SoFlacs

Vol. 28, No. 1 — South Florida Section American Chemical Society — January 2018

Section Meeting

Friday, January 26, 2018, 3:30 PM

followed by refreshments 4:30 – 5:00 PM

University of Miami
Cox Science Building, Room 318
1301 Memorial Drive, Coral Gables

Jean-Hubert Oliver, PhD

Redox-Assisted Self-Assembly of π-Conjugated Chromophores Provides Function-Enhanced Superstructures

While nature has mastered the art of engineering non-equilibrium structures that enable energy capture, conversion, and storage with unrivaled efficiency, this level of structural control over synthetic materials with dimensions spanning the nano- to mesoscale remains elusive. Consequently, current technology exploits equilibrium-based strategies to construct organic electronic materials for which molecular interactions and macroscopic organization are neither structurally nor electronically configured for maximum efficiency. Redox-assisted self-assembly of water-soluble perylene diimide will be presented as a new tool to access out-of-equilibrium intermediates through which to navigate the aggregation free energy landscapes and engineer supramolecular assemblies kinetically trapped in local energy minimum. Investigating the electronic properties of these off-equilibrium superstructures using ground-state electronic absorption spectroscopy indicates a 30% enhancement of the exciton bandwidth when compared to equilibrium-constructed architectures. Such modification of nanoscale-object electronic properties exclusively provided by redox-assisted self-assembly originates from a reconfiguration of the superstructure conformation. Examination of the solid-state morphology of assemblies produced through electronically perturbed out-of-equilibrium intermediates reveals complex hierarchical architectures that feature micrometer-long anisotropic domains. To conclude, a preliminary molecular road map to regulate redox-assisted self-assembly will be introduced. The ability to modulate nanoscale-object electronic structure, used in conjunction with facile hierarchical organization offers exceptional promises for the development of optoelectronic materials.

Originally from Strasbourg, France, Jean-Hubert attended the University of Strasbourg where he obtained his M.Sc. in organic and supramolecular chemistry and his Ph.D. developing new classes of luminescent liquid crystals and light-matter interactions in hierarchical materials. He then moved to Duke University in 2011 as a postdoctoral associate to focus on the engineering of polymer-wrapped carbon nanotube compositions for solar energy capture and conversion. As an Assistant Professor in the Department of Chemistry at the University of Miami, he is developing molecular tools to create new classes of structure-function optimized organic materials constructed from out-of-equilibrium intermediates. In addition to elucidating fundamental electronic processes in these emerging materials, his research program targets applications in solar energy capture and conversion, mechanical energy harvesting, tactile sensors, and organic electronics.

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