STUDY OF OPTICAL PROPERTIES IN ZNO SINGLE CRYSTALS

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INTRODUCTION.

Amorphous semiconductors can find applications in optics and optoelectronics. For any practical purpose and device applicability, room temperature measurements are of great importance. A room temperature Photoluminescence has already been reported in amorphous GaAs [1]. Optical properties such as transmittance, reflectance, photoluminescence and characterization information in terms of X-ray diffraction, Raman spectra, and FTIR spectra can generate invaluable information for these material systems regarding their electronic structure, exciton spectra, and, as previously reported, phonon replicas [1]. Detailed information about the refractive index and a precise band-gap of the system can also be extracted by modeling the experimental results using relevant theory [2].

MATERIALS AND METHODS.

We employed ZnO single crystals obtained commercially. The crystals are 99.99% pure, and fit for measurements of optical properties. Among the equipments, UV-VIS Spectrometer from PerkinElmer for TR% and RE% were used, and Varian Cary Eclipse for Fluorescence spectroscopy were used for PL measurements. The Raman spectra were measured by Raman HR-TEC manufactured by StellerNet Inc.

RESULTS AND DISCUSSION.

The measured transmittance, reflectance, and photoluminescence data were fitted through theoretically calculated curves. The absorption spectra were calculated using band gap of the material found from the TR% measurement at 300 K. The calculated absorption was then used to find theoretical curve of photoluminescence and reflectance. The curves showed significant match, thereby enabling to confirm the band-gap of the material. The Raman peaks confirmed the purity of the material as well as helped to find more structural information regarding the sample such as c-axis information. There has always been vital interest in narrow and wide-band gap semiconductors for their applicability in short-wavelength photonic devices and in electronic devices operating in high frequency regime [2, 3]. Historically, ZnO was never favored as a potential material for the above applications primarily because of difficulty in growing it. This situation, however, has improved drastically in the past decade thereby renewing the attention on this material system, which also is the main reason to undertake our work. Hence, ZnO is being proposed for potential light emitting devices in the blue and UV regions of electromagnetic spectrum. This work also sheds important light on applicability of ZnO in high power transistors [2].

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