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Magnetic states in ensemble of ferromagnetic nanoparticles in Cu-Mn-Al alloy

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Two Cu-Mn-Al samples of different compositions were studied: one exhibiting martensitic transformation, another without structural transition. X-ray diffraction and magnetic measurements demonstrate that different magnetic behaviors of alloys originate from different concentrations of ferromagnetic nanoparticles, which appear after solid solution decomposition. In particular, in the sample with higher concentration of Mn atoms, x-ray pattern includes satellites around (200) peak, that indicate presence of nano-sized inclusions in non-magnetic Cu₃Al matrix in contrast with the other specimen.

Estimation of magnetic moments of ferromagnetic nanoparticles from magnetization curves in both the specimens was performed using Langevin function. Granular systems are known to show giant magnetoresistance [1]. Therefore, magnetoresistance of Cu-Mn-Al melt-spun ribbons after different ageing times was measured. The study has shown that increase in the concentration of Mn atoms in Cu-Mn-Al alloy leads to an increase in amount of precipitated phase appearing as ferromagnetic nanoparticles and to a decrease in the transformation temperature.

1. *Yiping L., Murthy A., Hadjipanayis G. C. Giant magnetoresistance in Cu-Mn-Al// Phys Rev B.-1996.-54, N 5.-P. 3033-3036.*