

Nanocomposites and nanomaterials

The effect of aging under hydrostatic pressure and magnetic field on mechanical and magnetic properties of Cu-Al-Mn alloys

A. Titenko¹, L. Demchenko², A. Perekos³, O. Gerasimov³, Ya. Titenko²

¹ *Institute of Magnetism, National Academy of Sciences and Ministry of Education and Science of Ukraine, 36-b, Vernadskoho Blvd., Kyiv 03142, Ukraine*
E-mail: titenko@imag.kiev.ua

² *National Technical University of Ukraine "Kyiv Polytechnic Institute", 37, Peremohy Ave., Kyiv 03056, Ukraine*

³ *G. V. Kurdyumov Institute for Metal Physics of the N.A.S. of Ukraine*

To improve physical and mechanical properties of alloys, thermal, thermomechanical or thermomagnetic treatments are widely used. The creation of nanostructural state plays an important role in improving the properties. Magnetic nanomaterials exhibit some features in magnetic behavior: superparamagnetism, giant magnetoresistance, and mechanical one: shape memory effect, thermoelasticity, superelasticity, plasticity of transformation, etc.

Cu-Mn-Al alloys are promising materials for controlling mechanical and magnetic properties. The aging of Cu-Mn-Al alloys leads to the formation of a system of nanoscale ferromagnetic particles of Cu₂MnAl phase in paramagnetic Cu₃Al-matrix. Heat treatment allows to control the amount and size of particles in alloy, as well as the temperatures and hysteresis of martensitic transformation, depending on the particles size and quantity [1, 2].

To search for optimal parameters of physical and mechanical properties of Cu-Mn-Al alloys, the thermal treatment with additional influences of external magnetic field of different strength and orientation and hydrostatic pressure, was proposed. The main results of the work are explained from the position of the phenomenological theory of diffusional decay of solid solution with precipitation of new phase nanoparticles. The tendency of increase in microhardness of alloys, accompanied by decrease in magnetic characteristics due to reduction of the ferromagnetic nanoparticles size, was noted.

1. *Titenko A., Demchenko L. Effect of annealing in magnetic field on ferromagnetic nanoparticle formation in Cu-Al-Mn alloy with induced martensite transformation // Nanoscale Res Lett. – 2016. - 11: 237*
2. *Titenko A., Demchenko L., Perekos A., Gerasimov O. Effect of thermomagnetic treatment on structure and properties of Cu–Al–Mn alloy // Nanoscale Res Lett. – 2017. - 12: 285*