Contribution ID: **295** Contribution code: **THU-PO3-612-04** Type: **Poster**

Fabrication of all c-grown RE123 melt-textured bulks with homogeneous trapping field distributions using Single-Direction Melt Growth method

Thursday, 18 November 2021 10:00 (20 minutes)

REBa₂Cu₃O<I>_y</I> (RE123) melt-textured bulks are expected for high field applications using their excellent field trapping properties. RE123 melt-textured bulks are typically fabricated using the Top-Seeded Melt Growth (TSMG) or Top-Seeded Infiltration Growth (TSIG) method where bulks are melt grown from the seed crystals placed on top of the pellets, which results in bulks consisting of both <I>a</I>-growth and <I>c</I>-growth regions. Because of the different J_c-B properties between the two regions, it is usually difficult to design and fabricate bulks showing uniform trapping field properties. In addition, although enlargement of the bulk-size is a direct and effective way to improve trapped fields, it is not easy to increase bulk-sizes by TSMG or TSIG methods because the random nucleation is likely to be triggered by the supercooling especially at the outermost regions of the bulks.
In the present study, we will present trapping field properties of all <I>c</I>-grown RE123 melt-textured bulks prepared using the Single-Direction Melt Growth (SDMG) method which we have developed for the last few years. In the SDMG process, RE123 melt-textured bulks are only grown vertically, <I>i</I>.<I>e</I>. one direction, from the seed plates cut from the large melt-textured bulks utilizing the difference in peritectic temperatures of RE123 with different rare earth elements, resulting in bulks wholly consisting of c-growth regions. In addition, the SDMG method is suitable for fabrication of large bulks because the crystal growth time does not depend on the bulk diameter. In this study, Y123 and Dy123 melt-textured bulks were grown on Gd123 and Eu123 seed plates provided by Nippon Steel Co., respectively. The critical current properties and trapping field characteristics of these SDMG bulks will be presented.

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Session Classification: THU-PO3-612 Bulk Magnets