Hall Conductivity and Vortex Phase in MgB_2 Thin Film

Soon-Gil Jung[a], W. K. Seong[a], W. N. Kang[*, a], Eun-Mi Choi[b], Heon-Jung Kim[b], Sung-Ik Lee[b], Hyeong-Jin Kim[c]

[a] *Department of Physics, Sungkyunkwan University, Suwon 440-746, Korea*

[b] *National Creative Research Initiative Center for Superconductivity, Department of Physics, Pohang University of Science and Technology, Pohang 790-784, Korea*

[c] *National Creative Research Initiative Center for Semiconductor Nanorods, Department of Materials Science and Engineering, Pohang University of Science and Technology, Pohang 790-784, Korea*

In MgB_2 thin film superconductor, we have found that Hall conductivity (σ_{xy}) is described by the sum of two terms, $\sigma_{xy}=C_1/H+C_3H$, where C_1 and C_3 are independent on the magnetic fields and have the positive values. The C_1 is observed to be proportional to $(1-t)^n$ with $n=3.3 \pm 0.1$ and t being the reduced temperature (T/T_c), and C_3 is weakly dependent on the temperature. These results are well consistent with those of the overdoped $La_{2-x}Sr_xCuO_4$ superconductors. Based on the Hall angle data, we obtained vortex phase diagram with three regions, vortex-solid, critical, and vortex-liquid regions.

Keywords : MgB_2 thin film, Hall conductivity, Hall angle, vortex phase diagram