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Magnetic Properties of Single Crystal γ Phase Hydrides RCo_3H_x*

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Magnetization measurements have been made for single crystal γ phase hydrides $RCo_3H_{\sim 4}$ with R = Tb and Dy in high magnetic fields up to 40 T and are compared with previous measurements on Y, Ho and Er. These hydrides become antiferromagnetic due to the appearance of negative Co-Co intersublattice exchange interaction. The Co sublattice in the hydrides exhibits a field induced metamagnetic transition from antiferromagnetic to ferromagnetic ordering in magnetic fields along the c axis. The R-Co exchange interaction plays an important role in this transition.

1. Introduction

The hydrogenation changes the ferromagnetic ordering of Co moments in YCo_3 with nonmagnetic Y atoms [1, 2]: The spontaneous magnetization of YCo_3H_x disappears in the β_1 ($x \sim 1-1.5$) and γ ($x \sim 4$) phases. The magnetization of the γ phase hydride behaves metamagnetically. The Mössbauer spectroscopy with doped ^{57}Fe isotope and specific heat measurements [3] indicate that the ground state of the γ phase hydride is antiferromagnetic. A recent high field magnetization study on a $YCo_3H_{3.9}$ single crystal [4] shows, that the metamagnetic transition occurs along the c axis from an antiferromagnetic to a forced ferromagnetic state. The metamagnetic transition field decreases with increasing temperature and becomes zero at the Neel temperature T_N = 200 K.

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