Frustrated coupling and the doping effect on ferrimagnetic $(Mn_{1-x}TM_x)_3O_4$

Spinel Mn_3O_4 has a crystal structure containing one tetrahedron and two octahedra per formula. Octahedra connect to each other by edge sharing and to tetrahedra by apex sharing. Due to the frustrated nature of Mn3+, Jahn-Teller distortion dominates the local structural distortion. The strong AFM coupling between the octahedron and the adjacent tetrahedra overwhelms the weak AFM coupling between two adjacent octahedral to become ferromagnetic. Combining these two effects, the Mn_3O_4 forms a canted ferrimagnetism. With transition metal (TM) doping, the crystal and spin structures, the magnetic coupling between tetrahedron and octahedron, and the spin-orbit coupling of $(Mn_{1-x}TM_x)_3O_4$ spinels can be altered with the doping level and temperatures. In this talk, I will present the doping of Cr, Fe, Ni, Co and Cu and their effect on these physical properties. The modern spintronics utilizes an AFM active layer that the spin orientation of this layer is easily to be manipulated. The advantage of the AFM active layer is the negligible stray field that enhances the stability of each pixel without being affected by the neighbor one. However, the disadvantage is the strong anisotropic spin structure with its spin orientation very difficult to be changed. This disadvantage can be lifted by the proper doped $(Mn_{1-x}TM_x)_3O_4$ that makes itself a great potential for future spintronic application.

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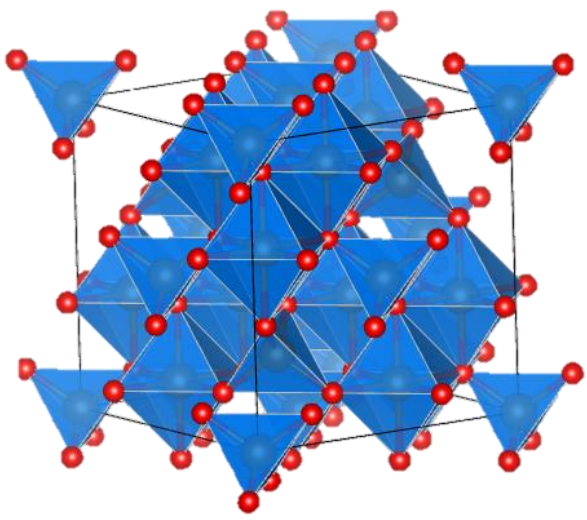

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