ELECTRIC CHARGE TRANSPORT IN HOLMIUM THIN FILMS AT LOW TEMPERATURES AND IN MAGNETIC FIELD

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9.7 cm

High precision electrical resistance measurements were performed on holmium bulk and thin film samples prepared in ultrahigh vacuum in the temperature range between 4.2 K and 300 K, and in magnetic field up to 5 T. A "knee-like" resistance anomaly was observed near the magnetic phase transition from paramagnetic state to basal-plane spiral antiferromagnetic structure ($T_N = 128.9$ K) in the bulk and below 122 K in thin Ho films having a thickness between 98 nm to 215 nm. Numerical analysis of experimental R vs. T data yielded the transition to magnetic cone-shape structure in bulk Ho at $T_C = 19$ K. Application of magnetic field parallel to the substrate at temperatures below ~ 150 K caused a decrease of resistance with increasing field. Moreover, a suppression of the T_N value up to ~ 5 K with increasing field up to 5 T was observed. An unexpected resistance minimum at ~ 9 K and a slope's change of the R vs. T curve near ~ 170 K was observed in 215 nm thin film. X-ray diffraction of Ho films revealed diffraction peaks originating from the h.c.p. structure of Ho and those from holmium dihydride.

13.4 cm

Subject category :

2. Magnetic Films, Surfaces and Multilayers

Presentation mode :
poster

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