Design of Colossal Solubility of Magnetic Impurities for Semiconductor Spintronics by the Co-doping Method[1] TETSUYA FUKUSHIMA, ISIR, Osaka University, KAZUNORI SATO, HIROSHI KATAYAMA-YOSHIDA — Based on first-principles calculations, we propose co-doping method for increasing solubility of magnetic impurities in dilute magnetic semiconductors (DMSs). The concentration dependences of the mixing energy of DMS, such as (Ga,Mn)N, (Ga,Cr)N, (Ga,Mn)As, and (Zn,Cr)Te, show large convexity and these systems have a tendency toward spinodal decomposition. By introducing compensating impurities into these DMS, the mixing energy shows gradual transition from convex to concave concentration dependence resulting in negative mixing energy of magnetic impurities. This observation suggests that the co-doping method dramatically increases the solubility of magnetic impurities in DMS, thus high concentration doping of magnetic impurities into DMS becomes possible.

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