The Optic Absorption Spectra of Polytoluidine Thin Films Doped With Inorganic Nanoclusters

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The development of nanotechnology attaches great importance to research materials that combine several functions, including "own" conductivity, optical absorption, touch sensitivity with flexibility, ease plasticity of polymers. Among these materials actively investigated conjugated polymers – polyaniline and their derivations: polytoluidine, polymethoxianiline and others. Manage of the optical and the electrical properties of these polymers is possible by doping with nanoparticles of different nature. In work, the features of the absorption spectra of polyorthotoluidine (PoTI) films doped by nanosilver (Ag), ferric chloride ($FeCl_3$) and complex K_3 [Fe $(CN)_6$] were studied.

The optical absorption spectra of PoTI are characterized by three bands. The first peak at a wavelength of 320 – 340 nm corresponds to π-π^* transition in polyaminoarene band gap. Absorption in the 620 - 650 nm can be attributed to the n-π^* transition in the amino-quinoid fragments in the polymer system. Absorption at $\lambda >$ 800 nm due to the presence of charge carriers of the polaron type which form own polaron zone [1].

It is shown the significant changes of optical absorption of PoTI-Ag films in comparison with the spectrum of undoped PoTI. The decreases of intensity and half-width of π-π^* transition band, the appearance of the absorption band with a maximum at 612 nm and leveling bipolaron broad band in the 800-950 nm were observed. These changes can be explained by the interaction of silver nanoparticles with a polymer chain, and at high levels of doping - plasmon resonance [2].

The doping of PoTI films with ferric chloride can be explained by the mechanism of recovery acceptor doping of Fe (3+) to Fe (2+). In this case can form a complex with charge transfer by $[PoTI]^+$ $[FeCl_4]^-$ type, which leads to an increase in intensity of the first absorption band. Introduction to the PoTI film of $K_3[Fe(CN)_6]$ complex causes the increase an intensity of the band at 620 nm and the disappearance of absorption induced by delocalized charge carriers.

The received results show a possibility to predict and control the optical properties of polyaminoarenes thin films using doping level and nature of dopant.

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2. Choudhgury A. Polyaniline/silver nanocomposites: dielectric properties and ethanol vapour sensitivity // Sensors and Actuators B. - 2009. - V.**138**, - P. 318-325.