Critical Behavior Study of the Magnetic Transitions in R₃Co (*R*=rare earth) by Means of *ac* Photopyroelectric Calorimetry

Aritz Herrero^S, Alberto Oleaga^C and Agustin Salazar Applied Physics I Department, University of the Basque Country UPV/EHU, Bilbao, Spain alberto.oleaga@ehu.es

Andrei Gubkin and Nikolai Baranov

M.N. Miheev Institute of Metal Physics, Ural Branch of the Russian Academy of Sciences, Ekaterinburg, Russia Institute of Natural Sciences and Mathematics, Ural Federal University, Ekaterinburg, Russia

The intermetallic family R_3T (R=Gd, Tb, Dy, Ho, Er; T=Co, Ni) is especially interesting because of its promising technological applications as potential cryocoolers due to the presence of an important magnetocaloric effect; moreover, they present giant magnetoresistance as well as relatively high spin-ordering temperatures for the rare earths. A study of the critical behaviour of the magnetic transitions in single crystals of the intermetallic Dy₃Co has been undertaken (as a first step in a comprehensive study of the critical behaviour in the whole family) through the study of thermal diffusivity, specific heat and thermal conductivity using an ac photopyroelectric calorimeter in the standard back configuration. There are two phase transitions, both of which present singularities in the three variables. The first one is an antiferromagnetic to paramagnetic phase transition at about 42 K for which the critical exponents and coefficients retrieved comply with the short range, isotropic universality class, 3D-Heisenberg (α_{exp} = -0.133, A^{+}/A^{-} exp = 1.64 for specific heat, $b_{exp} = -0.145$, U^{+}/U^{-} exp = 1.41 for thermal diffusivity while $\alpha_{theor} = b_{theor} = -0.13$, A^{+}/A^{-} theor = 1.52 = U^{+}/U^{-} theor). The second transition takes place at a lower temperature and is due to a rearrangement of the antiferromagnetic spin ordering at about 32 K. The critical behavior of this transition shows a deviation from an isotropic universality class, both in specific heat and thermal diffusivity ($\alpha_{exp} = -0.168$, $A^{+}/A^{-}_{exp} = 1.18$ for specific heat, $b_{exp} = -0.138$, $U^+/U^- \exp = 0.85$ for thermal diffusivity). These results are linked to magnetic measurements already found in literature. Further studies on Tb_3Co and $(Gd_{1x}Y_x)_3Co$ are currently been carried out in order to present a broader view of the magnetism in this family.

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