

# ESTIMATION OF CARRIER LIFE TIME FROM INTRINSIC PHOTOLUMINESCENCE OF ZnO

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**Introduction.** Comprehensive knowledge of the optical properties, particularly of the room temperature (RT) photoluminescence (PL), of ZnO is essential for the future employment of this wide-band gap (~3.3 eV at 300 K) II-VI compound semiconductor in photonic and optoelectronic device structures [1]. Hence, vigorous research activities on ZnO thin films, epilayers, and crystals took place during the last two decades, encompassing a vast variety of effects and phenomena such as birefringence, photocurrent, PL including sub-band gap emission, reflectance, transmittance, excitonic properties, Raman modes, and absorption edge steepness [1-4]. However, despite that large body of knowledge and its essential importance for light emitting processes, a discussion of the ZnO PL lineshape is not found in the literature [5].

**Materials and methods.** The commercial ZnO crystal investigated with dimensions and electron concentration of 10 mm x 10 mm x 0.5 mm and  $\sim 4 \times 10^{13} \text{ cm}^{-3}$ , respectively. The <0001> oriented crystal is two-side polished with the optical c-axis perpendicular to the surface. The quality and orientation of the sample was confirmed by surface backscatter Raman spectroscopy [6].

**Results and discussion.** Analysis of Raman peaks, transmission, reflection, and photoluminescence, with appropriate fitting functions driven by the absorption spectra of crystalline ZnO calculated through Ullrich and Bouchenaki model led us to effective diffraction length and life time of excited electrons at room temperature, with confirmation from literature [7].

**Conclusions.** Employing the model of Ullrich and Bouchenaki, in this work, the absorption dispersion of bulk ZnO is deduced from transmission and PL measurements and, by use of this information, we demonstrate via the extended Roosbroeck-Shockley relation the intrinsic relationship between absorption and PL lineshape [5].

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