Poster

MAGNETIC PROPERTIES OF SCREEN-PRINTED $(Y_{0.5}Sm_{0.5})Co_5$ MAGNET ARRAYS

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Screen printing is a modern materials deposition technique, widely applied in high-volume industrial applications and more recently for a patterned magnet deposition in MEMs devices [1]. Despite of the well adaptivity of this technique to MEMs microfabrication process, the magnetic properties of the resulting bonded printed magnets are, in general, inferior compared to the bulk sintered magnets. In this work, a study of the magnetic properties of magnet arrays based on $(Y_{0.5}Sm_{0.5})Co_5$ nanoparticles prepared on Si substrates by screen-printing method is presented.

$(Y_{0.5}Sm_{0.5})Co_5$ nanoparticles were obtained by mechanical milling starting from arc melted ingots and heat treated in Ar atmosphere. High magnetic properties, with a saturation magnetization M_s = 92.3 emu/g, remanent magnetization M_r = 63.3 emu/g and coercive field iH_c = 26 kOe were observed.

A well controlled paste like ink prepared with the nanoparticles and a mixture of organic solvent and polymer was used to print three different pattern arrays of square μdots of 200 μm, predefined in a polyester screen mesh with an opening of w = 150 μm and a thread diameter of d = 60 μm. After drying, well defined patterns with good adherence to the substrate were obtained. Patterns were cut in samples of 3 by 3 mm.

The microstructure of the samples was studied by optic and scanning electron microscopy (SEM). An isotropic homogeneous distribution of the nanoparticles inside the μdots was bserved. The final shape of the μdots in the array was found to be highly dependent on the squeeze pressure and speed over the mesh. Magnetic properties were studied by pulsed field magnetometry and VSM at room temperature. Samples showed lower saturation magnetization and a slightly increase in the coercive field. The influence of the polymeric matrix, size and distribution of nanoparticles in the arrays on the magnetic properties is discussed in detail.

A micromagnetic simulation of the magnetic behavior of the arrays were carried out with the MagPar software suite [2]. Pattern arrays with different separations between the bonded nanoparticles, as well as particle size and distributions were considered. Results of the simulations are presented and discussed.

References

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[2] W. Scholz, J. Fidler, T. Schrefl, D. Suess, R. Dittrich, H. Forster and V. Tsiantos, Comp. Mat. Sci. **28** (2003) 366