studies on Styrenic Thermoplastic

Elastomer Films
Khadar Basha Shaik, Department of Chemical and Biomolecular Engineering, University of Houston

F06: Sequence-Dependent Solvent and Thermal Annealing Pathways for Rapid Ordering of Block Copolymer Thin Films
Kshitij Sharma, Department of Chemical and Biomolecular Engineering, University of Houston

F07: Thermally and Mechanically Resistant Hydrogel Electrolyte for Supercapacitors
Mina Shanbedi, Department of Chemical and Biomolecular Engineering, University of Houston

F08: Sustainable Epoxy Resins Derived From Syringic Acid
Rosalie Berg, Department of Chemical and Biomolecular Engineering, University of Houston

F09: Greener Options for 3D Printing: Chitin and Chitosan as an Additive / Alternative Feedstock
Samuel Wallaert, Department of Chemical and Biomolecular Engineering, University of Houston

F10: Nanoparticle dynamics in semidilute polymer solutions: rings versus linear chains
Shivraj Bhagwatrao Kotkar, Department of Chemical and Biomolecular Engineering, University of Houston

F11: Rapid Heirarchical Nanostructures of Lamellar Block Copolymer Thin Films via Microwave Annealing
Ugur Aslan, Department of Chemical and Biomolecular Engineering, University of Houston

F12: Rheological Studies of Silica Nanoparticle Networks at the Air/Water Interface
Siddharth Thakur, Department of Chemical, Biological, and Materials Engineering, University of Oklahoma

Session H: Contributed session: Composite Matter

H01: Can charge/wettability bidispersity of particles lead to easier stabilization of Pickering Emulsions?
Arsalan Abutalebi, Department of Mechanical Engineering, Texas Tech University

H02: Heating patterns of carbon fibers and their composites in radio frequency fields
Smita Shivraj Dasari, Department of Chemical Engineering, Texas A&M University

H03: Can the Power Law Model predict behavior of Colloidal

Dispersions for 3D Printing Applications?
Mohammed Naimul Hoque, Department of Mechanical Engineering, Texas Tech University

H04: Colloidal model for the study of non-classical nucleation and crystallization
Gary Chen, Department of Chemical and Biomolecular Engineering, University of Houston

H05: Dynamics of Tracers in Deeply Supercooled Nanoparticle Liquids
Peter Edimeh, Department of Chemical and Biomolecular Engineering, University of Houston

H06: The influence of asphaltenes structure and aggregation on water-in-oil emulsion stability
Nataira M. Pagan Pagan, Department of Chemical and Biomolecular Engineering, Rice University

H07: Pinching dynamics of dense colloidal suspensions with depletion attractions
Diego Soetrisno, Department of Chemical Engineering, University of Houston

H08: Rheology of glassy nanoemulsions in the presence of different polymer depletant contents
Reza Foudazi, Department of Chemical, Biological, and Materials Engineering, University of Oklahoma

H09: Understanding the Growth Kinetics of Organic Crystals from Organic Solvent
Lakshmanji Verma, Department of Chemical and Biomolecular Engineering, University of Houston

H10: Patch Repair of Composites Using Dielectric Barrier Discharge Induced Heating and Curing
Anubhav Sarmah, Department of Chemical Engineering, Texas A&M University

H11: Confinement effects on electrical conductivity and dielectric permittivity of graphene and reduced graphene oxide dispersed polymer nanocomposite films
Farzana Likhi, Department of Materials Science and Engineering, University of Houston

H12: Fracture-controlled surfaces for low ice adhesion and extreme durability
Sina Nazifi, Department of Chemical and Biomolecular Engineering, University of Houston

H13: Liquid-crystal Templated Membranes with Slit-like Pores
Homa Ghaiedi, Department of Chemical Engineering, University of Arkansas

H14: Enabling Solution Processible COFs Through Suppression Of Precipitation During Solvothermal Synthesis

Safiya Khalil, Department of Chemical and Biomolecular Engineering, Rice University

H15: Colloidal Nanosurfactants for Additive Manufacturing

Minxiang (Glenn) Zeng, Department of Chemical Engineering, Texas Tech University

H16: Reconfigurable Ion Pairs

Scott Barrett, Department of Chemistry and Biochemistry, Texas State University