THE CHINESE UNIVERSITY OF HONG KONG
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SEMINAR

Optoelectronic Applications of Colloidal and Hybrid Nanomaterials

By

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Time: 3:30 p.m.
Venue: Room 222 Ho Sin Hang Engineering Building

Abstract:

In this seminar, two topics on the optoelectronic applications of colloidal and hybrid nanomaterials will be presented: (1) The microscopic characterizations providing evidence on the upconversion-induced near-infrared light harvest in hybrid organo-lead halide perovskite solar cells. Photon upconversion represents a promising avenue to reduce the spectral mismatch losses limiting the efficiency of solar cells. Here the impact of inserting Yb^{3+}/Er^{3+} co-doped KY_7F_{22} upconversion nanoparticles (UCNPs) into the different interfaces of a solution-processed mixed-cation lead mixed-halide perovskite solar cell is studied in detail. The upconversion contribution is quantified by a light-beam induced current/fluorescence mapping technique. Such mapping experiments offer a detailed microscopic and spectroscopic picture allowing a correlation of the electrical and optical contribution of UCNPs together with the solar cell morphology. (2) A new type of short-wave infrared (SWIR) photodetectors. Photodetection in the SWIR spectrum is a challenging task achieved often by costly low-bandgap compound semiconductors involving highly toxic elements. Here an alternative low-cost approach which relies on the plasmonic-induced photothermal effect of solution-processed colloidal gold nanorods (Au NRs). A series of uniform solution-processed Au NRs of various aspect-ratios were prepared exhibiting a strong and well-defined longitudinal localized surface plasmon resonance maximum from 900 nm to 1.3 μm. Hybrid device structures were fabricated by applying colloidal Au NRs on the surface of either a commercially available thermistor or a series of morphology-optimized resistive platinum (Pt) microwires. The photoresponse characteristics of these devices will be presented together with a series of microscopic mapping experiments providing a direct correlation between Au NRs and the device zone where resistance change happens under a laser illumination modulated at different frequencies. These hybrid Au-NRs/Pt photodetectors, capable to perform fast conversion between photon, heat, and resistance change, represents a brand-new strategy for alternative low-cost SWIR photodetection.

ALL ARE WELCOME

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