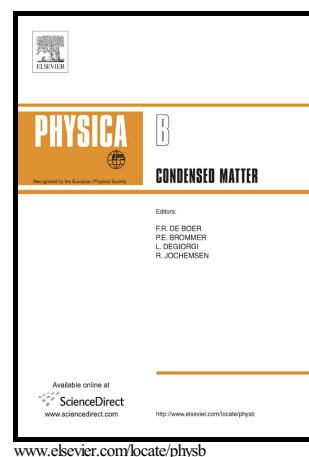


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Microstructural and optical properties of SiO₂ glasses doped with ZnSe Quantum Dots and Nd³⁺ Ions

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Abstract

SiO₂ glasses doped with ZnSe quantum dots and Nd³⁺ ions with compositions of (1% ZnSe – 99% SiO₂), (2% ZnSe – 98% SiO₂) and (2% ZnSe – 97% SiO₂ – 1% Nd³⁺) were synthesized by sol-gel method and then annealed at 683 K and 873 K for one hour. X-Ray diffraction (XRD) technique was used to identify the crystalline phases of ZnSe quantum dots. It was observed that 0 to 1 mol% of Nd₂O₃ addition produced single phase structure in XRD. The average crystallite sizes of ZnSe quantum dots were determined using Scherrer's equation and the $FW\frac{1}{5}/\frac{4}{5}$ M method. The size of the nanoparticles was found to be in the range of 4-10 nm. It was shown that the presence of Nd³⁺ ions led to smaller quantum dot sizes and a narrow size distribution.

Keywords: Quantum dot; sol-gel; XRD; neodymium; grain size distribution

1. Introduction

Over the past decades, II-VI nano-semiconductors have become an area of intensive study due to the nonlinear optical characteristics, wide range application areas like electroluminescence devices and telecommunications [1,2]. According to the quantum confinement effect, the optical properties of the quantum dots can be tuned through the control of their sizes. Due to

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