Monodisperse Carbon Nanomaterials in Electronic and Energy Conversion Devices

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Recent years have seen substantial improvements in the structural, chemical, and electronic monodispersity of carbon nanomaterials, leading to improved performance in a variety of technologically significant applications [1,2]. This talk will highlight our latest efforts to exploit monodisperse carbon nanomaterials in electronic and energy conversion devices [3]. For example, high purity semiconducting single-walled carbon nanotubes (SWCNTs) allow the fabrication of thin-film field-effect transistors with concurrently high on-state conductance and on/off ratio [4,5] and/or high frequency operation in excess of 150 GHz [6,7]. Using dielectrophoretic assembly, arrays of individual SWCNT transistors can also be realized with high yield [8]. Similarly, high performance digital circuits can be fabricated from semiconducting SWCNT inks via aerosol jet printing [9]. Beyond transistors, semiconducting SWCNTs have been utilized for light-emitting optoelectronic devices [10] or chemical sensors [11], while metallic SWNCTs are well-suited as transparent conductors [12,13] in organic photovoltaics [14]. This talk will also explore the utility of solution-processed graphene for high-frequency transistors [15], charge blocking layers in organic photovoltaics [16], and supports for photocatalytic production of solar fuels [17,18].

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