PS11

The Anomalous Hall Effect in an Anisotropic Ferromagnet $PrBaCo_2O_{5+x}$

A.A. Taskin[1], I. Tsukada[2], and Yoichi Ando[1]

[1]Department of Frontier Materials Creation, The Institute of Scientific and Industrial Research, Osaka University, Osaka

[2]Materials Science Research Laboratory, Central Research Institute of Electrical Power Industry, Kanagawa

Renewed interest in an old problem of the origin of the Anomalous Hall Effect (AHE) in ferromagnetic materials has led to a new theoretical approach based on the Berry-phase formalism. It has been shown theoretically that an intrinsic contribution to the Hall conductivity is intimately related to the details of the band structure of the material. In particular, the band crossings and splitting of the band dispersions caused by the spin-orbit interaction are very important. It means that the AHE must be very sensitive to the Fermi level and to the spin texture of the material.

Recently, we have succeeded in growing single crystals of $PrBaCo_2O_{5+x}$ (PBCO) which can be doped by charge carriers upon changing its oxygen content, allowing one to control the position of the chemical potential in this compound. Using high oxygen pressure annealing, we have achieved a metallic state in PBCO for $x > 0.8$. Compositions with high oxygen concentration ($x > 0.7$) are found to have a highly anisotropic ferromagnetic ground state.

In this contribution, we present a study of the AHE in $PrBaCo_2O_{5+x}$ near the metal-insulator transition ($0.70 < x < 0.87$), where a change from localized to itinerant state occurs. We found that in the zero-temperature limit the Hall conductivity A xy remains finite at all doping levels studied. The magnitude of A xy is strongly temperature dependent and even shows a sign reversal in samples with metallic conductivity. Following the spin anisotropy of the material, the Hall conductivity also shows very anisotropic behavior. Based on those experimental findings, we discuss the possible topological origin of the AHE in $PrBaCo_2O_{5+x}$.