

Application of classical and new, direct analytical methods for the elucidation of ion movements during the redox transformation of polypyrrole, Janaky C, Cseh G, Toth PS, Visy C, JOURNAL OF SOLID STATE ELECTROCHEMISTRY, 14 (2010) 1967-1973.

Abstract

Redox transformation and related processes in conjugated polymers have been studied by both classical (electrochemical quartz crystal nanogravimetry, in situ optical electrochemistry and a. c. impedance technique) and modern, direct analytical methods. As a model, polypyrrole thin layers have been deposited on a double-band indium tin oxide-supporting electrode – for the first time in the literature. The structure of the printed circuit made possible to monitor simultaneously the electrochemical, the optical, and the conductance changes during the processes, occurring in the self-same film. The film has been deposited under similar conditions on a quartz crystal-supported platinum electrode, as well, to follow the mass changes. The oxidation state of the layers has been gradually modified by multiple potential steps, and the abovementioned measurements have been completed by elementary analysis performed by energy dispersive X-ray (EDX) spectroscopy. From the correlation of the results, obtained by independent methods, the mixed anionic and cationic charge compensation has been evidenced. While during the first part of the oxidation (-0.6 V to 0.0 V) cations are removed from the layer, in the second part (0.0 V- 0.8 V) the anion incorporation is dominant. The results prove that EDX measurements can deliver direct semi-quantitative information on ion exchange processes accompanying the doping-undoping of conducting polymers.