MAR11-2010-002453

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Fundamentals and applications of monodisperse carbon-based nanomaterials

MARK HERSAM, Northwestern University

Carbon-based nanomaterials have attracted significant attention due to their potential to enable and/or improve applications such as transistors, transparent conductors, solar cells, batteries, water purification systems, infrastructure materials, drug delivery, and biosensors. This talk will delineate chemical strategies for tuning and enhancing the properties of these promising nanomaterials. For example, we have developed and commercialized a scalable technique for sorting single-walled carbon nanotubes (SWCNTs) by their physical and electronic structure using density gradient ultracentrifugation (DGU). The resulting monodisperse SWCNTs possess unprecedented uniformity in their electronic and optical properties, which enables the fabrication of high performance thin film field-effect transistors, optoelectronic devices, and transparent conductors. The DGU technique also enables multi-walled carbon nanotubes to be sorted by the number of walls, and solution phase graphene to be sorted by thickness, thus expanding the suite of monodisperse carbon-based nanomaterials. By recently extending our DGU efforts to SWCNTs and graphene dispersed in biocompatible polymers (e.g., DNA, poloxamers, etc.), new opportunities have emerged in biomedical applications. Ultimately, the ability to control structure and surface chemistry with sub-nanometer precision enables optimized properties for a diverse range of technologies that employ carbon-based nanomaterials.