

Joint Optics - Chemistry Colloquium

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The Impacts of Plasmonics on the Efficiency and Stability of Organic Optoelectronic Materials and Devices

Abstract:

Thin-film organic conjugated polymer materials are emerging as versatile alternatives to inorganic semiconductors for photovoltaic, display, lighting and laser applications. Additionally, polymer-based organic optoelectronic devices can exhibit small device embodied energies (due to comparatively low temperature and low energy-use fabrication processes) which is of interest for reducing the overall optoelectronic device cost and life-cycle energy consumption. However, further improvements in the energy conversion efficiency and stability of polymer-based optoelectronics are necessary and require effective light management such as nanoscale light trapping and light extraction.

In this talk, our studies of exciton-plasmon interactions between conjugated polymer thin films and nanostructured plasmonic surfaces will be presented. We demonstrate that the morphology of conjugated polymer thin films strongly influences the type of nanophotonic and plasmonic electromagnetic modes that affect the efficiency of light absorption and emission in the polymer thin films. In general, we find that light trapping and absorption are improved using semicrystalline conjugated polymer films; while more efficient light emission occurs using amorphous conjugated polymers. Additionally, our recent work on improving the stability of blue-emitting organic light-emitting diode (OLED) materials will be presented. We show that nanostructured metal surfaces can be employed to shorten the triplet exciton lifetime in these materials, which leads to improvements in their photostability. Finally, the impact of plasmonic nanostructures on the stimulated emission of high-gain conjugated polymers will be discussed.

Bio:

Deirdre O'Carroll is an Associate Professor in the Departments of Materials Science & Engineering and Chemistry & Chemical Biology at Rutgers University. Her research areas include nanophotonics, plasmonics, organic optoelectronics and energy materials. She obtained her B.E. in Electrical Engineering in 2002, and a PhD in Microelectronics in 2008 at University College Cork and the Tyndall National Institute, Ireland. Prior to joining Rutgers in 2011, she conducted postdoctoral research in plasmonics at California Institute of Technology and at the University of Strasbourg and CNRS in France. She is a recipient of a NSF CAREER Award (2016), an ACS Young Investigator Award in Polymer Material Science and Engineering (2017) and a SFI Future Research Leaders Award (2018). She currently serves as an associate editor for the SPIE Journal of Photonics for Energy and as a member of the editorial advisory board for APL Photonics.

Date: Monday, February 17 • **Time:** 3:30 pm • **Location:** Goergen 101

Hosts: Jaime Cardenas (jaime.cardenas@rochester.edu), Kathryn Knowles (kknowles@ur.rochester.edu)