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## Preparation and Characterization of Poly (3-Hexylthiophene) Sensitized Ag Doped TiO<sub>2</sub> Nanotubes and Its Carrier Density under solar light illumination

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### Abstract

Poly (3-Hexylthiophene) sensitized Ag doped TiO<sub>2</sub>-NTs (P3HT/Ag-TiO<sub>2</sub>-NTs) have been prepared using the three sequential steps: two step anodization, galvanostatic deposition and spin coating techniques. The morphology and structure of P3HT synthesized by oxidative polymerization with FeCl<sub>3</sub> were characterized using NMR, FT-IR, SEM, XRD and optical properties of P3HT were investigated using Uv-Vis technique. The characterization results showed that the P3HT has 64.7% HT-HT configuration, mainly edge-on oriented lamellar structure and the optical band gap of 2.24 eV. Also, the morphology and structure characterization of P3HT/Ag-TiO<sub>2</sub>-NTs were determined by FE-SEM and XRD. The electrochemical behaviors of P3HT/Ag-TiO<sub>2</sub>-NTs in acetonitrile electrolyte contained I<sup>-</sup> /I<sub>3</sub><sup>-</sup> were examined by utilizing Electrochemical Impedance Spectroscopy (EIS) and Cyclic voltammetry (CV). The EIS results displayed that after the modification with P3HT, the value of charge transfer resistance at -0.4V decreases from 514 Ω cm<sup>2</sup> to 121 Ω cm<sup>2</sup>, compared to Ag-TiO<sub>2</sub>-NTs. Furthermore, the analysis results of EIS and Mott-Schottky for P3HT/Ag-TiO<sub>2</sub>-NTs under simulated solar light revealed that the charge transfer resistance decreased from 121 Ω cm<sup>2</sup> to 51.60 Ω cm<sup>2</sup> and the carrier density (N<sub>D</sub>) increased from 8.69x10<sup>21</sup> cm<sup>-3</sup> to 70.1x10<sup>21</sup> cm<sup>-3</sup>,

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