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Distinct Mechanisms of DNA Sensing Based on N-Doped Carbon Nanotubes with Enhanced Conductance and Chemical Selectivity

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Carrying out first-principles calculations, we study N-doped capped carbon nanotube (CNT) electrodes applied to DNA sequencing. While we obtain for the face-on nucleobase junction configurations a conventional conductance ordering where the largest signal results from guanine according to its high highest occupied molecular orbital (HOMO) level, we extract for the edge-on counterparts a distinct conductance ordering where the low-HOMO thymine provides the largest signal. The edge-on mode is shown to operate based on a novel molecular sensing mechanism that reflects the chemical connectivity between N-doped CNT caps that can act both as electron donors and electron acceptors and DNA functional groups that include the hyperconjugated thymine methyl group[1].

Reference

[1] H. S. Kim, S. J. Lee, and Y. -H. Kim, Small (to be published as a Cover Story, DOI : 10.1002/sml.201301225)

Keywords: Carbon nanotube, nanopore, DNA sequencing, tunneling, DFT, NEGF

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Luminescence Study of Eu³⁺ Ions Doped BaMoO₄ Nanoparticles

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Cost-effective, robust devices for solid-state lighting industry that converts electricity to light revolutionize the current lighting industry. Phosphor materials used in these devices should be synthesized in a low-cost and effective method for use in WLEDs. In this presentation, the synthesis of Eu³⁺ ions doped BaMoO₄ phosphor samples by a facile synthesis process for red component of WLEDs will be shown. The tetragonal phase of the host lattice was substantiated by the X-ray diffraction patterns. The morphological studies were carried out by using a field-emission scanning electron microscope and transmission electron microscope. These confirmed the formation of a shuttle like particles with perpendicular protrusions in the middle of the particle. The photoluminescence (PL) properties exhibited good emission with a high asymmetry ratio when excited with ultraviolet B wavelengths (~ 280-315 nm). The cathodoluminescence (CL) spectra showed similar results to the PL spectra, indicating the rich red emission. The results suggest that this phosphor is a good material as red region component in the development of tri-band UV excitation based WLEDs.

Keywords: BaMoO₄: Eu³⁺, Inorganic Compounds, Shuttle like particles, Red Emission, Energy transfer, Color coordinates