

High Magnetic Field Generated by Bulk MgB₂ Prepared by Spark Plasma Sintering

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Abstract — From the applications point of view, the advantage of low density given by MgB₂ material must be taken into consideration and, the generation of strong magnetic flux densities using MgB₂ should be investigated. In this contribution, we have studied the magnetic properties of samples processed by a fast Spark Plasma Sintering machine that is able to produce dense and high quality MgB₂ samples. Experiments were carried out both on small pieces of the samples and on large-sized samples performing trapped field measurements in a Field-Cooling process. For temperatures between 10 K to 30 K, the results show a strong dependence of the magnetic behavior of the large-sized samples to the applied magnetic field sweep rate, while nothing particular appeared on the small samples. As the magnetic flux density produced by MgB₂ bulks is directly linked to the potential of the applications, we report the field produced at the surface of one single MgB₂ sample of 30 mm diameter and the field produced inside a stack of two MgB₂ samples of 20 mm in diameter. A generation of magnetic flux density up to 4.8 T @ 10 K and 3.92 T @ 20 K inside the stack of the two MgB₂ samples was observed. According to these values, thanks to their very low density and to their ease of manufacturing, MgB₂ bulks are promising materials for the applications of superconductors.

Keywords (Index Terms) — Bulk MgB₂, field-cooling process, flux jumps, strong magnetic field, trapped magnetic field.