Anisotropic magneto-transport properties of layered perovskite $Sr_3Fe_{2-x}Co_xO_{7-\delta}$ crystals

R. Nakamura[a], J. Tozawa[a], M. Akaki[a], D. Akahoshi[b], K. Itatani[a], and H. Kuwahara[a]

[a]Department of Physics, Sophia University, Tokyo 102-8554, Japan
[b]Department of Physics, Toho University, Funabashi 274-8501, Japan

The parent compound of this study, $Sr_3Fe_2O_{7-\delta}$ with layered structure, undergoes a metal-semiconductor transition at 350 K and then an antiferromagnetic one at 120 K. By substituting Co for Fe-site, the system has been reported to be a ferromagnetic (FM) metallic phase and show a negative magnetoresistance (MR). In this work, we have systematically investigated the magnetic and electronic properties of single-crystalline solid solution $Sr_3Fe_{2-x}Co_xO_{7-\delta}$ (x = 0.2, 0.5) by measurements of magnetization and resistivity as a function of temperature and magnetic field. By applying magnetic fields parallel to the c axis, the magnetization of $Sr_3Fe_{2-x}Co_xO_{7-\delta}$ (x = 0.5) shows a steep increase at 150 K. In contrast, it is not steep in the case of perpendicular to the c axis. These results suggest that the x = 0.5 sample has a large magnetic anisotropy, and that an FM moment is easily aligned along the c axis. On the other hand, the resistivity perpendicular to the c axis is smaller than that parallel to the c axis, as simply expected from the crystal structure. The resistivity perpendicular to the c axis drastically decreases with increasing magnetic fields parallel to the c axis. In contrast, that parallel to the c axis hardly changes against magnetic fields along the same direction. Therefore, the negative MR perpendicular to the c axis is much larger than that parallel to the c axis.