KENNESAW STATE UNIVERSITY
COLLEGE OF SCIENCE AND MATHEMATICS
Department of Chemistry and Biochemistry

Fall 2020

The **Chemistry and Biochemistry Departmental Seminar Series** covers a broad range of fields in the Chemical and Biochemical Sciences. In past seminars, scientists from Academia, Government, and Industry have presented their most recent discoveries and contributions in their respective areas. This Seminar Series offers students and faculty the opportunity to interact directly with other leaders in their specializations and to gain a good overview of the entire range of fields in Chemistry and Biochemistry.

Seminars are held on Tuesdays via Microsoft Teams, 12:30 - 1:30pm. All are invited to attend.

Tuesday, September 15, 2020

Dr. Mark Dadmun, Professor, Department of Chemistry, University of Tennessee

Title: *New material to Expand the Opportunities for 3D printing*

Abstract: 3D Printing has emerged as an interesting fabrication technique for models, prototypes, and complex structures. However, producing complex geometries with isotropic, robust mechanical properties by 3D Printing remains a key target in expanding additive manufacturing towards the production of large scale commercially relevant structures. Due to the large size of polymer chains and the complex thermal environment experienced by the printed filament in fused deposition modeling (FDM), entanglement of polymers between layers in incomplete, resulting in weak inter-layer interfaces and unsatisfactory Z-strength. In this presentation, I will discuss work in our group that seeks to address these shortcomings, by developing novel polymer materials for FDM that revolve around the introduction of low molecular weight surface segregating additives to the filament. We have recently expanded this concept to reactive additives, where these reactive additives can now form inter-layer crosslinks by rational introduction of UV photo- initiators and fiber-optic based UV illumination during printing. In situ reactive processing of the printed layers results in drastic increases in the interlayer strength to create essentially isotropic materials.

View event on Facebook: http://www.facebook.com/events/1264962110507345

Tuesday, September 22, 2020

Dr. Michael G. Walter, Associate Professor, Department of Chemistry, University of North Carolina at Charlotte

Title: *Properties and Applications of Highly Fluorescent Thiazolothiazole Materials*

Abstract: The Walter research lab at UNC Charlotte focuses on developing new molecular materials for a variety of photochemical applications related to light-driven charge transfer, nanoscale materials, solar energy conversion, and biosensing. We have developed a new class of extended viologen and donor-acceptor dye structures that incorporate the thiazolo[5,4-d]thiazole (TTz) conjugated backbone. The extended viologen TTz dyes exhibit reversible yellow to dark blue electrochromism and high fluorescence quantum efficiency that is deactivated upon electrochemical reduction. The fused bicyclic thiazolothiazole heterocycle allows the alkylated pyridinium groups to remain planar, strongly affecting their electrochemical properties. Aqueous gel electrofluorochromic devices have been developed which demonstrate two colorful redox states and good cycling. In addition, the TTz viologen electrochromic devices can be activated using a unique photo-assisted electrochromic mechanism. The donor-acceptor TTz dyes exhibit strong solvatofluorochromism, large transition dipole moments, and high fluorescence quantum yields. These dyes show good biosensing capabilities with recent studies indicating good cell membrane localization and promising voltage sensitivities. Overall, the multifunctional and strongly

fluorescent properties of these TTz materials make them attractive for molecular electronics, biosensing, and related photochemical applications.

View event on Facebook: http://www.facebook.com/events/1458765754320283

Tuesday, September 29, 2020

Dr. Nikita L. Burrows, Assistant Professor, Department of Chemistry and Physics, Monmouth University

Title: *Student experiences and alternative assessments in the lab*

Abstract: Research has begun to explore the undergraduate laboratory in many facets, such as students' feelings, goals, and instructional approaches to the laboratory. However, research has not explored the experience of students with summative assessment in the laboratory. This qualitative study investigates the experiences of upper-level undergraduate students' exposure to lab interviews as an oral summative assessment. A phenomenological approach guided the analysis and interpretation of data gathered from sixteen semi-structured student interviews. Exploration of the data resulted in the development of an outcome space with three fundamental features and the core perception of students about lab interviews. This outcome space explores students' feelings, performance, and perceived conceptual understanding before, during, and after the interview process. Implications and suggestions for the design and improvement of assessment practices are discussed.

View event on Facebook: http://www.facebook.com/events/789069011911666

Tuesday, October 6, 2020

Chiamaka Obianyor, Graduate Student, Grover and Hud Labs, Georgia Institute of Technology

Title: *Elucidating key parameters for enhancing non-enzymatic DNA ligation*

Abstract: The use of non-enzymatic ligation is widespread in the generation of synthetic DNA structures, the development of molecular sensing probes, and in the ligation of non-Watson-Crick base pairs, systems for which enzymes are less suited. In addition, non-enzymatic ligation is necessary for the scale up of DNA nanotechnology, a process currently limited by high cost of enzymes. Nonetheless, these non-enzymatic ligation reactions are often hindered by both the low reactivity of the substrates (even with the aid of chemical activation) and the long reaction times to achieve high yields. In this study, using a well-defined biomolecular system and carbodiimide as the activating agent, we investigated the key parameters for enhancing non-enzymatic DNA ligation. First, a systematic investigation of the ligation reactions revealed the need to optimize three main parameters to attain high yields; reaction kinetics, equilibrium assembly, and side product formation. Afterwards, a quantitative framework was developed to demonstrate that an increase in template-substrate stability will lead to near quantitative product formation in low equilibrium assembly ligating systems. Lastly, we established a theoretical model to describe the pertinent reactions observed in our system and subsequently aid in the design of other ligating systems. Results from this study successfully identified parameters necessary for decreasing chemical ligation reaction times from ~ 6 days to 24 hr, while increasing average products from 60 % to over 98 %. In the field of nucleic acids technology where efficient non-enzymatic ligation reactions are necessary for improving the synthesis of

artificial DNA structures, our work provides a wide variety of conditions that can facilitate the development of DNA covalent structures.

View event on Facebook: http://www.facebook.com/events/2704380529889832

Tuesday, October 27, 2020

Dr. Rafael Quirino, Associate Professor, Department of Chemistry and Biochemistry, Georgia Southern University

Title: *Vegetable Oils as a Chemical Platform*

Abstract: As dwindling crude oil reserves around the planet bring uncertainty about the supply of energy and raw materials to mankind, many scientists are focusing their efforts in developing inventive solutions to diminish our dependency on petroleum. Besides appeasing concerns related to a very vulnerable economy strongly tied to crude oil markets, alternative technologies and sources of chemicals have the potential to provide more sustainable solutions, relying primarily on renewable resources. In that context, vegetable oils can be used as a chemical platform, leading to a variety of products through chemical modifications. This seminar covers the use of vegetable oils for the preparation of various materials, including biofuels, polyolefins, polyurethanes, and their corresponding composites.

View event on Facebook: http://www.facebook.com/events/2648833918703159

Tuesday, November 3, 2020

Dr. Shanlin Pan, Professor, Department of Chemistry & Biochemistry, University of Alabama

Title: *Advanced Scanning Electrochemical and Spectroelectrochemical Methods for Analyzing Surfaces of Catalytic Electrode Materials*

Abstract: Ultrasensitive electrochemical and optical imaging approaches are critical for realizing local chemical information particularly for systems such as sustainable energy harvesting and conversion. We are interested in developing electrochemical and spectroelectrochemical techniques for ultrasensitive quantitative analysis of catalytic surfaces and localized redox activities with improved spatial and spectral and temporal resolutions. Examples of scanning electrochemical microscopy based on ultramicroelectrodes, nanoelectrodes, and optical fiber electrodes and optical imaging techniques will be discussed in this seminar. These techniques help understanding fundamental aspects of an electrochemical process, such as local heterogeneities in catalytic reaction and stability issues of functional low-dimension metallic and semiconductor electrode materials with synergistic functions for sunlight harvesting, conversion, and storage into chemical fuels. These studies will provide insights into developing unique catalytic and photonic properties of nanostructured electrode materials for the efficient and selectivity of the solar-to-fuel conversion.

View event on Facebook: http://www.facebook.com/events/646747149564461

KENNESAW STATE UNIVERSITY
COLLEGE OF SCIENCE AND MATHEMATICS
Department of Chemistry and Biochemistry

Fall 2020

Tuesday, November 17, 2020

Dr. Saki Golafale, Limited Term Assistant Professor, Department of Chemistry and Biochemistry, Kennesaw State University

Title: *Tuning the Luminescent Behavior of trans-Stilbene Metal-Organic Frameworks*

Abstract: Stilbenes are important for use in many technologies including solid-state scintillation and organic NLO materials. However, when exposed to radiation, stilbenes undergo trans-cis isomerization. The cis isomer can produce photobyproducts including cyclization to dihydrophenanthrene. Though incorporating trans-stilbene ligands into metal-organic frameworks (MOFs) structures has shown to significantly suppress trans-cis isomerization, the luminescent outputs of trans-stilbene-based MOFs are often compromised by interpenetration of multiple nets within their structures. Such interpenetration promotes interchromophore interactions and loss of luminescence behavior. This presentation will focus on studies conducted on tuning the luminescent behavior of trans-stilbene-based metal-organic frameworks as well as their structure-function correlations.

View event on Facebook: http://www.facebook.com/events/924868478045286

Tuesday, December 1, 2020

Dr. Barry C. Thompson, Professor, Department of Chemistry, University of Southern California

Title: *Reimagining Semiconducting Polymers for Alternative Energy Applications*

Abstract: Conjugated polymers have been the cornerstone of organic electronics, with applications in areas such as photovoltaics, field effect transistors, and electrochromics. Specifically, polymer based solar cells have generated significant attention due to the promise of a lightweight, flexible, and inexpensive solar energy conversion platform. However, a number of challenges are still apparent, including, accessibility, scalability and efficiency. Our related efforts have focused on novel, simplified polymer and device architectures and synthetic methods. Specifically, we have spent significant effort focusing on scalability of polymer synthesis, which is best embodied in our work on Direct Arylation Polymerization (DArP), which is a C-H activation route to the synthesis of conjugated polymers. Additionally, efforts toward the synthesis of novel non-conjugated electroactive polymers will be introduced.

View event on Facebook: http://www.facebook.com/events/416332969537687