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Low-temperature mechanical properties of MgB₂ bulk fabricated by hot isostatic pressing

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Since grain boundaries of MgB₂ bulk superconductors are not weak-links, uniform distribution of trapped magnetic field is easy to obtain even for large bulk samples. Bulk superconductors are subjected to electromagnetic force and thermal stress in the superconducting devices. Thus, understanding of the mechanical properties is indispensable. However, the mechanical properties of MgB₂ bulks have not been investigated extensively. In the previous study, we evaluated the fracture strength of MgB₂ bulk samples at room temperature. Packing ratio of an MgB₂ bulk fabricated by hot isostatic pressing was higher than those of conventional MgB₂ bulks fabricated by using capsule method and the fracture strength of the former MgB₂ bulk was excellent. Evaluation of the mechanical properties at cryogenic temperature is informative for the practical application of bulk superconductors. In the present study, evaluation of the fracture strength of an MgB₂ bulk fabricated by hot isostatic pressing has been carried out at 77 K. It was observed that the fracture strength was improved by cooling. The average fracture strength at 77 K was about 10 % higher than that at room temperature. The fracture strength at very low temperature was estimated from the experimental results at 77 K and room temperature. Fracture toughness was also evaluated at 77 K through the single-edge V-notched technique.

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