

Electrical resistivity of Au-SM-RE 1/1 approximants

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Rare-Earth containing Tsai-type 1/1 approximants (ACs) have well-localized spins on the icosahedron shell of the Tsai-type cluster. Since 2010, the existence of a long-range magnetic order was reported in Cd₆Tb and Au-Si-RE ACs [1-2]. For the Au-Al-Gd AC, it was reported that it has a wide single phase region, and the magnetism changes systematically within the single phase region [3]. Until now, the magnetic properties of these ACs have been investigated mainly by magnetization and specific heat measurements. In the present work, we investigated the magnetic properties of ACs by electrical resistivity measurements.

Polycrystalline alloys were prepared by arc-melting and annealed under Ar atmosphere. The phase purity of the samples was examined by X-ray diffraction (XRD) using CuK α radiation. The temperature and field dependence of magnetization were measured using a Superconducting Quantum Interference Device (SQUID) or Vibrating Sample Magnetometer (VSM). The specific heat was measured using Physical Property Measurement System (PPMS). The electrical resistivity was measured by the AC four terminal method.

The temperature dependence of the electrical resistivity of the ferromagnetic Au-Al-Gd AC was measured. It was found that the resistivity has a very sharp peak at the Curie temperature of 28 K. This phenomenon is not common to ferromagnetic transitions and its origin is of a particular interest. The peak in the resistivity was found to be suppressed under a low magnetic field of 20 mT, showing that the peak is of a magnetic origin. In the present work, the temperature dependences of the electrical resistivity of ferromagnetic ACs with different Au/Al ratio and ferromagnetic ACs with different compositions were investigated. Details will be reported in the presentation.

[1] R. Tamura, et al., Phys. Rev B 82, 220201 (2010)

[2] T. Hiroto, et al., J.Phys. Condens. Matt. 26, 322202 (2014)

[3] A. Ishikawa, et al., Phys. Rev B 93, 024416 (2016)