# Program

## 8th Annual Texas Soft Matter Meeting

Friday, August 16, 2019, Texas Tech University

Texas Tech Innovation Hub. Rm. 103-105
Breakfast, Lunch, Coffee Break, Poster Reception – Atrium

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**7:30 am – 8:30 am**
Registration and breakfast

**8:30 am – 8:40 am**
Welcome and opening remarks (Drs. Joseph Heppert, Wei Li, Ya-Wen Chang)

**8:40 am – 9:20 am**
**Invited Talk**
**Jeremy Palmer** (University of Houston)
*Modeling nanoparticle transport in polymer solutions*

**9:20 am – 10:10 am**
**Sounds Bites I: Polymers** (chair: Wei Li)

**1. Kristin Hutchins** (Texas Tech University)
*Design of materials for removal of pharmaceutical contaminants*

**2. Kasturi Sarang** (Texas A&M University, Jodie Lutkenhaus's Group)
*Poly(fluorene-alt-naphthalene diimide) (PFNDI) as n-type polymer electrodes for energy storage*

**3. Madhusudhan Reddy Pallaka** (Texas Tech University, Sindee Simon's Group)
*Synthesis of thermoplatic epoxy in CPG nanopores*

**4. Md Mezbah Uddin** (Texas Tech University, Ya-Wen Chang's Group)
*Swelling characteristics of soft composite gels*

**5. Dongjie Chen** (Texas Tech University, Greg McKenna's Group)
*Polymer Macrocycles: a novel topology to control dynamics of rubbery materials*

**6. Hongda Cao** (University of Houston, Megan Robertson's Group)
*3D Printable water-degradable polymers*

**7. Qian Tian** (Texas Tech University, Sindee Simon's Group)
*Butyl methacrylate polymerization kinetics in nanoporous confinement*

**8. Shuang Jin** (Texas Tech University, Greg McKenna's Group)
*Effect of nanoconfinement on polymer chain dynamics*

**9. Zach Fondren** (Texas Tech University, Greg McKenna's Group)
*Crystallization kinetics of PETN thin-films on different material substrates*

**10. Sourya Banik** (Texas Tech University, Greg McKenna's Group)
*Dynamics of circular polymers*

**11. Kapil Surve** (University of Houston, Ramanan Krishnamoorti's Group)
*Investigation of HTHP polymers post thermal ageing*

**12. Amy Le** (University of Houston, Ramanan Krishnamoorti's Group)
*Understanding dynamics of copolymers of Isobutylene and cyclic monomers*

**13. Wei Li** (Texas Tech University)
*Responsive polyelectrolyte nanofilms and hydrogels*

**10:10 am – 10:30 am**
Coffee break

**10:30 am – 11:10 am**
**Invited Talk**
**Gordon Christopher** (Texas Tech University)
*How can we manipulate the properties of particle laden interfaces?*

**11:10 am – 11:50 pm**
**Sounds Bites II: Colloids and Nanoparticles** (chair: Wei Li)

**1. Dali Huang** (Texas A&M University, Zhengdong Cheng's Group)
*Engineered 2D magnetic nanoplates for interfacial applications*

**2. Mingfeng Chen** (Texas A&M University, Zhengdong Cheng's Group)
*Rainbows in a vial: controlled assembly of 2D colloids in two perpendicular external fields*

**3. Mariah Gallegos** (University of Houston, Jacinta C. Conrad's Group)
*Phase behavior of colloids with polymer-mediated attractions*

**4. Micah Green** (Texas A&M University)
*Heating of carbon nanotube systems by RF heating*

**5. Anish Patel** (Texas A&M University, Jodie Lutkenhaus's Group)
*Thermally stable Aramid nanofiber separators for energy storage*

**6. George Tan** (Texas Tech University)
*Fabrication of nanoporous polycaprolactone microtubes by core-sheath electrospinning*

**7. Ali Slim** (University of Houston, Jacinta C. Conrad's Group)
*Particle dynamics in semidilute polyelectrolyte solutions*

**8. Khurshida Afroz** (Texas Tech University, Nurxat Nuraje's Group)
*HMF oxidation to FFCA using CdS catalyst*

**9. Edward Quitevis** (Texas Tech University)
*Dissolution of polycrystalline cellulose fibers in ionic liquids*

**10. Prakash Parajuli** (Texas Tech University, Noureddine Abidi's Group)
*Cellulose-based monoliths with enhanced surface area and porosity*

**11:50 pm – 12:50 pm**
Lunch (Atrium)

**12:50 pm – 1:30 pm**
**Invited Talk**
**Elizabeth Q. Contreras** (Aramco Services Company)
*Engineered polyaramide vesicles: enhancing the mechanical properties of cement*

**1:30 pm – 2:05 pm**
**Sounds Bites III: Rheology and Mechanics** (chair: Ya-Wen Chang)

**1. Diego Soetrisno** (University of Houston, Jacinta C. Conrad's Group)
*Extensional rheology of colloid-polymer mixtures with bridging*

**2. Mohammed Naimul Hoque** (Texas Tech University, Gordon Christopher's Group)
*Dripping-onto-substrate (DoS) rheometry of colloidal Suspensions*

**3. Pouria Nourian** (Texas Tech University, Rajesh Khare's Group)
*Application of probe rheology simulation technique in rheological characterization of soft matter*

**4. Satish chandra hari Mangalara** (Texas Tech University, Greg McKenna's Group)
*Non-linear mechanical spectroscopy of polymers*

**5. Qi Li** (Texas Tech University, Greg McKenna's Group)
*Soft colloidal micro-rheology: from glass transition to particle interaction*

**6. Rafikul Islam** (Texas Tech University, Rajesh Khare's Group)
*Determination of polymer gels viscoelasticity using particle rheology simulations*

**7. Masoud Norouzi Darabad** (Texas Tech University, Mark W. Vaughn's Group)
*Capillary imbibition of emulsions in thin rectangular channels*

**8. Hugo Miniere** (Texas Tech University, Ya-Wen Chang's Group)
*Jet stability in yield stress materials*

**9. Maxine Quitaro** (Anton Paar USA) [sponsor]
*Overview of Anton Paar Rheometer-Raman Setup*

**2:05 pm – 2:45 pm**
**Invited Talk**
**José Alvarado** (University of Texas at Austin)
*Nonlinear flow response of soft hair beds*

**2:45 pm – 3:05 pm**
Coffee break

**3:05 pm – 3:45 pm**

**Invited Talk**

**Keshia Walters** (University of Oklahoma)
*Design, Synthesis, and Characterization of Stimuli Responsive Polymer Systems*

**3:45 pm – 4:05 pm**

**Sounds Bites IV: Biological Interfaces** (chair: Ya-Wen Chang)

**1. Lingjuan Qi** (Texas Tech University, Gordon Christopher's Group)
*Effects of CxEy surfactants on the formation of pellicles by P. aeruginosa*

**2. Dejie Kong** (Texas Tech University, Greg McKenna's Group)
*Rheology of linear/circular DNA mixtures in the linear entanglement regime*

**3. Fahimeh Khakzad** (University of Houston, Megan L. Roberston and Jacinta C. Conrad's Group)
*Smart antifouling polymer brushes for paints and coatings*

**4. Brandon Niese** (University of Texas at Austin, Vernita Gordon's Group)
*Bacteria response to mechanics*

**5. Marilyn Wells** (University of Texas at Austin, Vernita Gordon's Group)
*Effects of Enzymatic and Vapor Nanobubble Treatment on Neutrophil Engulfment of Bacterial Biofilms*

**4:05 pm – 6:00 pm**

Poster and reception

**5:30 pm**

Awards presentation and concluding remarks (Drs. Rajesh Khare, Wei Li, Ya-Wen Chang)

## Invited Abstracts

**Jeremy Palmer** (jcpalmer@uh.edu)
Chemical Engineering, University of Houston

*Modeling Nanoparticle Transport in Polymer Solutions*

The dynamics of nanoparticles in complex fluids are of great interest for applications in drug delivery, oil recovery, and materials processing. Particle mobility is well described by the generalized Stokes-Einstein (GSE) relation when the nanoparticles are much larger than the polymers. Violations of GSE predictions are observed, however, when the size of nanoparticles is comparable to or smaller than length scales in polymer solutions [1]. We investigate the microscopic origin of this anomalous behaviour using multi-particle collision dynamics (MPCD) [3], an advanced algorithm for rigorously modelling solvent-mediated hydrodynamic interactions in coarse-grained, mesoscale simulations. We apply MPCD to study transport in nanoparticle-polymer systems and the effects of many-body hydrodynamic interactions on this behaviour. We demonstrate that the translational centre-of-mass motions of both nanoparticles and polymers are sub-diffusive on short times before transitioning into a diffusive regime on longer time scales [2]. The long-time diffusivities of nanoparticles collapse according to scaling predictions [4], in accord with recent experiments [1]. The sub-diffusive behaviour predicted by MPCD simulations, by contrast, agrees with experiments [1], but significantly deviates from theoretical predictions. We show that this disagreement is due to a hitherto unreported transport mechanism characterized by the tight coupling of the translational motions of the nanoparticle and polymer centres-of-masses, which is not accounted for in current theories. Finally, we investigate the influence of polymer flexibility on particle transport. As the persistence length of the polymers increases, the nanoparticle dynamics become more subdiffusive and decouple from the dynamics of the polymer chain centre-of-mass [5].

References

[1] R. Poling-Skutvik, R. Krishnamoorti, and J. C. Conrad, ACS Macro Lett., 4, 1169-1173 (2015).
[2] R. Chen, R. Poling-Skutvik, A. Nikoubashman, M. P. Howard, J. C. Conrad, and Jeremy C. Palmer, Macromolecules, 51, 1865-1872 (2018)
[3] A. Malevanets and R. Kapral, J. Chem. Phys., 17, 8605-8613 (1999)
[4] L.-H. Cai, S. Panyukov, and M. Rubinstein, Macromolecules, 44, 7853–7863 (2011)
[5] R. Chen, R. Poling-Skutvik, M. P. Howard, A. Nikoubashman, S. A. Egorov, J. C. Conrad, and J. C. Palmer, Soft Matter, 15, 1260-1268 (2019)

**Gordon Christopher** (Gordon.christopher@ttu.edu)
Mechanical Engineering, Texas Tech Univeristy

*How Can We Manipulate the Properties of Particle Laden Interfaces?*

Bulk properties of particle stabilized Pickering Emulsions are determined by dispersed drops' behavior. In Pickering emulsions, particle laden interfaces create steric repulsion and interfacial viscoelasticity, altering drop behavior. By controlling these interfacial properties, emulsions can also be manipulated. However, to do this requires understanding the relationship between interfacial mechanical properties and contact angle, interface composition, and inter-particle interactions. In the Christopher lab, we have created a suite of unique techniques that allow us to characterize such relationships.

Using Bessel Beam microscopy, we have found that even monodisperse particle populations at oil/water interfaces have large contact angle distributions due to normal diffusion and particle variation. Using Stokesian Dynamic simulations, we have found that increasingly random initial particle order and stronger

hydrodynamic interactions create denser networks when particles aggregate at an interface. Finally, using simultaneous interfacial rheology and microscopy, we have found that inter-particle attraction sets interfacial moduli magnitude but microstructure deformation determines global properties such as relative elasticity and yield strain. Our results indicate that it is possible to manipulate particle laden interfaces so that in the future we may manipulate bulk emulsions.

**Elizabeth Q. Contreras** (Elizabeth.Contreras@aramcoservices.com)
Aramco Services Company
*Engineered Polyaramide Vesicles: Enhancing the Mechanical Properties of Cement*
Oil and gas wells undergo stresses induced by various downhole conditions that can lead to fractures in the cement sheaths, which force production shutdown and high remedial costs. To overcome current challenges in the construction of oil wells, innovative polymers, based upon a family of polymers known as aramides, are mixed into cement to enhance cement elasticity without compromising compression strength.
Findings show that the new polyamide-cements exhibit unconfined compressive strength improvements greater than 25% when compared to latex-treated cement. Furthermore, cement performance based upon tri-axial load cell measurements, quantitatively analyzed the reliability of cement by measuring cumulative fatigue damage to predict cement failure. Strain-controlled cyclic tests to measure mechanical properties at 20 °C showed aramide-cements resisted deformation better than the latex cement. Aramide cements had only an 11% permanent strain when compared to latex cement, which had a 27% permanent strain. It is important to assess the mechanical performance of oil well cement, which is subject to cyclic loading due to dramatic changes in pressure and temperature during production. Lastly, as temperature varies up to 180 °C, the rate of cement strength retrogression decreases for aramide-cement, allowing for higher strength at increased temperatures when compared to latex cements and to cement with no additives.
Collectively, the data on elasticity and high compressive strength for cement systems show the value of this new polymer additive for imparting mechanical properties essential to extend the endurance of wellbore cement sheaths.

**José Alvarado** (alv@chaos.utexas.edu)
Physics, University of Texas at Austin
*We are 'Hairy' on the Inside*
Beds of passive fibres anchored to a surface and immersed in fluids are prevalent in many biological systems, including intestines, tongues, and blood vessels. These hairs are soft enough to deform in response to stresses from fluid flows. Yet fluid stresses are in turn affected by hair deformation, leading to a coupled elastoviscous problem that is poorly understood. Here we investigate a biomimetic model system of elastomer hair beds subject to shear-driven Stokes flows. We characterize this system with a theoretical model that accounts for the large-deformation flow response of hair beds. Hair bending results in a drag-reducing nonlinearity because the hair tip lowers towards the base, widening the gap through which fluid flows. When hairs are cantilevered at an angle subnormal to the surface, flow against the grain bends hairs away from the base, narrowing the gap. The flow response of angled hair beds is axially asymmetric and amounts to a rectification nonlinearity. We identify an elastoviscous parameter that controls nonlinear behaviour. Our study raises the hypothesis that biological hairy surfaces function to

reduce fluid drag. Furthermore, angled hairs may be incorporated in the design of integrated microfluidic components, such as diodes and pumps.

**Keisha Walters**
Chemical, Biological and Materials Engineering, University of Oklahoma
*Design, Synthesis, and Characterization of Stimuli Responsive Polymer Systems*

Advances in nano- and micro-technologies and the desire for fine tuning of macromolecular properties have spurred efforts for material design and manipulation at the molecular scale. To effectively design a material for a particular application, we need an understanding of the fundamental relationships between molecular structure/architecture, intra- and inter-molecular interactions, secondary structures, and macromolecular (engineering) properties. The focus of this talk is the synthesis, characterization, and utilization of polymers—in bulk and grafted to surfaces and interfaces—such that macroscopic properties can be controlled by selection and method of integration of the molecular-level components. Well-controlled syntheses allow for targeted selection of chemical composition, molecular weight, and ultimately the stimulus condition and resultant change in properties. The focus of this talk will be stimuli-responsive polymers (SRPs) which display substantially altered physical properties (e.g., shape, size, viscosity) in response to environmental triggers (e.g., temperature, pH, solvent quality). SRPs will be examined as stand-alone materials and as part of polymer-grafted nanoparticle composites that offer inherent advantages in terms of being able to fine-tune nanostructure, surface chemistry, integrate multiple (potentially disparate) materials, and dynamically assemble two- and three-dimensional structures. Characterization of stimuli responsive behaviors will be presented in the context of a wide range of applications including medicine, energy harvesting, sensors, self-healing materials, and environmental remediation.

## Posters

**1. Josiah Hanson** (University of Houston, Megan Robertson's Group)
*Improving mechanical properties of fatty acid-derived thermoplastic elastomers by incorporating a transient network*

**2. Qixiuan Zheng** (Texas Tech University, Kristin Hutchins's Group)
*Synthesis of Pharmaceutical Co-crystals and Pyridine-functionalized Polymers*

**3. Xiao Zhao** (Texas Tech University, Sindee Simon's Group)
*A model-free study of excess properties to reduce relaxation times of polymer*

**4. Jesus Daniel Loya** (Texas Tech University, Kristin Hutchins's Group)
*Co-crystallization of the anti-cholesterol drug Bezafibrate and synthesis of functionalized polystyrene polymer beads*

**5. Tzu-Han Li** (University of Houston, Megan L. Roberston and Jacinta C. Conrad's Group)
*Polymer dispersity affects conformation of brushes grafted on nanoparticles*

**6. Mingjie Shen** (University of Houston, Megan L. Roberston's Group)
*Sustainable and degradable epoxy resins containing multifunctional biobased components*

**7. Elliot Geikowsky** (Texas Tech University, Burak Aksak's Group)
*The effect of flexible joint-like elements on the adhesive performance of nature-inspired bent mushroom-like fibers*

**8. Chunhao Zhai** (Texas Tech University, Sindee Simon's Group)
*Benzyl methacrylate polymerization under nanoconfinement*

**9. Jose Clemente Contreras Naranjo** (Texas A&M University, Victor Ugaz's Group)
*Label-free interference-based single-cell phenotyping of cancer cells*

**10. Rong Ma** (Texas A&M University, Zhengdong Cheng's Group)
*Synthesis of graphene quantum dots with amphiphilic Janus structure as Pickering emulsifier*

**11. Liyun Wang** (University of Texas at Austin, Vernita Gordon's Group)
*Bacterial mechanosensing of the substrate stiffness: whether and how*

**12. Ziye Dong** (Texas Tech University, Wei Li's Group)
*Humidity-responsive nanolayered polymer films for anti-counterfeiting applications*

**13. Yatish Rane** (Texas Tech University, Jeremy Marston's Group)
*Towards optimization of Needle-free jet injection for intradermal tissue delivery*

**14. Dinesh Sundaravadivelu Devarajan** (Texas Tech University, Rajesh Khare's Group)
Deciphering nanocolloid rheology: viscoelasticity and time-concentration superposition

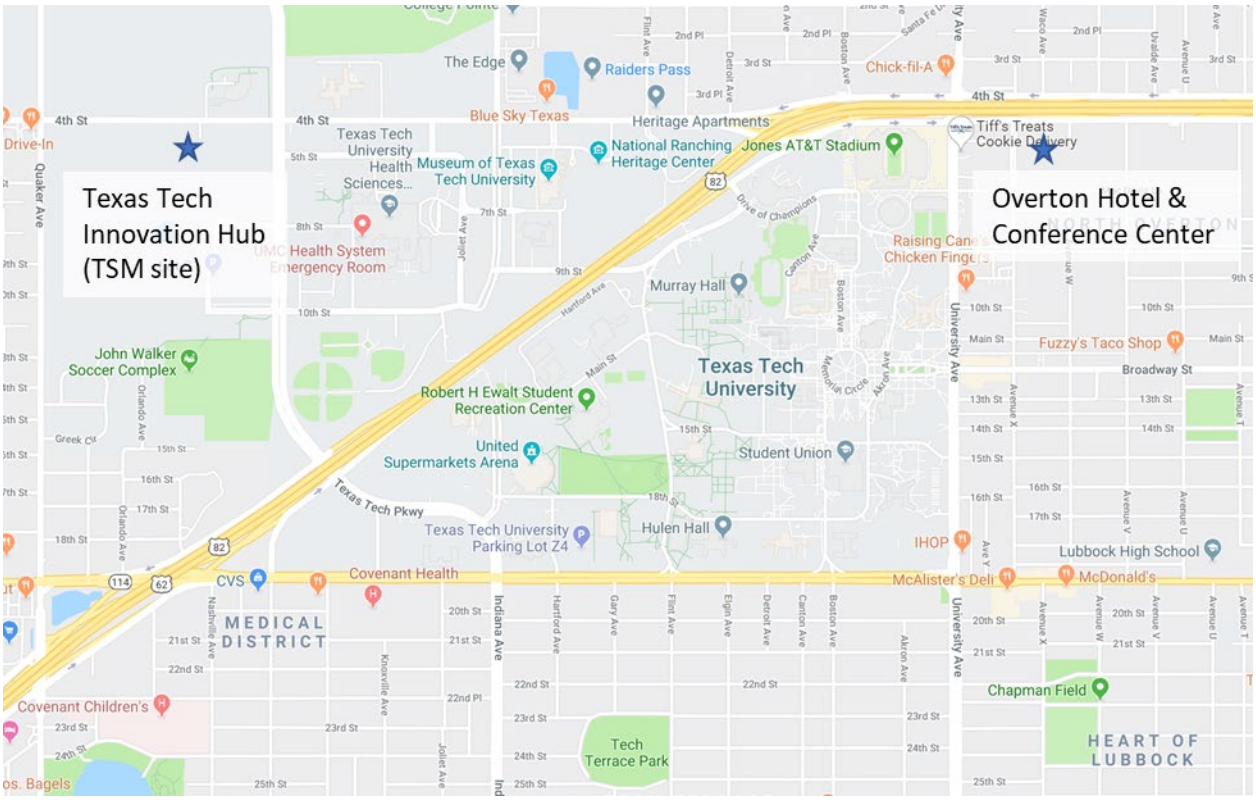
**15. Prakash Parajuli** (Texas Tech University, Noureddine Abidi's Group)
*Cellulose-based monoliths with enhanced surface area and porosity*

**16. Wan Zheng** (Texas Tech University Health Science Center, Hongjun Liang's Group)
*Environmentally degradable nanoantibiotics with size-dependent antimicrobial activity*

**17. Shaoyang Wang** (Texas A&M University, Jodie Lutkenhaus's Group)
*Real-time insight into the doping mechanism of redox-active organic radical polymers*

**18. Wei Li** (Texas Tech University)
*Electroresponsive homogeneous polyelectrolyte complex hydrogels from naturally derived polysaccharides*

## Map and Directions




Texas Tech Innovation Hub at Research Park is located at 3911 4th Street, Lubbock, Texas 79415. Parking on site is free. Citibus shuttle will be running from the Overton Hotel to the event site every 10-15 min starting 7:30 am to 9:30 am on August 16.

***A special thanks to our sponsors:***

**Anton Paar USA, Inc., VWR, part of Avantor, The Department of Chemical Engineering, and The Office of Research and Innovation at Texas Tech University!**