The Effect of Pore Evolution on the Critical Current Density of an *in-situ* Processed MgB_2 Superconductor

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There are two different processes to fabricate MgB_2 superconductor bulk and wires. One is an *in-situ* process which makes MgB_2 bulk directly by the reaction between Mg and B power, and the other is an *ex-situ* process which makes the bulk by a readily synthesized MgB_2 powder. The former process is a reaction method and the latter is a densification method. In the *in-situ* process many pores are evolved during the formation reaction, but no reaction pore forms in the *ex-situ* process. The critical current density (J_c) of the *in-situ* processed MgB_2 is, in general, higher than that of the *ex-situ* processed MgB_2. Although the *in-site* process is known to have many advantages of the strong grain connectivity among high J_c grains, good combination with dopant materials and high flux pinning capacity, the pores included in bulk sample remain as a big problem to be solved to overcome the low J_c of MgB_2. To understand the mechanism of pore formation, MgB_2 bulks were made by both solid state and liquid reaction methods at various reaction temperatures and time in Ar atmosphere. It was found that the pore size and the distribution were fairly dependant on the reaction condition. The J_c of the MgB_2 varied with heat treatment time and temperature. In this study, we reported on the material factors evolved during the *in-situ* process for the formation of MgB_2 and its effect on J_c of MgB_2

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