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Characterization of Mn and Fe diffusion into ZnO Films and single crystals for diluted magnetic semiconductor applications.[1] R. GATEAU, D.H. HILL, R.A. BARTYNSKI, P. WU, Y. LU, Rutgers University — There is growing interesting in the use of transition metal (TM) doped ZnO films as a diluted magnetic semiconductor for room temperature spintronics applications. Various methods of doping have been investigated including ion implantation and co-deposition during the growth process. In essentially all approaches, doping either accompanies, or is followed by, an annealing step intended to achieve a uniform distribution of the TM dopant, and/or encourage substitution of TM ions for Zn in the Wurtzite lattice. We have studied the diffusion of Mn and Fe into epitaxial and highly-oriented ZnO films, and into ZnO single crystals. The epitaxial films were grown on r-sapphire, exposing the (11-20) surface, while the highly oriented films were grown on a-sapphire exposing the (0001) surface of ZnO. The single crystal substrates were cut to the (0001) and (1100) orientations. Metallic films of $\sim$ 20nm thickness were deposited onto the ZnO substrates, which were subsequently annealed to 700C for between 10 and 40 minutes. We find that the diffusion rate for Mn is approximately an order of magnitude larger than for Fe under the same annealing conditions. Differences in diffusion rates associated with crystallographic orientation and film morphology will be discussed.

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