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M3Or3B-04: Improvement of Upper Critical Field and Irreversible Field in MgB2 Wires and Bulks by Fiber Strain Engineering Method and REO Additions

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In this work, exploration on upper critical field (BC2), irreversible field (Birr) properties and structural properties on MgB2 wires and bulks has been made via alumina fiber strain engineering approach and rare earth oxide (REO) addition approach. Alumina fiber was used in a series of bulk samples in MgB2 (1-x) Al2O3(x), with x being 0, 1 mol%, 3 mol%, 5 mol% and 8 mol%. Another set of MgB2 samples with REO additions (La2O3 and Nd2O3) were fabricated in both wire and bulk forms. The REO addition level in MgB2 (1-x) REO(x) samples ranges from 0 %, 1 %, 3 % and 5 % in wires and bulks. Bulk samples were prepared through in situ route, mixed powders were pressed with a load of 3000 psi. On the other hand, wires with multifilaments were fabricated using Advanced Internal Magnesium Infiltration (AIMI) method. Both bulk samples and wire samples were heat treated at 650 ^{0}C for 30 min in Argon flowing furnace as a first attempted heat treatment procedure. BC2 and Birr values of all the samples were derived from resistivity-temperature measurement in Physical Property Measurement System (PPMS). BC2 of alumina fiber added samples is expected to be higher than the pristine samples due to the unique coherent or semi-coherent grain boundary structures generated by strain engineering. Structures of these samples were evaluated under microscopes. Birr values of REO added MgB2 bulks and wires are expected to show significant enhancement due to the formation of fine LaB6 and NdB6 in MgB2 samples. Moreover, a fine distribution of the rare earth boride precipitates is expected to be seen inside the MgB2 grains. BC2 and structure properties of the REO added MgB2 samples were investigated under different heat treatment conditions in order to maximize the superconducting properties (mainly BC2, Birr, Jc) of these samples.

Primary author: Ms ZHANG, Danlu (The Ohio State University)

Co-authors: SUMPTION, Mike (The Ohio State University); WAN, Fang (The Ohio State University); Dr COLLINGS, Edward (The Ohio State University); Mr THONG, Chee (Hyper Tech); RINDFLEISCH, Matt (Hyper Tech Research); TOMSIC, Michael (Hyper Tech Research Inc.)

Presenter: Ms ZHANG, Danlu (The Ohio State University)

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