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INVESTIGATION OF LINEAR OPTICAL PARAMETERS AND DIELECTRIC PROPERTIES OF PVA–ZnO NANOCOMPOSITE FILMS

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This work is devoted to prepare ZnO nanoparticles to be dispersed in a polymer matrix to obtain nanocomposite material with high refractive index to electronic applications.

Polyvinyl alcohol (PVA) based metal oxide nanocomposites has held remarkable interest by the scientific community due to their ability to combine the properties of both polymers and dopants. There are many applications of these polymer-based nanocomposites because of their electron transport, mechanical and optical properties in medical and engineering technology [1]. ZnO based polymeric nanocomposite materials have attracted scientific community because of their good transparency, high electron mobility, wide band gap (3.22 eV, at 300 K) [2].

In this study, the optical and dielectric properties of PVA/ZnO nanocomposite films were evaluated. ZnO nanoparticles were obtained by sol-gel method and then dispersed in the polymer solution by ultrasonic. The nanocomposite films were obtained via a solution casting technique. The surface morphology of the PVA/ZnO nanocomposite films were elucidated using scanning electron microscope. The optical properties were studied using UV-visible spectroscopy. The optical band gap value was found to decrease as the ZnO concentration increases in the polymer matrix. This may be attributed to the formation of localized states within the band gap due to the increase in the degree of disorder in the PVA matrix. The Urbach energy increases with the increase of the ZnO nanoparticles in the PVA matrix. This confirms the increase of disordering degree in the polymer films. The refractive index increases from 1.445 for pure PVA to 3.027

for PVA/ 2wt.% ZnO (at □=500 nm). The charge transport properties were evaluated based on the dielectric and impedance spectroscopy techniques. dielectric constant ε′ and dielectric loss ε″ values were found to increase with the increase the temperature. This testifies that the polymer films show thermally activated behavior. It creates more free volume in the polymer matrix and the orientation of the dipole simplified in the polymer films which leads to enhancement of dielectric permittivity. Low ZnO loading composite shows low dielectric value at higher frequency and behaves as a lossless material. The complex impedance spectra suggest the change in conductivity, due to the change in bulk resistance of the materials and less relaxation time. Thus, all PVA/ZnO nanocomposites behave as lossless materia

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СИНТЕЗ И ИССЛЕДОВАНИЕ СТРУКТУРЫ ОКСИДНОГО МАТЕРИАЛА СОСТАВА $Y_2Ba_3Fe_{3.3}Co_{1.7}O_{13+\delta}$

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SYNTHESIS AND STUDY OF THE STRUCTURE OF THE OXIDE MATERIAL OF THE COMPOSITION $Y_2Ba_3Fe_{3.3}Co_{1.7}O_{13+\delta}$

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Partial substitution of iron with cobalt $Y_2Ba_3Fe_{5-x}Co_xO_{13+\delta}$ has stabilized formation of the ordered structure. The oxygen content in the complex oxides has been determined in air over a wide temperature range by means of high-temperature thermogravimetry and iodometric titration.

Соединение состава $Y_2Ba_3Fe_{3.3}Co_{1.7}O_{13+\delta}$ носится к классу новых слоистых оксидных материалов общего состава $Ln_2Ba_3Fe_{5-x}Co_xO_{15-\delta}$ [1-2].

Данный класс соединений представляет интерес из-за наличия у них перовскитоподобной сверхструктуры, включающей не только упорядоченное расположение с катионов Y и Ba в A-подрешетке, но и близких по размеру и химической природе Co и Fe в B- подрешетке.

На сегодняшний день известно о существовании только Co-замещенного феррита иттрия-бария состава $Y_2Ba_3Fe_3Co_2O_{13+\delta}$ [2].

Поскольку в литературе нет сведений о соединении состава с меньшим содержанием кобальта. Поэтому в настоящей работе была предпринята попытка