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Dilute magnetic semiconductors (DMSs) are a highly attractive field of research due to their potential to open new technological functionality. Here, we perform a systematic study of In₂O₃ thin films with dopant ions of Mn, Co, Ni, and Fe to investigate the unique interaction of each of these ions and their incorporation into the semiconductor lattice. We report substitutional positioning of Fe atoms into the In³⁺ site and a mixture of interstitial, metallic clustering, and substitutional positioning for Co, Mn, and Ni, discriminating between oxidation states for all dopant atoms.