Growth & Characterization of Layered Magnets

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MnPS3 and GdPS have been researched due to the recent insight into 2D magnetism. The ZrSiS family (GdPS belongs to this family) can be used as topological materials through elemental substitution and strain application. On the other hand, MnPS3 belongs to the MPX3 family (M is a transition metal, and X is a chalcogen). Both crystals are synthesized through the Chemical Vapor Transport method. GdPS is heated till 975-1075 °C in a furnace for 1 week. On the other hand, MnPS3 is heated till 600-650 °C for 1 week. Then, the material composition and the crystal structure are determined through XRD (X-ray Diffraction) and EDS (Energy-Dispersive Spectroscopy). Finally, the temperature dependence of the magnetic susceptibility (?) is measured by putting both samples in the PPMS (Physical Property Measurement System). The susceptibility is measured by applying out-of-the-plane (H||c) and in-plane(H||ab) magnetic fields. Both materials exhibit a Néel temperature. For GdPS, the Néel temperature is around 7 K. For MnSP3, the temperature is around 78 K. However, MnPS3 could be doped with other elements. For example, Mn0.36Fe0.64PS3 has a Néel temperature of 48.4 K. Finally, the Mangenese in MnPS3 could be replaced with other elements. For example, Ni0.82Co0.18PS3 has a Néel temperature of 146 K and FePS1.5Se1.5 a Néel temperature of 106 K. These new materials could replace MnPS3 because they are more temperature resistant before establishing a long-term magnetic order or if a device needs to achieve a long-term magnetic order at a lower temperature.

Awards Won:
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