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The role of Mn doping in ZnO based DMS studied by x-ray absorption and emission spectroscopy JINGHUA GUO, Lawrence Berkeley National Laboratory, AMITA GUPTA, PARMANAND SHARMA, K.V. RAO, Royal Institute of Technology, Sweden, J.M.O. GUILLEN, RAJEEV AHUJA, Uppsala University, Sweden — Independent control of spin and charge of doped carriers has attracted much interest in diluted magnetic semiconductors (DMSs) because the combination of the two degrees of freedom is expected to open up new functionalities in optoelectronic and magnetoelectric devices. Recently dilute Mn doped ZnO was shown to have such a property when processed at temperatures below 500°C. In general, electronic structure ultimately determines the properties of matter, and therefore a detail description of the electronic structure of DMS will lead to a better understanding its magnetic properties. We studied the electronic structure of Mn-doped ZnO using X-ray absorption (XAS) and emission spectroscopy (XES). Upon Mn doping, the top of O $2p$ valence band extends into bandgap and a distinct absorption feature appears at the bottom of the conduction band, which suggests the strong hybridization of Mn $3d$ and O $2p$. The evidence of the ligand-hole states of Zn *3d – O 2p* is shown. Furthermore, Mn $2p$-absorption and $L-$emission spectra indicate Mn^{2+} replacing Zn site in tetragonal symmetry.

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