

Growth and Characterization of 2D Magnetic Materials

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Both, MnPS₃ and GdPS, have been researched due to the recent insight into 2D magnetism and topological states. 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 CVT (chemical vapor transport) method. GdPS is heated till 1075-975 °C in a furnace for 1 week. The same can be said for MnPS₃, but the material is heated to 650-600 °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) and applying a magnetic field out of the plane ($H \parallel c$) and in-plane ($H \parallel ab$) magnetic fields. Both materials exhibit a Néel temperature. For GdPS, the Néel temperature is around 7 K. For MnPS₃, the temperature is around 78 K. Therefore, both crystals display antiferromagnetic properties before their respective Néel temperatures. As a result, they can be used as superconductors below the Néel temperature. They are used in spintronics and thin layered magnetic fields due to their magnetic anisotropy.

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