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The investigation on the regional nanoparticle Ag doping into $MgTi_{0.06}B_2$ bulk for improvement the magnetic levitation force and the bulk critical current

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ABSTRACT

Fabrication methods are important way to improve structural and superconducting properties of MgB_2 such as critical current, magnetic levitation force (MLF) and magnetic field trapping capability. Although the graded fabrication technique has been used for single-grain bulk YBCO superconductor to improve critical current and bulk superconducting properties, similar technique as regional doping has not been used for bulk MgB_2, until now. In this study, nanoparticle silver doping was carried out in to the bulk $MgTi_{0.06}B_2$ superconductor by using in-situ solid state reaction and partial graded (regional) doping method together, to improve the radius independent uniform bulk current density and the magnetic levitation force as well as the structural properties of the MgB_2 bulk superconductors. Both the $J_c(0)$ self-field critical current and F_p ($\mu_0 H$) pinning force density values enhanced in comparison with the inner region values, when the nanoparticle Ag doping is carried out in to the outer section of the sample. Addition to the enhancement of the structural and the micro electromagnetic properties as $J_c(0)$ and F_p ($\mu_0 H$), our study also focused on the improved of the bulk J_c and the radius of shielding current loop *r*, to improve bulk electromagnetic properties as the levitation force. It is seen that the structural properties enhanced and both the vertical levitation force and the lateral guidance force value increased with Ag doping to the outer section of $MgTi_{0.06}B_2$ sample. On the other hand, the increasing ratio of the lateral guidance force of 19.7 % and the vertical levitation force of 10.8% of the sample with 3 wt% Ag-doped than the undoped one points out that the regional doping method to the outer section is very suitable for guidance force applications, which is important in the magnetic bearing application such as Maglev and magnetic energy storage systems.

Keywords: MgB_2, regional Ag doping, Local critical current, Magnetic levitation force

1. Introduction

Within intermetallic superconductors, MgB_2 superconductor having some properties, as the high critical temperature (T_c) and the high critical current density (J_c), makes these materials very promising candidates for some applications as the next generation of medical MRI devices and super-magnets for Maglev systems [1-3]. Additionally, it can be said that high vertical force, guidance force and high magnetic field trapping properties of the bulk high