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Trapped Magnetic Field Experiments and Characterization of Large-Sized Bulk MgB₂ Samples

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From the applications point of view, the advantage of the very low density of MgB₂ bulk samples must be taken into consideration and, the generation of strong magnetic flux densities using MgB₂ should be investigated [1]. In this contribution, we have studied the trapped magnetic field properties of samples of 20 mm, 40 mm and 50 mm in diameter. Samples with a diameter of 20 mm and 40 mm were processed by *ex-situ* Spark Plasma Sintering, since the sample of 50 mm of diameter, from Edison Spa, has been produced using a Reactive Mg-Liquid Infiltration process. Both processes are able to produce dense and high quality MgB₂ samples. For the sample of 40 mm diameter, some Field Cooling experiments were carried out at temperatures from 10 K to 30 K both on a single pellet of 4 mm high and on a stack of several pellets of the same diameter. With the help of modeling tools, we have simulated the behavior of such samples in order to deduce their parameters as $J_c(B)$ and n -value, Fig. 1.

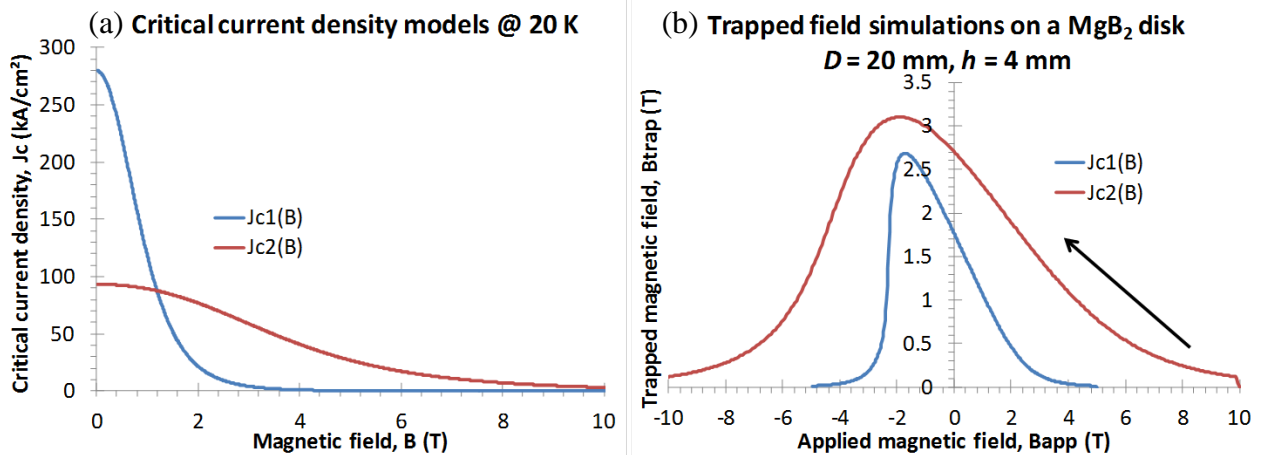


Fig. 1: Two models of critical current density (a), and the simulated resulting trapped magnetic field at the center of the surface of a bulk MgB₂ of 20 mm of diameter and 4 mm high (b).

With these simulations and experiments, we will show that the most relevant parameter for the applications of large-sized bulk MgB₂ samples as permanent magnet is the irreversibility field H_{irr} and not the critical current density at zero field $J_c(0)$.

References

1. J. G. Noudem, M. Aburras, P. Bernstein, X. Chaud, M. Muralidhar, and M. Murakami, *Development in processing of MgB₂ cryo-magnet superconductors*, J. Appl. Phys. **116**, 163916 (2014).