

Nanocomposites and nanomaterials

ZnO NANOPARTICLES/POLY(3-METHYLTHIOPHENE) COMPOSITES FOR RGB ELECTROCHROMIC DEVICE

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Nowadays intrinsically conducting polymers (ICP) are considered as a promising alternative to electrochromic inorganic and low molecular organic materials for multicolor electrochromic devices (ECD). To enhance their spectral and transport characteristics some inorganic nanoparticles can be included in the ICP layer at the electrodes. In our work we used the simple, stable and inexpensive ICP representatives poly(3-methylthiophene) (P3MT) and polyaniline (PANI) placed on parallel counter ITO glass electrodes of the ECD that allowed fast and reversible RGB color transitions [1]. ZnO nanoparticles/poly(3-methylthiophene) thin layer composites were electrochemically synthesized as alternative electrochromic electrode to P3MT.

The effects of kinetic limitations on electrochemical reactions and electronic properties of the polymers were estimated from spectroelectrochemical studies. Spectral changes in the cell during stepwise changed electrochemical polarization were monitored to estimate input of each polymer in the color efficiency of the cell.

Based on additivity of the spectroelectrochemical behavior of the both polymers we summarized their electronic absorption spectra taken at the selected potentials and transformed the obtained sums to the transmittance spectra. Using spectral characteristic of the light source (white LED) and the transmittance spectra, we calculated the light intensity spectra of the model ECD prototype. Based on CIE standards and calculated light intensity spectra we have modeled the color palette of the ECD of the transmissive type. It is found that ZnO nanoparticles included in the poly(3-methylthiophene) layer modified its spectral characteristics and changed characteristics of the developed prototype of ECD based on P3MT and PANI electrochromic layers.

1. D. Sydorov, Ie. Duboriz, A. Pud Poly(3-methylthiophene)–polyaniline couple spectroelectrochemistry revisited for the complementary red–green–blue electrochromic device // Electrochimica Acta.-2013.-106.-P. 114–120.