# High Energy Fano-type Resonances for Localized States in Alloys

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The wide bandgap II-VI semiconductors containing ions of the 3d Transition Metals (TM) are promising materials for short wavelength magneto-optical applications. The electronic band structure, especially the location of 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→Mn3d* photoionization threshold (48 eV – 52 eV).

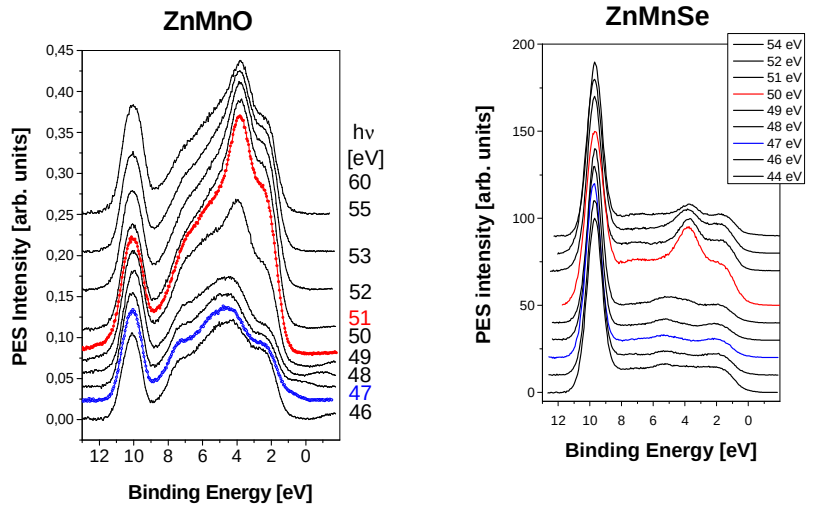


Fig.1. Photoemission EDC spectra of ZnMnO (left) and ZnMnSe (right) measured across the Mn3p→Mn3d photoionization threshold.

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 $E_F$), 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 $V_{pd}$ 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].

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