Effects of Excess Mg on Pore Formation and Critical Current Density of *In-Situ* Reaction Processed MgB_2 Bulk Superconductors

Dan-Bi Kim[a,b], Byung-Hyuk Jun[a], Youngha Kim[c], Jinho Joo[b], Chan-Joong Kim[a]
[a] *Neutron Science Division, Korea Atomic Energy Research Institude(KAERI), Daejeon, 305-353, Korea*
[b] *School of Advanced Materials Science and Engineering, SungKyunKwan University, Suwon, Gyeonggi, Korea 440-746*
[c] *Korea Advanced Institute of Science and Technology, Daejeon, 305-701, Korea*

Pores are known to develop during an in-situ reaction of Mg and B to form MgB_2. The presence of pores which is a non-superconducting volume reduces the critical current density (J_c) of MgB_2. The pores are considered to be caused by the melting of Mg and its capillary movement to narrow space of higher negative pressure. It indicates that the amount of pores formed in the in-situ reaction is related the amount of Mg that melts. To understand the effect of Mg content on the formation of pores and superconducting properties, $Mg_{1+x}B_2$ bulk superconductors of various compositions (x=0. 0.05, 0.1, 0.15, 0.2, 0.3) were synthesized by an in-situ process. Powder mixtures of various Mg contents were pressed uniaxially in a steel mold into pellets. The samples were heat-treated at 900^{o}C for 1h in an argon atmosphere for the formation reaction to MgB_2. The dimensional change of pellet before/after heat treatment was estimated. It was observed that after the heat treatment, the sample diameter was increased and the density was decreased in all samples. Reduction in sample density after heat-treatment was increased with increasing amount of excess Mg. We reported the pore formation and the J_c values calculated from the magnetization curves for rectangular samples which were obtained at 20K and 5K using a superconducting quantum interference device magnetometer.

Keywords: in-situ reaction process, MgB_2, excess Mg, pore formation, critical current density

Acknowledgement
This research was supported by a grant (R-2006-1-248) from Electric Power Industry Technology Evaluation & Planning center (ETEP), Republic of Korea.