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ENHANCING PHOTOSENSITIVITY OF CARBON NANOTUBES BY MODIFICATION WITH METAL CONTAINING BLOCK COPOLYMERS

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Carbon nanotubes exhibit highly promising potentials in applications such as optoelectronics, advanced composites, sensing, and biomedics. They have been demonstrated to be the key materials in various optoelectronic devices such as field effect transistors, photo switching, light sensing, and light emitters. In order to disperse carbon nanotubes in solution, chemical modification of nanotube surface or surfactants have to be used. Here, we report the use of a multifunctional metal containing block copolymers for dispersing carbon nanotubes and modification of their photosensitivity. **Ru-b-Py** (Figure 1) was synthesized by reversible addition-fragmentation chain transfer polymerization. The block copolymer contains pyrene moieties in one block and ruthenium terpyridine isothiocyanate complexes in another block, which function as anchoring groups and photosensitizers, respectively. After mixing **Ru-b-Py** with multiwalled carbon nanotubes in DMF, the dispersion was stable for more than 5 days. The nanotube dispersion was drop casted on an ITO substrate with patterned electrodes, and the photoconductivity of individual nanotube was measured with a conductive atomic force microscope with and without illumination of light. It was observed that the photocurrent response of the copolymer:nanotube composite at different wavelength agreed well with the absorption spectrum of carbon nanotube modified with **Ru-b-Py**. This strongly suggests that the enhancement of photoconductivity of the block copolymer-nanotube composite is due to the ruthenium complex sensitizers, which strongly absorbs between 500-700 nm. This new approach in modifying carbon nanotubes allows us to fine-tune the optical and electronic of carbon nanotubes and related materials with similar structures, such as graphenes.

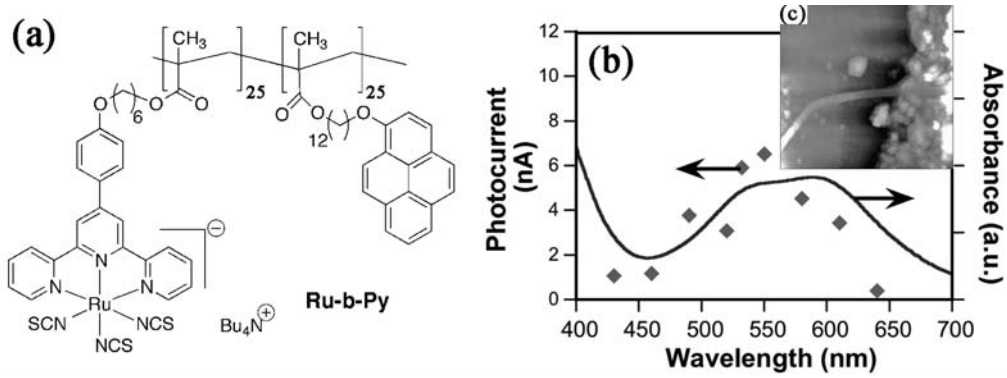

Figure 1. (a) Structure of the multifunctional block copolymer; (b) photocurrent response and optical absorption spectrum of the copolymer:carbon nanotube composite; (c) AFM micrograph of carbon nanotube functionalized with **Ru-b-Py** at the edge of an ITO electrode (full scale = 2 μm).