Photoconductivity measurements on $Mg_xZn_{(1-x)}O$ thin films in the mid-infrared spectral range

Fourier transform infrared photoconductivity (FT-IR-PC) spectroscopy was carried out on MgZnO samples with Mg-contents of up to 40%. By alloying ZnO with Mg its band gap of 3.4 meV can be tailored to energies above 4 meV. Therefore MgZnO/ZnO heterostructures are promising as active medium for future transparent optoelectronic devices. Although large effort is nowadays carried out to study the electrical properties and the defect structure of ZnO, little is known about MgZnO.

The MgZnO thin films were grown by Pulsed Laser deposition on a-plane sapphire substrates and exhibited no phase-separation of MgO, confirmed by X-ray diffraction measurements. The low temperature (5 K) PC-spectra show strong similarities to those of pure ZnO. While no spectral shifts dependent of the Mg-content were observed, additional transitions occur at 365 and 400 meV. However, this is in contradiction to results obtained by Deep level transient spectroscopy (DLTS), where the activation energy of the prominent defect E3 shifts towards higher values with increased Mg-content.

Up to five phonon replicas of a transition at 175 meV occurred in some PC-spectra. Bias dependent measurements were performed in order to determine the strength of the electron-phonon-coupling . A Huang-Rhys-factor of up to 2 could be estimated for zero bias.

Furthermore temperature dependent measurements were carried out. Additional transitions at ~160 and ~405 meV could be observed at temperatures above 60 K. An explanation in terms of the process of photothermal ionisation will be given.