THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

COLLOQUIUM

Inorganic Sculptured Nano Forests

by

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Date: January 26, 2021 (Tuesday)
Time: 11:00 a.m. - 12:00 n.n.
Place: Rm. G25, Science Centre North Block, CUHK
Join ZOOM Meeting: https://qrgo.page.link/2i1Xn

ALL INTERESTED ARE WELCOME
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Abstract

When materials are shrunk to a size comparable to or even smaller than some characteristic scales (such as the wavelength of light interacting with matters, exciton diffusion length, and mean free path of charge carriers), the resulting materials, so-called nano (or quantum) materials, possess new properties distinct from their bulk counterparts. It leads to a wide range of potential applications with enhanced functions of, e.g., lighting, solar harvesting for electricity generation, molecular detection, bio-imaging, drug delivery and disease therapies. These novel properties/functions are intrinsically dependent on the component, composition, size, shape, crystallinity, surface area, and surface modification of nanomaterials. Flexible engineering of these diverse degrees of freedom plays a key role in the understanding and development of nanomaterial science and technology.

In this colloquium, I will present a facile nano-fabrication technique, glancing angle deposition (GLAD), which enables the generation of a close-packed array of separated nanopillars that are made of a wide range of inorganic materials (including metals, semiconductors and dielectrics) and are flexibly sculptured in nanostructures, that is, sculptured nano forests (SNAFs). Evaporated atoms are condensed on a supporting substrate at a deposition angle > 80º with respect to the normal direction of the substrate, so that the resultant self-shadowing effect accounts for the formation of nano forests. Movement of substrate during GLAD results in the sculpturing of nanostructures.

Three applied studies of SNAFs will be presented, including macroscopic manipulation of molecular chirality mediated with metal nanohelices, semiconductor SNAFs functioning as charge transporting layers to enhance power conversion efficiency, mechanical robustness and shelf stability of flexible perovskite solar cells, and biocompatible SNAFs for swift differentiation of neural stem cells into miniature substantia nigra-like structures with therapeutic effects on Parkinsonian rats. The sculptured structures of SNAFs are verified to substantially determine and enhance the concerned functions. These works provide an insight into the applications of the engineerable interactions of 1D nanostructures with light, cells and molecules to the important research fields of asymmetric (photo)catalysis, green energy generation, optoelectronics, and cell culture for cell therapy.

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