# Stable Charged and Neutral Exciton at Near Room Temperature in a ZnO/(Zn,Mg)O Quantum Well

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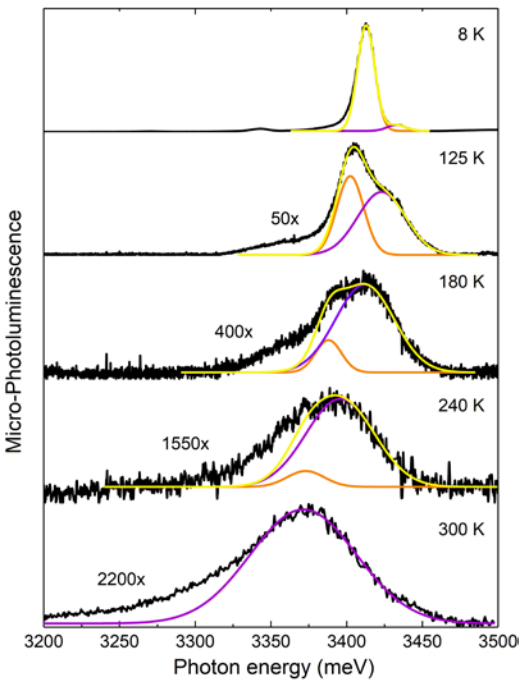
ZnO based low dimensional structures such as quantum wells (QWs) offer a high exciton oscillator strength and exciton binding energy by far exceeding room temperature thermal energy. This makes such structures highly attractive for a variety of optoelectronic applications. So far, ZnO/(Zn,Mg)O QWs have been studied mostly in the context of neutral excitons and effects such as room temperature stimulated emission and lasing. A stable charged exciton state would allow spintronics devices involving the degree of freedom related to the spin of the minority carrier (hole), with an advantageous ability of external electric field manipulation due to an uncompensated charge of the majority carrier (electron).




Micro-photoluminescence of a single ZnO/(Zn,Mg)O Quantum Well at the temperatures from 8 K to 300 K. Deconvolution of the spectra with two Lorenzian curves representing $X_A$ and $X^-_A$ transitions is shown.

Here, we study the optical transitions of charged and neutral excitons in a single ZnO/(Zn,Mg)O QW produced by plasma-assisted molecular beam epitaxy on an *a*-plane sapphire substrate. The QW thickness of 1.7 nm is determined by scanning transmission electron microscopy. Photoluminescence (PL) measurements conducted in magnetic field of up to 10 T confirm the exciton lines identification. Statistics gathered in the PL spatial mapping measurements carried with a 150 µm step on 76 × 52 points enables reliable determination of the QW emission properties. Record high value of charged exciton binding energy attaining 22 meV or 27.6 meV is found in the PL spatial mapping or optical transmission measurements, respectively. Temperature dependent measurements show that emission of neutral and charged excitons, survives, respectively, up to room and near room temperature. The study indicates ZnO/(Zn,Mg)O QW as promising active material in optoelectronic and spintronic devices operating at ambient conditions.

[1] M. Muszyński, H. Teisseyre, K. Sobczak, and J. Suffczyński, *Appl. Phys. Lett.* **117**, 033102 (2020).