Transport and magnetic properties of the topological (Weyl) semimetal: Hexagonal - $(Mn_{1-\alpha}Fe_{\alpha})_3Ge$

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Antiferromagnetic Weyl semimetal Mn_3Ge displays a large anomalous Hall effect (AHE) up to room temperature, which originates from the topologically protected Weyl nodes. The location and separation of the Weyl nodes determine the strength of AHE and chiral anomaly observed in the system. These parameters can be controlled by the suitable dopants of the parent Weyl semimetal. Therefore, we have studied the evolution of transport properties in a series of single crystal $(Mn_{1-\alpha}Fe_{\alpha})_3Ge$. We observed that the strength of AHE and chiral anomaly weakens drastically with an increase in Fe doping and vanishes beyond $\alpha = 0.22$. Furthermore, polarized and unpolarized neutron diffraction of $\alpha = 0.22$ (single crystal) showed that the magnetic structure of the doped compound remains the same as that of the parent compound, only in the temperature regime where AHE and chiral anomaly is observed. These observations suggest that the Weyl nodes are present in the doped compounds also, as long as Mn_3Ge type magnetic structure persist. We also observed that characteristics of the Weyl nodes can be tuned significantly by suitable doping of the Weyl semimetals.