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Facile synthesis and characterizations of polypyrrole/BiOCl hybrid composites

ABSTRACT

Polypyrrole(PPy)/BiOCl hybrid composites were synthesized for the first time via one-step chemical oxidation process by addition of Bi_2O_3 nanoparticle in an aqueous solution of pyrrole monomer/$FeCl_3$ oxidant agent. X-ray diffractions (XRD), field emission scanning electron microscopy (FESEM), and thermogravimetric technique confirmed the growth of BiOCl in PPy matrix. From the XRD, the amount of BiOCl in PPy matrix increased with increasing of Bi_2O_3addition in pyrrole solution. The FESEM images indicated the presence of two phases related to PPy and BiOCl. Thermal stability of PPy/BiOCl hybrid composites has been improved in the range 300–800 K and degraded above 800 °C, i.e., decomposition point of BiOCl. Fourier transforms infrared spectroscopy point to a mutual interaction between PPy and BiOCl system. The characteristic optical absorption peaks of PPy shifted to higher wavelength in PPy/BiOCl(5%) composites and disappeared at PPy/BiOCl(20%). From electrical measurement, the PPy/BiOCl hybrid composites have higher conductivity than PPy, where the maximum conductivity observed was for PPy/BiOCl(5%). The conducting mechanism of PPy and PPy/BiOCl composites followed three-dimensional Mott variable range hopping in the range of 300–150 K and has involved fluctuation-assisted tunneling phenomenon below 150 K.

Keyword: Chemical synthesis; Polypyrrole; BiOCl; Composites; Conductivity