P-47

Application of synchrotron radiation for study Fano type Mn (3p-3d) photoemission resonances

E. Guziewicz*, B. A. Orlowski, B. J. Kowalski and K. Kopalko

Institute of Physics, Polish Academy of Sciences, Warsaw, Poland

Keywords: synchrotron radiation, photoemission spectroscopy, zinc selenide, zinc oxide

*e-mail: guzel@ifpan.edu.pl

The synchrotron radiation beam in the continuous energy range from 40 to 160 eV was used to obtain EDC photoemission spectra of the valence band and the resonant photoemission Fano type resonance for the Mn (3p-3d) transition. The wide bandgap II-VI semiconductors containing ions of the 3d Transition Metals (TM) are promising materials for short wavelength magneto-optical applications.

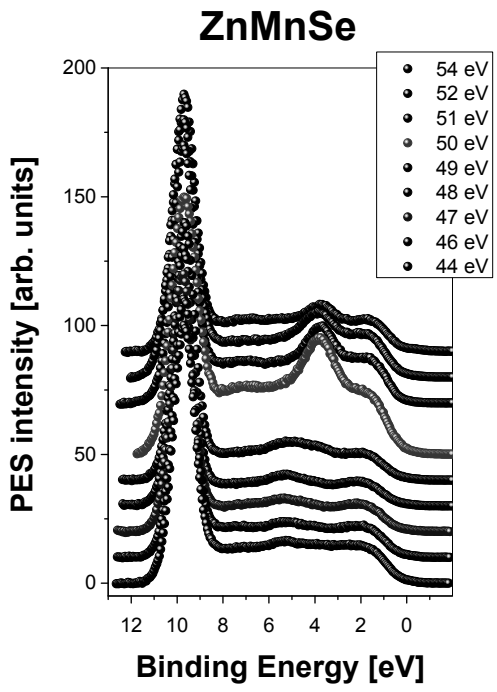

Fig.1. Photoemission EDC spectra of ZnMnSe ternary alloy measured in the region of the Fano resonance corresponding to the Mn3p-3d photoionization threshold.

The electronic valence band structure and especially the contribution of localized and delocalized Mn3d states in respect to the valence band edge and the Fermi level is of great importance for most of these applications.

In the experiment presented here we investigated the Mn3d contribution to the valence band of ZnMnSe and ZnMnO semiconductors. The resonant photoemission Energy Distriution Curves (EDCs) have been measured in the binding energy range from the valence band edge to 14 eV below. We explored the photon energy range across the Mn3p-3d photoionization threshold (44 eV – 54 eV).

The resonant photoemission study shows the fingerprints of the Mn3d states in the valence band region within 9 eV below the Fermi edge. One can distinguish three Mn3d related structures: a structure around the Fermi edge (1-3 eV below EF), the main peak between 3.8 and 4.5 eV, and a broad satellite located between 5.5 and 9 eV below the Fermi edge. The branching ratio of the satellite/main structure is related to the Vpd hybridization parameter [1] and it decreases with increase of hybridization. The branching ratio was measured as 0.43 for ZnMnO and 0.9 for ZnMnSe. It indicates a high degree of hybridization between manganese's and ligand's electron states. The branching ratio obtained for ZnMnO and ZnMnSe alloys follow the trend towards higher hybridization as we move up in the Periodic Table, which was observed in ZnY compounds (Y=S, Se, Te) [1, 2].

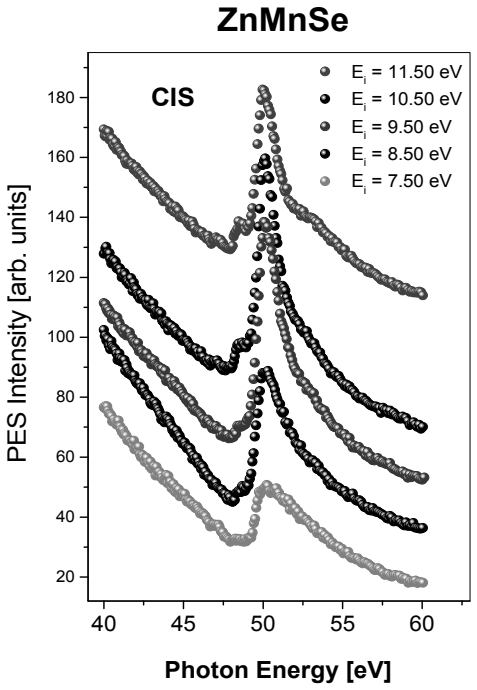

Fig.2. Photoemission Constatnt Initial State (CIS) spectra of ZnMnSe showing the Fano resonance curves of ZnMnSe measured across of the Mn3p-3d photoionization threshold.

Acknowledgement: The work was partially supported by the Polish NCN project DEC-2012/07/B/ST3/03567.

[1] R. Weidemann *et al., Phys. Rev. B* **45** (1992) 1172.
[2] E. Guziewicz *et al., Physica Scripta* **T115** (2005) 541.