Chemical & Biological Engineering Seminar

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Guiding Light at the Nanoscale: From Energy to Biomedical Applications

Rizia Bardhan
Assistant Professor
Department of Chemical and Biomolecular Engineering
Department of Biomedical Engineering
Vanderbilt University Institute of Imaging Science
Vanderbilt Biophotonics Center
Vanderbilt Ingram Cancer Center

Abstract

Metal nanostructures with subwavelength dimensions when excited with resonant light couple incident photons to conduction electrons giving rise to localized surface plasmon resonances (LSPR). By altering the morphology and composition of metal nanostructures, these LSPRs can be manipulated to generate unique optical characteristics that can be utilized for applications ranging from solar cells to biomedical innovations. This talk will highlight how my group has used these light guiding properties of metal nanostructures in enhanced light harvesting in perovskite, and dye-sensitized solar cells resulting in >25% improvement in device efficiency. We have also performed ultrafast spectroscopy to probe the fundamental underpinnings in these classes of solar cells, and in perovskite nanocrystals. Further, my talk will also focus on the use of metal nanostructures as contrast agents for multimodal multiplexed detection of immunomarkers of cancer in mouse models combining clinical PET imaging with Raman spectroscopy. I will also show how this multimodal imaging platform can provide response to immunotherapy in mice treated with checkpoint blockade therapies. I will end my talk demonstrating the capabilities of label-free Raman spectroscopy in probing alterations in metabolic, lipidomic, and proteomic markers in response to treatment with signal transduction inhibitors.

Biosketch

Professor Rizia Bardhan joined Vanderbilt University Chemical and Biomolecular Engineering Department in Fall 2012. Rizia received a B.A. in Chemistry and Mathematics from Westminster College, Fulton, MO. She then moved to Houston, TX to pursue a Ph.D. at Rice University under the supervision of Prof. Naomi Halas. During her graduate work, her research focused on fundamental plasmonics and nanophotonics, and applications of plasmonic nanostructures in nanomedicine. Prior to coming to Vanderbilt, Rizia spent two years as a postdoctoral fellow in the Molecular Foundry at Lawrence Berkeley National Laboratory designing nanomaterials for energy conversion and storage.

She has received the CDMRP Career Development Award (2018), ORAU's Ralph E. Powe Junior Faculty Enhancement Award (2014), NSF BRIGE Award (2013), and was also a recipient of Forbes "Top

30 Under 30 : Rising Stars of Science and Innovation" Award (2012). Rizia has published 61 publications in high impact journals including Science, Nature Materials, Nano Letters among others with >7200 citations and h-index of 32.