2016 Texas Soft Matter Meeting

August 12, 2016

Department of Chemistry and Biochemistry

The University of Texas at Dallas

Full Program

All presentations will be held in SLC 2.303. Lunch will be served in Dinning Hall West (DHW on the Campus Map). The dinning services meal coupon is enclosed in the participant's name tag. Details about the meeting including the campus map and the parking permit is provided on the meeting's web page (http://www.utdallas.edu/chemistry/txsoftmatter/).

Schedule of Events

7:30-8:00am	Breakfast and pick-up name tags (room SLC 2.303)
8:00-8:05am	Introductory Remarks (Dean Bruce Novak)
8:05-8:10am	Meeting Introduction (Mihaela C. Stefan)
8:10-8:40am	Dr. Rafael Verduzco (Invited Talk)
8:40-10:00am	Contributed Talks (Sponsor: Anton Parr)
10:00-10:30am	Dr. Vernita Gordon (Invited Talk)
10:35-11:45am	Contributed Talks (Sponsor: Travis Wolff)
12:00-1:30 pm	Lunch (Dining Hall West)
1:30-2:00 pm	Dr. Jacinta Conrad (Invited Talk)
2:00-2:30 pm	Contributed Talks (Sponsor Travis Wolff)
2:30-3:00 pm	Dr. Nicolay Tsarevsky (Invited Talk)
3:00-4:10 pm	Contributed Talks (Sponsor: NS&M, UT Dallas)
4:15 pm	Concluding Remarks (Mihaela C. Stefan)

Texas Soft Matter Meeting Sponsors

We acknowledge the generous support from Anton Paar USA, Inc, Travis Wolff, and the School of Natural Sciences & Mathematics (UT Dallas).

Texas Soft Matter Meeting: Invited Abstracts

Surface Active Bottlebrush Polymer Additives for Functional Surface Coatings

Rafael Verduzco, Department of Chemical and Biomolecular Engineering, Rice University

Abstract: Bottlebrush polymers are a type of branched or graft polymer with polymeric side-chains attached to a linear backbone, and the unusual architecture of bottlebrushes provides a number of unique and potentially useful properties. These include a high entanglement molecular weight, enabling rapid self-assembly of bottlebrush block

copolymers into large domain structures, the self-assembly of bottlebrush block copolymer micelles in a selective solvent even at very low dilutions, and the functionalization of bottlebrush side-chains for recognition, imaging, or drug delivery in aqueous environments. Here, we discuss the design and application of bottlebrush polymers as surface-active additives. Through an entropy-mediated process, bottlebrushes spontaneously accumulate at film interfaces Secondary-ion mass spectroscopy measurements show that athermal blends of bottlebrush polymers in a linear polymer matrix segregate to interfaces, driven by the increased conformational entropy of chain ends and depending on the relative lengths of polymer side-chains and linear matrix chains. Mixed side-chain bottlebrush polymers rapidly segregate to film surfaces, driven by enthalpic interactions and surface energy differences. These bottlebrush polymers segregate to film surfaces at low loading (1 wt %) and can be used to produce large changes in the surface contact angle. These studies demonstrate the role of interfaces and strategies for tailoring interfacial properties in very different types of soft materials.

Soft-matter mechanics in the initiation of bacterial biofilms

Vernita Gordon, Department of Physics, University of Texas at Austin

Abstract: Biofilms are communities of microbes that are embedded in a self-produced matrix of polymer and proteins. Biofilms cause chronic, recalcitrant infections - even bacteria that are easily cleared by antibiotics and/or the immune system when they are in a free-swimming, so-called "planktonic" state become highly resistant to both antibiotics and the immune system when they are in a biofilm. We study biofilms grown from the bacterium Pseudomonas aeruginosa, an opportunistic human pathogen that produces chronic biofilm infections in patients with cystic fibrosis, chronic obstructive pulmonary disease, and diabetes. We find that bacteria sense that they are on a surface, and therefore change their gene expression to start making a biofilm, by sensing shear stress. Shear stress is mediated by sticky polymers that bind the bacteria to the surface, and varying the strength of polymer-mediated adhesion changes how well the bacteria can sense that they are on a surface. This suggests new ways to make surfaces that resist the development of biofilms by preventing bacteria from experiencing shear stress.

Non-equiulibrium solidification of colloid-polymer mixtures: dispersity and confinement effects

Jacinta Conrad, Department of Chemical and Biomolecular Engineering, University of Houston

Abstract: Submicron particles suspended in complex fluids containing surfactants, polymers, micelles, or other species are widely used in materials shaping and forming processes, including three-dimensional printing and nanocomposite processing, and in technical applications as paints, coatings, inks, and drilling muds. These applications

require control over suspension rheology and microstructure, which are affected by interactions between the different constituents. Practically, constituents of high dispersity in size or molecular weight are inexpensive and hence widely used; fundamentally, the effects of size dispersity on suspension properties remain poorly understood, especially when the particles exhibit attractive interactions. As simple models of practical suspensions we study mixtures of submicron poly(methyl methacrylate) particles suspended in solutions of non-adsorbing polystyrene polymers, which generate a controlled entropic depletion attraction between the particles. Here, I will discuss studies in which we investigate the effect of particle dispersity and polymer dispersity on the non-equilibrium phase behavior, microstructure, and rheology of colloid-polymer mixtures, and describe the implications for the formulation of suspensions for practical applications.

Hypervalent Iodine Compounds in Polymer Synthesis

Nicolay Tsarevsky, Department of Chemistry, Southern Methodist University

Abstract: Hypervalent iodine(III) compounds of the type $ArIL_2$ (Ar = aryl, L = ligand such as (pseudo)halide or carboxylate) can participate in both radical and ionic reactions, which makes them very attractive reagents for the synthesis of functional, responsive, and dynamic polymers. For instance, ligand exchange reactions are known with variety of nucleophiles (Nu^-), which afford the hypervalent iodine compounds $ArINu_2$. The homolysis of the weak hypervalent I-L (or, after ligand exchange, I-Nu) bonds under thermal or photochemical conditions leads to the formation of iodoarenes ArI and radicals $L^\bullet$ (or $Nu^\bullet$), which can be used to initiate polymerization or to functionalize a number of substrates, including pre-made polymers. The synthesis and properties of functional linear, star-shaped, graft, branched, and crosslinked polymers via ligand exchange reactions involving hypervalent iodine compounds, in some cases followed by decomposition of the products of the exchange, in addition to dynamic polymers containing the –I(Ar)– structural motif, will be described.

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7:30-8:00 am	Breakfast and pick-up name tags (room SLC 2.303)
8:00-8:05 am	Introductory Remarks (Dean Bruce Novak)
8:05-8:10 am	Meeting Introduction (Mihaela C. Stefan, mihaela@utdallas.edu)
8:10-8:40 am	**Dr. Rafael Verduzco, (Rice University, rafaelv@rice.edu), *Surface Active Bottlebrush Polymer Additives for Functional Surface Coatings***
8:40-8:45 am	Wenyue Ding, (University of Houston, dingwenyue1234@gmail.com) *Sustainable Thermoplastic Elastomers Derived from Rosin*

8:45-8:50 am Yixuan Song, (Texas A&M University, dorianxuan@tamu.edu), *Polyelectrolyte Multilayer Nanocoating Exhibiting Super Oxygen Gas Barrier and 100% Self-Healing Efficiency*

8:50-8:55 am Ruvini Kularatne, (University of Texas at Dallas, rsk090020@utdallas.edu), *Chromonic Liquid Crystal Hydrogels*

9:00-9:05 am Ryan Poling-Skutvik, (University of Houston, rpoling-skutvik@uh.edu), *Dynamics of Polymer Grafted Nanoparticles using Complementary Scattering Methods*

9:05-9:10 am Na Park, (University of Houston, nykim@uh.edu), *Confined Flow of Attractive Colloids*

9:10-9:15 am Nate Lynd, (University of Texas at Austin, lynd@che.utexas.edu), *Design and Synthesis of Macromolecular Materials, Department of Chemical Engineering*

9:15-9:20 am Vivek Yadav, (University of Houston, vivek8yadav@gmail.com), *Dispersity-Enhanced pH-Response in Poly(acrylic acid) Brushes*

9:20-9:25 am Zhaoxu Wang, (Southern Methodist University, zhaoxuw@smu.edu), *Redox-Active Viologen-Containing Polymers*

9:25-9:30 am Anish Patel, (Texas A&M University, agpatel@tamu.edu), *Aramid Nanofibers/Graphene Layer-by-Layer Electrodes for Structural Energy and Power*

9:30-9:35 am Tyler Cooksey, (University of Houston, tyler.j.cooksey@gmail.com), *Tuning Self-Assembly and Diffusion of Block Copolymer Micelles Via Co-Solvent Addition*

9:35-9:40 am Madushani Dharmarwardana, (University of Texas at Dallas, mxd110630@utdallas.edu), *Solid-State Thermochromism in a Single Crystal Organic Semiconductor*

9:40-9:45 am Taylor Ware, (University of Texas at Dallas, taylor.ware@utdallas.edu), *Programmed Anisotropy, Microstructure, and Stimulus Response in Liquid Crystal Polymer Networks*

9:45-9:50 am Jack Deodato Jacob, (University of Houston, jdjacob@uh.edu), *Nanoparticle Dispersion in Porous Media*

9:50-9:55 am Lecheng Zhang, (Texas A&M University, zlcbernie@tamu.edu), *Shear-Tolerant Micro-Emulsion Fracturing Fluid*

10:00-10:30 am **Dr. Vernita Gordon, (University of Texas at Austin, gordon@chaos.utexas.edu), *Soft-Matter Mechanics in the Initiation of Bacterial Biofilms***

10:30-10:35 am Michael Byington, (University of Houston, mbyington7@gmail.com), *Novel Mass Spec Analysis for Detecting Dimers Predicted by Two-Step Nucleation Theory*

10:35-10:40 am Raymond Welch, (University of Texas at Dallas, rpw031000@utdallas.edu), *Template Directed Synthesis of Porous and Protective Core-Shell Bionanoparticles*

10:40-10:45 am Minxiang Zeng, (Texas A&M University, glennlands@gmail.com), *The Synthesis of Amphiphilic Luminescent Graphene Quantum Dot and Its Application in Miniemulsion Polymerization*

10:45-10:50 am Andrea Jaimes-Lizcano, (University of Houston, yandreajaimes@gmail.com), *Attachment of Escherichia Coli to Cysteine Surfaces*

10:45-10:50 am Hao Mei, (Rice University, hm11@rice.edu), *Bottlebrush Polymers for Antifouling*

10:55-11:00 am Renjie Chen, (University of Houston, rcnotess@gmail.com), *Simulation of Nanoparticle Diffusion in Semidilute Polymer Solutions*

11:00-11:05 am Shaoyan Mou, (University of Houston, moushaoyan@gmail.com), *Preparation of pH-Responsive Proppants*

11:05-11:10 am Morgan Barnes, (Rice University, MG69@rice.edu), *Step-growth Liquid Crystal Elastomers with Low Glass Transition Temperatures*

11:10-11:15 am Ryan Roberts, (University of Houston, Rockhound08@gmail.com), *Attractive Nanoparticle Glasses as Models of Molecular Glasses*

11:15-11:20 am Narendra Kumar Dewangan, (University of Houston, ndewangan@uh.edu), *Effect of Dispersants on Motility and Adhesion of Bacteria on Oil Water Interfaces*

11:20-11:25 am Amit Jain, (Rice University, aj45@rice.edu), *Multivalent Ion Selective Polymer Coating For Capacitive Deionisation Application*

11:25-11:30 am Ryan McLay, (University of Houston, rmclay3@gmail.com), *Engineering Inducible Fimbriation in Escherichia coli*

11:30-11:35 am Arosha Karunathilake, (University of Texas at Dallas, axk113330@utdallas.edu), *Hexaphenylbenzene and Hexabenzocoronene based Porous Organic Polymers for Adsorption of Volatile Organic Compounds*

11:35-11:40 am Maxwell Smith, (University of Houston, maxsmith1989@gmail.com), *Improving Point-of-Care Diagnostics with Ultrasensitive Lateral Flow Assays*

11:40-11:45 am Melanie Ecker, (University of Texas at Dallas, melanie.ecker@utdallas.edu), *Thermomechanical Behavior of Softening Shape Memory Polymer Substrates for Flexible Bioelectronics before and after Sterilization*

12:00-1:30 pm ***Lunch in*** **Dinning Hall West**

1:30-2:00 pm **Dr. Jacinta Conrad, (University of Houston, jcconrad@uh.edu), *Non-equilibrium Solidification of Colloid-polymer Mixtures: Dispersity and Confinement Effects***

2:00-2:05 pm Katherine Washington, (University of Texas at Dallas, kew084000@utdallas.edu), *Comparison of Linear and Star-like Poly(ε-caprolactone)-b-poly{γ-2-[2-(2-methoxy-ethoxy)ethoxy]ethoxy-ε-caprolactone} Amphiphilic Block Copolymers for Drug Delivery Applications*

2:05-2:10 pm Shaoyang Wang, (Texas A&M University, wang.shaoyang@tamu.edu), *In-situ Mechanistic Investigation of Nitroxide Radical Polymer Cathode on Interfacial Charge and Mass Transfer*

2:10-2:15 pm Taniya Pathiranage, (University of Texas at Dallas, txk121930@utdallas.edu), *Synthesis of Poly(4-vinylpyridine)-block-poly(3-(2-ethylhexyl)thiophene) for Improved Supramolecular Self-assembly*

2:15-2:20 pm William Pineros, (University of Texas at Austin, wdp0@utexas.edu), *Designing Interactions That Stabilize Assemblies to Changes in Density or Temperature: Application to Square, Snub Square and Kagome Lattices*

2:20-2:25 pm Sampath Alahakoon, (University of Texas at Dallas, sba130030@utdallas.edu), *Rational Design of Azine-linked 2D-Covalent Organic Frameworks (COFs)*

2:25-2:30 pm Yanpu Zhang, (Texas A&M University, yanpuzhang@tamu.edu), *The Effect of Water on the Thermal Transition Observed in Polyelectrolyte Complexes*

2:30-3:00 pm **Dr. Nick Tsarevsky, (Southern Methodist University, nvt@smu.edu), *Hypervalent Iodine Compounds in Polymer Synthesis***

3:00-3:05 pm Andrea Miranda, (Rice University, alm9@rice.edu), *Polymer Binders for Li-ion Battery Electrodes*

3:05-3:10 pm Dali Huang, (Texas A&M University, dhuang@tamu.edu), *Preparation of Iridescent Colloidal Polystyrene Photonic Crystal with Enhanced Color*

3:10-3:15 pm Yixin Ren, (University of Texas at Dallas, yxr140330@utdallas.edu), *Versatile Neodymium Based Catalyst for Polymerization of Dienes and Lactones*

3:15-3:20 pm Crystal Niermann, (University of Texas at Dallas, cxn141630@utdallas.edu), *Three-dimensional Printing of Elastomeric Semiconducting Polymers*

3:20-3:25 pm Mohammad Safari, (University of Houston, moh.safari.91@gmail.com), *Role of Disulfide Bonds on Protein Clusters*

3:25-3:30 pm Ruwan Gunawardhana, (University of Texas at Dallas, kxg141730@utdallas.edu), *Benzodithiophene Based Small Molecules for Solar Cells Applications*

3:30-3:35 pm Gayan Adikari Appuhamillage, (University of Texas at Dallas, gka130130@utdallas.edu), *Design Paradigm Utilizing Reversible Diels-Alder Reactions to Enhance the Mechanical Properties of 3D Printed Materials*

3:35-3:40 pm Jia Du, (University of Texas at Dallas, jxd123830@utdallas.edu), *Systematic Investigation of Benzodithiophene-Benzothiadiazole Isomers for Organic Photovoltaics*

3:40-3:45 pm Kejia Yang, (University of Texas at Dallas, kxy130030@utdallas.edu), *Diels-Alder Rapid Extrusion (DARE) 3D Printing of Melt-Processable Thermoset Polymers*

3:45-3:50 pm Dushanthi Dissanayake, (University of Texas at Dallas, dxd122030@utdallas.edu), *Alkoxy Functionalized Polythiophenes via McCullough Method*

3:50-3:55 pm Avichal Vaish, (Southern Methodist University, avaish@smu.edu), *Dynamic & Self Healing Gels Based on Hypervalent Iodine Crosslinker*

3:55-4:00 pm Rajesh Kumar, (Southern Methodist University, rajeshk@smu.edu), *Polymerization of Methyl Methacrylate using Cyclic Hypervalent Iodine Compound as a Radical Initiator*

4:00-4:05 pm Gregory Ellson, (University of Texas at Dallas, gte130030@utdallas.edu), *Rapid Photopolymerization of Polythiourethanes*

4:05-4:10 pm Hongbo Fan, (University of Texas at Dallas, fanhb1314@live.com), *Shape Memory Polymers Enabled by Radiation Crosslinking*