

Effect of Ball Milling Time of the Boron Powder with Glycerin Treatment on the Superconducting Properties of MgB₂ Bulk

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A correlation between the ball milling time and liquid glycerin (C₃H₈O₃) treatment for boron (B) powder on the superconducting properties of MgB₂ was investigated. The aim of the planetary ball milling was to enhance the high field critical current density (J_c) by controlling the particle size of the boron powder. The B powder was ball-milled for 1, 2, 5, 7 and 15 hours at the disc speed of 200 rpm in toluene. Each of the different ball-milled B powders was then treated with glycerin as a source for a C doping. The MgB₂ phase for all the samples was well-developed at a heat treatment temperature of 900°C for 30 min with no other impurities found except the MgO phase. The results showed that by combining mechanical milling and glycerin treatment for the B powder, the J_c increased significantly over the entire range of the magnetic fields as compared to the pure MgB₂ sample. The optimum level of the milling time + glycerin treatment was found to be 2 hour, and a further milling process with glycerin treatment decreased the critical properties such as the J_c and H_{c2} due to the severe decrease in T_c caused by the ball milling and a greater C incorporation into the MgB₂ samples.

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