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Microstructure and Trapped Magnetic Field of Multi-Seeded Single Domain YBCO

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The size of the superconducting domains and the critical current density inside these domains have to be enhanced for most of cryomagnetic applications of melt-textured YBCO bulks. To enlarge the size of the domains we studied the multi-seeding technique based on a well-established procedure for preparing high quality YBCO monoliths using self-made SmBCO seeds. The distance between the seeds was optimised as a result of the investigation of the effects of various seed distances on the characteristics of the grain boundary junctions. The influences of the a-b plane intersection angle and c-axis deviation were researched. Thereby, a small range of tolerance of the misorientations between the seed crystals was found. Field mapping was applied to control the materials quality and the superconductor's grain structure was investigated using polarisation microscopy. For comparison, fourfold seeded samples with an arrangement of making type (100)/(100) and (110)/(110) boundary junctions respectively were processed. The trapped field profile in both sample types showed single domain behaviour. YBCO function elements with up to six seeds in a line were prepared. Here a variation of the trapped flux along the seed-line was observed, but the trapped flied showed only a decay to 60% of the maximum trapped field. Thus there is still current flowing across the grain boundaries. To demonstrate the potential of the multi-seeding method a ring-shaped sample was processed by placing sixteen seeds in circle in a way to make both (100)/(100) and (110)/(110) grain junctions at the same time. The results up to now are very promising to prepare large single domain melt-textured YBCO semi-finished products in complex shapes

Keywords : Multi-seeded melt-textured YBCO, seed distance, misorientation angle, grain boundaries