

Preparation and physical properties of polypyrrole / zeolite composites

ABSTRACT

Polypyrrole (PPy')/zeolite composites were synthesized via chemical oxidation of pyrrole in the presence of zeolite. FeCl₃ was used as an oxidant with the FeCl₃-to-pyrrole molar ratio (MR) equal to 1. The zeolite contents were 0%, 5%, 10%, 15% and 20% of the total weight of PPy'. For comparison, pure PPy'' with FeCl₃-pyrrole MR equal to 2 was also synthesized using the same method. The structural and physical properties of the samples were studied using X-rays diffraction (XRD), Fourier transform infrared spectroscopy, field emission electron scanning microscopy, thermogravimetric analysis, van Der Pauw technique and UV-VIS-NIR spectroscopy. The XRD of PPy'/zeolite (5%) revealed a presence of crystalline nature of zeolite in a spectrum of host amorphous PPy'. The XRD peaks increased, became stronger and shifted slightly to higher 2 θ in PPy'/zeolite (10–20%) composites. Compared with PPy', the composites were denser, more compact and had better thermal stability. The composites conductivity increased while their bandgap tended to reduce with increasing of zeolite. PPy'/zeolite (20%) composite had the highest conductivity value of 3.6 S cm⁻¹ with an optical bandgap of 2.21 eV. The results showed that zeolite has been incorporated into PPy' matrix and improved its physical properties.

Keyword: Polypyrrole composites; Band gap; Conductivity; Thermal stability; Zeolite