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COERCIVITY ENHANCEMENT OF Nd-Fe-B MAGNETS BY THE GRAIN BOUNDARY DIFFUSION OF Nd(FeCo)Cu EUTECTIC ALLOYS

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In this work we are going to investigate an influence of the diffusion of Nd(Fe-Co)Cu eutectic alloys on magnetic properties of Nd-Fe-B based permanent magnets.

Nowadays Nd-Fe-B based permanent magnets have an important value. They are used in many applications where the high value of maximum energy product $(BH)_{max}$ is needed, e.g. motors for hybrid and electric vehicles. An operating temperature can reach 200 °C that requires a coercivity of the order of 30 kOe. This is possible by replacing Nd with Dy at the expense of $(BH)_{max}$. In addition, localized natural resources and the high cost of Dy have stimulated current efforts at the development of Dy-free high coercive Nd–Fe–B magnets. One of the best approach to enhance coercivity is the grain boundary diffusion of eutectic alloys. The coercivity enhancement from 16.6 to 19.5 kOe for HDDR powders [1], from 14.0 to 29.5 kOe for thin films [2], and from 5.3 to 23.8 kOe for melt-spun ribbons [3] using this procedure was reported.

In this work we are going to investigate an influence of the diffusion of Nd(Fe-Co)Cu eutectic alloys on magnetic properties of Nd-Fe-B based permanent magnets. A mixture of a commercially available MQP-B alloy (70 wt. %) and $Nd_{75}(Cu_{0.25}(FeCo)_{0.75})_{25}$ powders (30 wt. %) was chosen as an object of the study. The components were milled and mixed in a vibrating mill for 20 minutes, then pressed into parallelepipeds 5 × 5 × 10 mm in size and placed in quartz ampoules for a further heat treatment. Measurements were carried out by a pulse magnetometer with magnetic fields H of up to 100 kOe and the PPMS DynaCool with magnetic fields H of up to 90 kOe. The results of the investigation will be presented on the conference.

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DOMAIN STRUCTURE IN POLYCRYSTALLINE $BiFeO_3$ THIN FILMS: COLLECTIVE POLARIZATION AND TRANSPORT PHENOMENA

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The relation between the piezoelectric response, polarization and conductivity polycrystalline $BiFeO_3$ films is investigated. Polarization-dependent conductivity of the GBs was observed. Domain structure and piezoelectric response in thin film BFO was demonstrated to be dependent on grain size

Many efforts have been devoted so far to achieve the control of interfaces in ferroelectric materials based on their polarization. These efforts resulted in the discovery of a variety of different phenomena such as polarization-dependent tunneling effect, resistive switching, symmetry breaking, etc. [1, 2]. Charge transport across the interfaces in complex oxides attracts a lot of attention because it allows creating novel functionalities useful for device applications. In particular, it has been observed that movable domain walls in epitaxial $BiFeO_3$ films possess enhanced conductivity that can be used for read out in ferroelectric-based memories [3].

In this work, the relation between the piezoelectric response, polarization and conductivity in sol-gel sintered polycrystalline $BiFeO_3$ films is investigated. The grains exhibit self-organized domain structure in these films, so that the “domain clusters” consisting of several grains with aligned polarization directions are formed. Surprisingly, GBs between these clusters (with antiparallel polarization direction) have significantly higher electrical conductivity in comparison to “inter-cluster” GBs, in which