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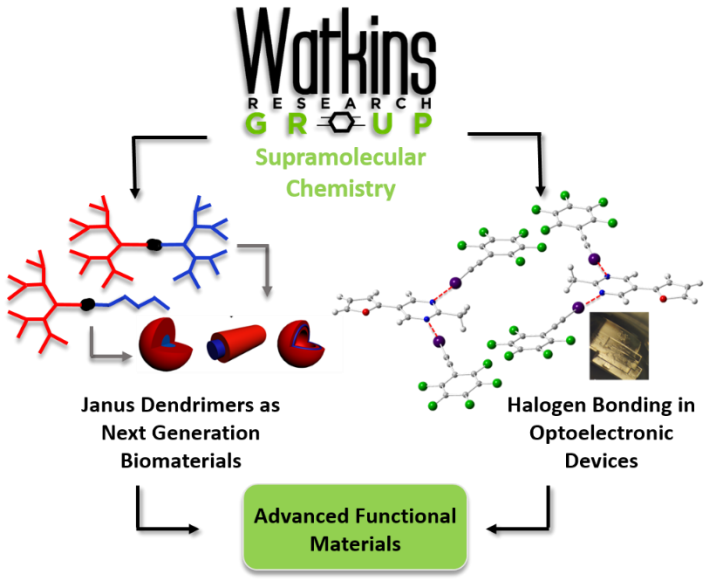
Supramolecular Approaches to Advanced Functional Materials



Abstract: In the "bottom-up" approach, materials and devices are constructed from molecules capable of assembling themselves by principles/methods of molecular recognition. Although well-defined assemblies can be engineered by exploiting various noncovalent interactions, there are limited methods in the literature regarding the design and analysis of self-guiding molecules for materials application in which there is a strategic integrations of the self-assembling motif. The principle research conducted in the Watkins Group encompasses fundamental studies towards understanding the molecular assembly of complex systems as it relates to overall performance. Reported are design guidelines towards novel building blocks for functional materials—specifically those for applications in optoelectronic devices and biomaterials. The multi-step synthesis of these building blocks are discussed. Spectroscopic analysis as well as characterization via transmission electron microscopy (TEM) and X-ray crystallography of the molecular components and their resulting supramolecular assemblies reveal materials possessing properties that are comparable to—even surpass—those commonly reported in the literature. Results of this study will be employed towards further research in novel molecular components capable of yielding high performing materials.

Bio: A native of Memphis, Tennessee, Davita L. Watkins obtained her Bachelor of Science in Chemistry and Anthropology from Vanderbilt University in Nashville, Tennessee. As an undergraduate, she conducted research under the guidance of Dr. David Hercules and later Dr. Grace Zoorob. It was there that she cultivated an interest in synthetic development and analytical characterization methods. After working briefly as Lead Chemical Analyst for a bioanalytical company, she obtained a PhD in Chemistry from the University of Memphis under the tutelage of Dr. Tomoko Fujiwara. As a doctoral candidate, she developed and established multi-step synthetic methods for a series of stimuli-responsive molecules and polymeric materials which demonstrated potential applications in phase transfer catalysis, catalytic control, and drug delivery. As a postdoctoral researcher at the University of Florida in Gainesville, Florida with Dr. Ronald K. Castellano, she developed novel self-assembling organic materials for photovoltaic applications. In 2014, she began her independent academic career at the University of Mississippi. Her research focuses on establishing design guidelines towards novel functional materials with tunable properties through molecular self-assembly. The well-defined, programmable nanostructured materials produced in her laboratory are designed to be used in a variety of applications which range from therapeutics to electronic devices. Within her first year at the university, she received the Oak Ridge Associated Universities (ORAU) Ralph E. Powe Award for her studies of noncovalent interactions in organic semiconducting devices. In the early part of 2017, she earned a National Science Foundation CAREER Award to catalyze the growth and sustainability of her novel research program that exploits sigma-hole interactions to optimize organic electronic materials. She has been named a 2018 Young Investigator by the Polymeric Materials: Science and Engineering (PMSE) Division branch of the American Chemical Society and was selected as an Emerging Investigator by the Royal Society of Chemistry Journal of Materials Chemistry C. Alongside her research efforts, Dr. Watkins has been an active voice for initiatives to increase minorities and women in STEM. She developed and directs a federally funded (National Science Foundation) four week science initiative for minority women called Operation ICB (I Can Be) to introduce high school scholars to the laboratory setting, encourage them to pursue STEM-related degrees and careers.