

スピンホール磁気抵抗効果を用いた Cr_2O_3 薄膜のネール点検出

Resistive detection of the Néel temperature of Cr_2O_3 thin films

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Although bulk magnetic properties of various antiferromagnets have been vigorously studied since long ago, their properties in the form of thin films, which are more relevant to antiferromagnetic spintronic devices, have not been investigated as much. In this work, we characterized the Néel temperature of Cr_2O_3 thin films by investigating the temperature dependence of the spin Hall magnetoresistance (SMR) in $\text{Cr}_2\text{O}_3/\text{Pt}$ bilayers.

We prepared $\text{Cr}_2\text{O}_3/\text{Pt}$ bilayers epitaxially grown on a single crystal $\alpha\text{-Al}_2\text{O}_3$ substrate. We performed the resistance ratio measurements shown in Fig. 1 (a) in order to sensitively detect the resistance change up on the magnetic phase transition. We employed Cr_2O_3 films with the magnetic easy axis parallel to the y direction. Fig.1 (b) shows the temperature dependence of $(V_1/V_2)-1$. The drastic change in $(V_1/V_2)-1$ around 300 K is associated with the resistance change due to SMR up on the magnetic phase transition and it corroborates the Néel temperature of Cr_2O_3 (cf. 307 K is reported for the bulk.). The results provide a reliable way to determine the Néel temperature of antiferromagnetic thin films.

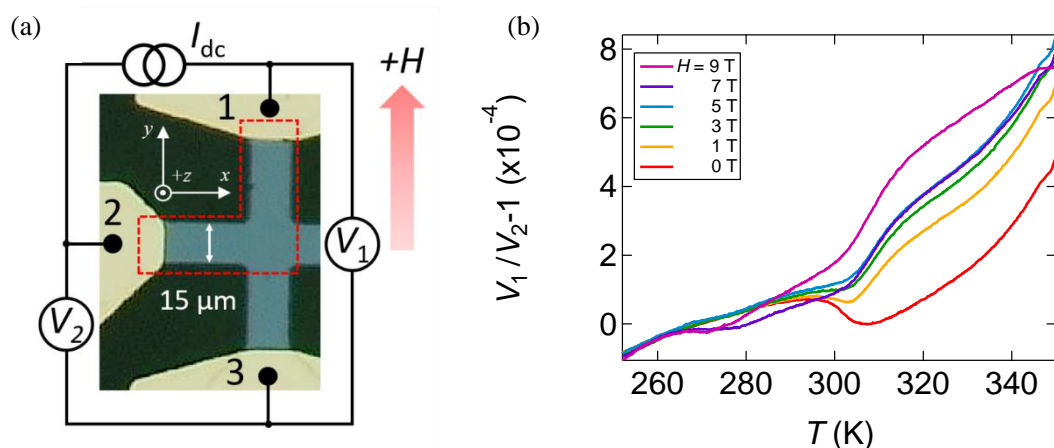


Figure 1 (a) Microscopy image of the device under test with the electrical circuitry used in our measurements. (b) Temperature dependence of $(V_1/V_2)-1$.