МЕЖДИСЦИПЛИНАРНЫЕ ИССЛЕДОВАНИЯ

INVESTIGATION OF STRUCTURAL, ANTIBACTERIAL, ANTIOXIDANT, AND ANTICANCER PROPERTIES OF CARBON QUANTUM DOT SUPPORTED CO-DOPED ZnO NANOPARTICLES

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The Co-doped ZnO and Co-doped ZnO/CQDs nanoparticles are prepared by the chemical method. The incorporation of CQDs reduces the crystallite size, whereas the bond length remains the same. The chemical composition and elemental mapping are reported. The bandgap of Co-doped ZnO is reduced by the addition of CQDs. The Carbon quantum dots-supported Co-doped ZnO nanoparticles exhibited antibacterial activity against B. subtilis, E. coli, and K. pneumoniae...

Keywords: nanoparticles, band gap, *E. coli*, antioxidant, carbon quantum-dot.

1. Introduction. The increasing demands on energy and biocompatible applications call for new metal oxide semiconductor nanoparticles with tunable properties. A few famous

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metal oxide semiconductor nanoparticles include iron oxide [1], cobalt oxide [2], nickel oxide [3], copper oxide [4] and manganese oxide [5], in which zinc oxide is a wide band gap II-VI semiconducting compound. It has a high band gap [6], high excitation energy at room temperature [7], high thermal stability [8] and high magnetic moment [9]. These advantages make the material as a unique candidate in the field of LED [10], batteries [11], supercapacitors [12], solar cell [13], photodetectors [14] and transistor [15].

The properties of zinc oxide can be enhanced by tuning the donor/acceptor level. This can be done by the addition of a foreign atom as the dopant. Among transition metals, cobalt can be easily doped in zinc lattices due to its partially filled d-orbital. As the ionic radius of Co^{2+} is 0.072 nm [16] which is smaller than the ionic radii of Zn^{2+}, the effective substitution of Co^{2+} can be effectively done in Zn lattices. Co-doped ZnO nanoparticles are effectively used as an antibacterial material and photocatalyst [17, 18]. Since the role of crystallite size of the particles determines their structural, optical, photochemical and electrochemical properties of the nanoparticles, the understanding of the crystallite size as a function of doping concentration is highly needed...

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