Trigger-Release & Encapsulation for Product Alteration

April 9-10, 2019
Whispering Pines Conference Center
401 Victory Highway, West Greenwich, RI 02817

The U.S. Army Research Office with the University of Rhode Island is sponsoring a small workshop to explore end-of-life management capabilities for industrial products which typically are determined post-production. A paradigm shift in end-of-life strategies is needed to maximize sustainable disposal of future manufactured products. The workshop will examine the possibility of remediating or destroying materials from the inside out rather than the traditional industrial outside-in approach to transform materials into environmentally benign products. If you wish to be a participate in this workshop, call or write Jimmie Oxley at joxley@chm.uri.edu or 401-874-2103.

Associate Prof. Adah Almutairi, Skaggs School of Pharmacy, UC San Diego
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The Almutairi lab is highly interdisciplinary, utilizing and expanding current knowledge in nanotechnology, polymer science, and chemistry. Specifically, they develop novel smart polymers that degrade into small molecules in response to mild acid, oxidative conditions, or light (even near infrared light, which can safely penetrate living tissue). Formulating these polymers into nanoparticles and hydrogels allows delivery of a variety of cargo, from drugs to imaging agents to biological molecules. These materials enable unprecedented control over delivery and should allow complete clearance of the carrier.

Assistant Prof. Saadyah Averick Allegheny Health Network Research
Saadyah.Averick@ahn.org, (412) 359-4943

Dr Averick's laboratory is focused on the interface of polymer science and biotechnology. This research has had direct impacts on the ability to synthesize and characterize biohybrid materials but more broadly influences the synthesis of polymers in aqueous media. Recent research from the Averick group is the use of novel chemical reactions including SuFEx chemistry for complex polymer functionalization. These works have been widely cited and included in review articles. Dr Averick is also pursuing next generation drug delivery systems to help end the opioid crisis.

Prof. Ray Baughman, Chemistry, U Texas, Dallas
Ray.Baughman@utdallas.edu, (972) 883-6538

A pioneer in the field of nanotechnology and prolific inventor and scientist, Baughman is a member of the National Academy of Engineering since 2008. His research focuses on new technologies for harvesting and storing waste energy, new types of artificial muscles, fabrication, characterization and application of carbon nanotube sheets and yarns, sensors, new material synthesis, and fundamental structure-properties relationships. He co-invented printable indicators that change color due to time and temperature to reflect shelf-life remaining, e.g. "Meals Ready to Eat;" vaccines.

Prof. Joan W. Bennett, Plant Biology, Rutgers, NJ
profmycogirl@yahoo.com, (848) 932-6223

The Bennett laboratory studies the genetics and physiology of filamentous fungi. In addition to mycotoxins and other secondary metabolites, research focuses on the volatile organic compounds (VOCs) emitted by fungi. Dr. Bennett is a past president of both the American Society of Microbiology and the Society for Industrial Microbiology and Biotechnology. She was elected to the National Academy of Sciences in 2005.

Prof. Balaji Narasimhan, Chemical & Biological Engineering
nbalaji@iastate.edu, (515) 294-8019

Narasimhan is Director of the Nanovaccine Institute. His research focuses on molecular design of nanoscale polymer systems and biomaterials to precisely control molecular architecture and functionality to answer questions related to organization and dynamics occurring on length scales ranging from nanometer to micron-scale at surfaces and interfaces between nanoparticles, inorganic materials, cells, and biomolecules Tools utilized include novel synthesis methodologies, precise functionalization of nanoparticles, and surface/interfacial characterization.

Dr. James D. Oxley, Staff Scientist Southwest Research Institute
joxley@swri.org, (210) 522-2913

Oxley is a Staff Scientist in the Department of Pharmaceuticals and Bioengineering at the Southwest Research Institute (SwRI) in San Antonio, TX. Dr. Oxley directs staff engaging in contract research pertaining to encapsulation and controlled release. His responsibilities include delineating a research approach in encapsulation, process development, formulation development, analytical studies, and the development of novel micro- and nanoencapsulation techniques. (Not related to Dr. Jimmie C. Oxley)

Dr. Phillip Pagoria, Head Explosive Synthesis Lawrence Livermore National Laboratory (LLNL)
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The Synthesis Group of the Energetic Materials Section at LLNL is dedicated to discovery and development of new energetic materials for DoD and DOE. The main focus has been development of new heterocyclic energetics and their precursors. We also develop new synthetic methodologies and optimize synthetic pathways for scale-up and possible commercialization. Other research areas include synthesis of new high nitrogen materials and detection of explosives.

Prof. Scott Philips, Micron School of Materials Science & Engineering Boise State University
sphillips@boisestate.edu, (208) 426-4824

The Phillips group is developing plastics that do not contaminate the environment, as well as plastics that are easily recycled. Some of these materials display amplified changes in their properties in response to specific applied signals, while others are specifically designed for low-energy recycling schemes.

Prof. S. Thai Thayumanavan, Chemistry, U Mass, Amherst
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The Thayumanavan lab is interested in translating novel polymer-based molecular assemblies into innovative materials to make a lasting impact in biomedical and sustainability applications. The group develops fundamental design guidelines for self-assembled systems that predictably respond to specific cues. These guidelines are used in enabling applications in a variety of areas including self-healing materials, autonomously functioning systems, drug delivery, intracellular delivery of biologics, and cryptic catalysis.

Dr. Gerald O. Wilson, VP Autonomic Materials (AMI)
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Dr. Wilson is Vice President of Technology Development for AMI, an advanced materials company based in Champaign, IL. In this role, he is responsible for new product and application development, product scale-up and manufacturing. Over the course of his career, Dr. Wilson has developed new chemistries for self-healing coating, adhesives, sealants, composite and biomedical applications, which are at various stages of commercialization.

Prof. Ting Xu Chemistry, University of California, Berkley
tingxu@berkeley.edu, (510) 642-1632

Prof. Xu's research interests rest at the interface among chemistry, soft matter, biology and material engineering. Her research efforts focus on understanding assembly process in multi-component systems to control the assembly kinetics and pathways to generate hierarchically structured nanomaterials with built-in functionalities. Her recent work focuses on design principles of heteropolymers that enables proteins, enzymes and biomachineries to function in non-native environments.

Prof. Min Zhou, Mechanical Engineering Georgia Tech
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The Zhou group studies material behavior over a wide range of length and time scales. Research emphasizes finite element and molecular dynamics simulations as well as experimental characterization with digital diagnostics. The objective is to design materials or provide guidance for the enhancement of performance through synthesis. Recent research focuses on the failure resistance of structural materials, reliability of materials in energy applications, and the ignition and detonation of plastic-bonded explosives under high-rate loading.

Prof. Steven C. Zimmerman, Chemistry University of Illinois
sczimmer@illinois.edu, (217) 333-6655

The Zimmerman group develops new polymers for a wide range of applications, including encapsulation and stimulated release that benefits from novel degradation mechanisms. A recent interest has focused on single chain polymeric nanoparticles (SCPNs) that contain transition metal catalysts and act as biocompatible artificial metalloenzymes.

University of Rhode Island (URI) Participants

Prof. Jimmie C. Oxley, Chemistry
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The Oxley lab examines all aspects of energetic materials. This ranges from thermal stability of explosives considered for military use to homemade explosives (HME) used by terrorists. For that reason we look for ways to make the detection of explosives easier developing new analytical techniques and new training aids for canines. Oxley organized this workshop at the request of the Army folks listed above. The idea is if reactive materials can be incorporated into explosives without modified their performance and these materials can be released upon command, then post manufacture changes can be affected. (Not related to Dr. James D. Oxley)

Prof. Arijit Bose, Chemical Engineering
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Bose's research encompasses colloidal and interfacial engineering, with specific efforts in areas of nanoparticle/nanostructured materials synthesis and characterization. Applications of his current work are in enhancement of electrochemical performance and safety of lithium ion batteries, Raman-based nanoparticle sensors for detection of contaminants in water, and bacteria-material interactions.

Assistant Prof. Jyothi Menon, Biomedical & Pharmaceutical Sciences
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Dr. Menon specializes in nanomedicine, drug delivery, biomaterials and tissue engineering. Her research includes developing innovative polymer- and lipid-based drug delivery systems for sustained and controlled release of therapeutic agents to treat conditions such as lung cancer and working at the interface of nanotechnology, biomaterials and tissue engineering to develop nanocomposite systems for regenerative medicine.

Assistant Prof. Jie Shen, Biomedical & Pharmaceutical Sciences and Chemical Engineering
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Dr. Shen's research is mainly focused on: *1)* the development of novel drug delivery systems to improve bioavailability and reduce side effects of a variety of therapeutics, with particular interests in sustained and/or targeted brain, ophthalmic and oral drug delivery; *2) in vitro* and *in vivo* performance testing, and the development of *in vitro-in vivo* correlation (IVIVC) for complex dosage forms including microspheres, implants and nanoparticles; and *3)* manufacturing of advanced drug delivery systems such as liposomes and microspheres.

Government Participants

Dr. Luz Marina Calle, NASA Kennedy Space Center Corrosion Technology Lab
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Dr. Calle's research concerns the development of encapsulation technology, specifically designed to incorporate corrosion indicators, inhibitors, and self-healing agents into a coating, in such a way that the delivery of the indicators and inhibitors is triggered by the corrosion process, and the delivery of self-healing agents is triggered by mechanical damage to the coating. The technology allows the incorporation of smart functionality into coatings and materials.

Dr. Robert Mantz, Army Research Office
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Dr. Mantz is the Army Research Office Chemistry Div. Chief, Program Manager (PM) of the Electrochemistry Program and Acting PM of Environmental Chemistry. He is interested in electro-chemical redox reactions and transport of species and in the way these are coupled with electrode, catalysis, electrolyte, and interface. He welcomes research in ionic conduction in electrolytes, electrocatalysis, interfacial electron transfer, transport through coatings, surface & polymer electrolytes, activation of C-H and C-C bonds, and spectroscopic techniques that probe electrode surfaces and interfaces.

Dr. Dawanne E Poree Army Research Office
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Dr. Poree currently serves as the Program Manager for the Polymer Chemistry and Reactive Chemical Systems (acting) programs at the U.S. Army Research Laboratory-Army Research Office (ARL-ARO). In this position, she executes and manages a diverse research portfolio of ~160 projects, totaling more than $19M in annual research investments while also identifying and guiding novel scientific opportunities to address fundamental basic research gaps to achieve scientific breakthroughs and discoveries leading to critical new protection and sensing capabilities for the U.S. Army.

Dr. Laura Krnavek, Army Research Office
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SETA contractor, Environmental Chemistry Program. Interested in new opportunities and topics to further develop the program's scope. Current interests are in chemical transformations and degradation processes in environmental media, and development of new methodologies for environmental forensics, with low sensitivity and high selectivity capabilities for complex matrices. Also interested in exploring new approaches to waste management and end-of-life material management.

Dr. Pamela Sheehan, U.S. Army, Picatinny
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The Army has almost 500,000 tons of munitions that are too old or unsafe to use. It must store these weapons and eventually destroy them. Sheehan, an environmental engineer and microbiologist at Picatinny Arsenal in New Jersey, has pioneered the first environmentally-friendly method of demilitarizing one of the major items in the nation's outdated military weapons stockpile, the nitrogen-rich propellant used in M119 howitzer artillery rounds. Sheehan's solution to extract nitrogen from the propellant and use it to grow algae that will produce ethanol and an oil product that can be later refined.