MAR07-2006-002797

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Large anisotropic normal-state magnetoresistance in clean MgB_2 thin films[1]

QI LI, Penn State University

MgB_2 is arguably the first material which shows clear multiband superconductivity and two energy gaps. The interplay between the interband and intraband scattering as well as electron-phonon coupling has manifested in many physical properties. In this talk, I will review the magnetoresistance measurements of the normal state of MgB_2. We have shown large normal-state magnetoresistance with temperature-dependent anisotropy in very clean epitaxial MgB_2 thin films (residual resistivity much smaller than 1 $\mu\Omega$cm) grown by hybrid physical-chemical vapor deposition.[1] The magnetoresistance shows a complex dependence on the orientation of the applied magnetic field, with a maximum magnetoresistance (MR 136%) observed at the field H parallel to ab plane at low temperature. However, the angular dependence changes dramatically as the temperature is increased, and at high temperatures ($T > 100$ K), the magnetoresistance maximum changes to the H perpendicular to ab direction. We attribute the large magnetoresistance and the evolution of its angular dependence with temperature to the multiple bands with different Fermi surface topology in MgB_2 and the relative scattering rates of the σ and π bands, which vary with temperature due to stronger electron-phonon coupling for the sigma bands. The change of anisotropy with disorder has also been reported in neutron irradiated MgB_2 thin films.
Work done in collaboration with B. T. Liu, Y. F. Hu, J. Chen, H. Gao, L. Shan, H. H. Wen, A.V. Pogrebnyakov, J. M. Redwing, and X. X. Xi.

[1] Qi Li et al., Phys. Rev. Lett., 96, 167003 (2006).

[1]Work is supported by NSF.