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Nanoscale Optoelectronic Characteristics of Organic Nanostructures

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Hybrid coaxial nanotubes (NTs) of multiwalled carbon nanotubes (MWCNTs) coated with light-emitting poly (3-hexylthiophene) (P3HT) are fabricated, and their optical and structural properties are characterized. The \textit{i-V} characteristics of the hybrid junction between the outer P3HT NT and the inner MWCNT, for the hybrid single NT, exhibits the characteristics of a diode (i.e., rectification), whose efficiency is clearly enhanced with light irradiation. The rectification effect of the hybrid single NT has been analyzed in terms of charge tunneling models. The quasi-photovoltaic effect is observed at low bias for the P3HT/MWCNT hybrid single NT.

We also report on the fabrication and optoelectronics using organic semiconducting self-assembled copper phthalocyanine (CuPc) and rubrene nanowires (NWs), NTs, and nanosheets (NSs). The structural transformation and enhanced optoelectronic properties for CuPc-based NWs and highly crystalline rectangular NTs are discussed. Nanoscale photoluminescence and optical wave-guiding characteristics for rubrene NTs and NSs are presented.