Plasma Synthesized Boron Nano-Sized Powder for MgB_2 Wires

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Abstract - Plasma synthesized boron powder has been prepared under a variety of RF plasma conditions to examine the suitability of these powders for the preparation of powder-in-tube MgB_2 wire. Particle size emerging from the RF torch typically ranges from 5 nm to 200 nm and lattice imaging studies in a transmission electron microscope show large portions of both amorphous and beta rhombohedral crystalline material. In situ powder-in-tube wire that is made with a continuous tube filling and forming process consistently gives critical current densities ranging from 20,000 to 100,000 A/cm2 at 5 K and 5 Tesla for a powder containing about 4% carbon. As the temperature rises, the critical current density of 100,000 A/cm2 occurs at 4.3 T at 10 K, 3.5 T at 15 K, and 2.5 T at 20 K. In preparation for studies of an ex-situ powder-in-tube process, we have studied the size of reacted MgB_2 powder formed in a magnesium vapor. Reaction rates are much slower than for solid state diffusion in the in-situ process and care is needed to hold particle size under the micrometer range.

Keywords - Superconductors, Nano-scale, Powders

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