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Synthesis of Graphene oxide and Copper Phthalocyanine, AC electrical characterization and tuning the band gap of RGO-CuPc composite

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In the last decades, the grapheme science has engendered a revolution in technology due to its outstanding properties. In this research work, we synthesized CuPc, GO via improved Hummers' method, and RGO-CuPc composite through the reduction of GO by Hydrazine hydrate. This composite was analyzed by FT-IR, UV-vis spectroscopy, and FESEM microscopy. The results showed that most of the oxygenated groups of GO are removed or become very weak for the composite; Also some results verify the coupling of these two materials through π-π inter-molecular interaction. The UV-vis spectrum of resultant RGO-CuPc composite illustrates the red shift for the Q-band with the respect to that of CuPc's, implying relocation of the electrons from CuPc to graphene sheets as acceptors leading to tuning their band gap. The value of optical energy band gap for CuPc and RGO- CuPc are obtained 2.2 0.05 eV and 1.7 0.05 eV respectively. Sandwich devices of RGO-CuPc thin film with Aluminum electrodes (Al/RGO-CuPc/Al) were fabricated to investigate the AC electrical properties of RGO-CuPc composite over the frequency range of 102-105 Hz and the temperature range of 298-393 K. Capacitance for this device decreases by increasing frequency specially for frequencies below 103 Hz and in the temperature range of 343-393K. For high frequencies (f 103 Hz) it approaches a constant value. The RGO-CuPc composite acts as a novel semiconductor with high electron mobility. The conduction mechanism dominated by the band theory for frequency ranges below 103 Hz and in the temperature range of 298-393 K.