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Templating Copper on Polymer/DNA Hybrid Nanowires

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Abstract : DNA-templated poly(N-substituted pyrrole)bipyridinium nanowires were synthesised at room temperature using the chemical oxidation method. The resulting CPs/DNA hybrids have been characterised using electronic and vibrational spectroscopic methods especially Ultraviolet-Visible (UV-Vis) spectroscopy and FTIR spectroscpy. The nanowires morphology was characterised using Atomic Force Microscopy (AFM). The electrical properties of the prepared nanowires were characterised using Electrostatic Force Microscopy (EFM), and measured using conductive AFM (c-AFM) and two terminal I/V technique, where the temperature dependence of the conductivity was probed. The conductivities of the prepared CPs/DNA nanowires are generally lower than PPy/DNA nanowires showingthe large effect on N-alkylation in decreasing the conductivity of the polymer, butthese are higher than the conductivity of their corresponding bulk films.This enhancement in conductivity could be attributed to the ordering of the polymer chains on DNA during the templating process. The prepared CPs/DNA nanowires were used as templates for the growth of copper nanowires at room temperature using aqueous solution of Cu(NO3)2as a source of Cu2+ and ascorbic acid as reducing agent. AFM images showed that these nanowires were uniform and continuous compared to copper nanowires prepared using the templating method directly onto DNA. Electrical characterization of the nanowires by c AFM revealed slight improvement in conductivity of these nanowires (Cu-CPs/DNA) compared to CPs/DNA nanowires before metallisation.

Keywords : templating, copper nanowires, polymer/DNA hybrid, chemical oxidation method
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