TiO2 was prepared by the thermal hydrolysis of a titanium precursor (TiCl4) at a relative low temperature (<100 °C) in 1.0M HCl acidic aqueous solution. The XRD made on the resulting TiO2 shows the positions of all diffraction peaks correspond to rutile. However, in comparison to the normal powder XRD pattern, the intensity of the (101) peak is relatively heightened and its full width at half maximum (FWHM) is shrunken. The feature likely indicates that the resulting TiO2 rutile crystallites are major nanorods growth preferably in [001] direction and the (101) planes are the side wall of TiO2 nanorodes which are preferentially exposed to X-ray. Polypyrrole/Titanium dioxide nanocomposite (PPy/TiO2) was synthesized by in-situ chemical polymerization of pyrrole (Py) monomer in colloidal suspension of TiO2 rutile. Experiments show that the PPy/TiO2 nanocomposite is a core-shell structure of granular PPy covering TiO2 needles. From chemical view of consideration, at the first oxidization stage the TiO2 surface (donor sources) in the reaction medium acts as nucleation sites for the Py radical monomers (acceptor sources) adsorbed and anchored on as an evidence of strong bonds between TiO2 and PPy via donor-acceptor interaction. As a result, the core-shell structure will form p-n junction between PPy-TiO2. On the exposure to open air, the oxygen molecules will adsorb on PPy surface and then abstract electrons from the material (p-type semiconductor) and yielding positive holes. The more oxygen concentration in the environment, the more electrons are extracted, as a result, the material conductivity is increased and vice versa. Hence, with the TiO2 additive, the O2 sensitivity of PPy/TiO2 is 16-18 times higher than those of PPy. The feature indicates the fact that the inversion layer creates more additive oxygen deficiency on the PPy-shell surface. The cyclic voltagram diagrams have shown that at around 15 % TiO2 and scan rate 100mV/s the nanocomposites can reach a specific capacitance about 176 F/g.


Keywords: TiO2 rutile, nanocomposite PPy/TiO2, energy storage