Atomic Layer Epitaxial Growth of Kagome Magnet Fe_3Sn_2 Thin Films

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Kagome magnets are attractive family of materials due to complex spin textures and topological band structures [1]. As a typical example of kagome magnet, Fe_3Sn_2 has been shown to exhibit spin frustration [2] and magnetic skyrmions [3] in real space, and massive Dirac fermions [4] in momentum space. However, most of these studies were done on bulk crystals. The development of epitaxially grown Fe_3Sn_2 thin films will be an exciting future direction, as the thin films of kagome magnets enable potential applications in devices as well as the discovery of new phenomena.

In this presentation, we report our progress in atomic layer molecular beam epitaxy (AL-MBE) growth of kagome magnet Fe_3Sn_2 thin films on Pt(111) buffer layer on $Al_2O_3(0001)$ substrates. During the growth, the RHEED intensity shows oscillatory behavior, indicating layer-by-layer growth mode (Fig. 1(a)). AL-MBE allows us to grow Fe_3Sn_2 at much lower temperatures and therefore produces a sharp interface. The high quality of the sample is confirmed by various methods (Fig. 1(b)). The magnetic properties of Fe_3Sn_2 thin films are also presented here (Fig. 1(c)) [5]. We further show that the anomalous Hall effect (AHE) only has intrinsic contribution, suggesting the magnetic Weyl semimetal nature of Fe_3Sn_2 (Fig 1(d)).

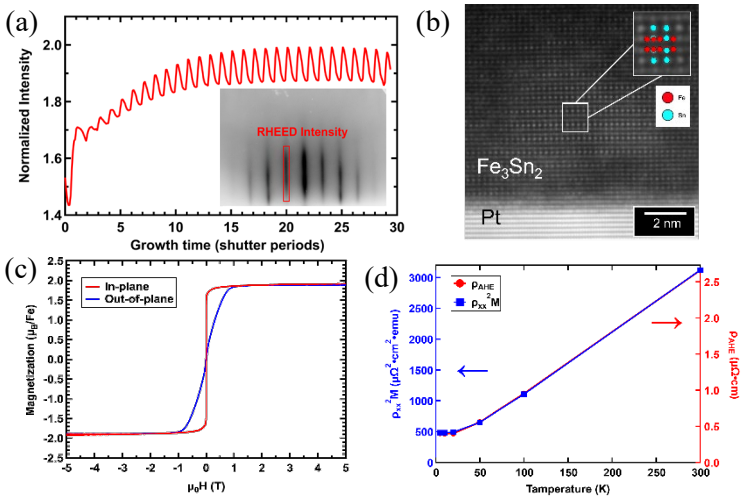

Figure 1 (a). RHEED oscillation and RHEED pattern (inset). (b). Cross-sectional transmission electron microscope image of Fe_3Sn_2. (c) Hysteresis loop of Fe_3Sn_2 thin film measured with SQUID magnetometer. (d). AHE data of Fe_3Sn_2.

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