



Contribution ID: 430

Type: not specified

[Special Invited Oral: 2014 ICMC Award for Excellence Winner] Key microstructural features of Bi2212 and Bi2223: why is the J_c of highly textured Bi2223 smaller than that of isotropic high J_c Bi2212 round wires?

Wednesday, 9 July 2014 11:00 (30 minutes)

By utilizing the over pressure technique, Bi₂Sr₂CaCu₂O_x (Bi2212) round wires without macroscopic texture recently achieved J_c of 4000 A/mm² at 4.2 K, 5T, despite the presence of many universally-assumed obstructing high angle grain boundaries (HAGBs). We sought to understand the nature of more local scale texture, in particular to better understand the apparent disagreement between Bi2212 and its sibling Bi₂Sr₂Ca₂Cu₃O_x (Bi2223). In order to understand whether HAGBs in Bi2212 are superior to those in Bi₂Sr₂Ca₂Cu₃O_x or REBa₂Cu₃O_{7- δ} , or whether other mechanisms compensate for obstructing HAGBs, we extensively compared the grain and GB structure in a Bi2212 round wire to those in a uniaxially textured Bi2223 flat tape by using the electron backscatter diffraction orientation image analysis (EBSD-OIM). It turned out that, compared with the Bi2223 tape in which the in-plane orientations of grains are basically random in spite of small out-of-plane GB misorientations, the Bi2212 round wire possesses the quasi-biaxial texture in which large basal-plane-faced GBs are formed as a result of large grain formation in the constraint of narrow filament cavities. It is strongly suggested that the major current paths in the high J_c Bi2212 round wire are ~ 10 - 15° basal-plane-faced, c-axis twist GBs which are strongly coupled due to their large area and force-free configuration in current flow and magnetic fields. These unique features of the Bi2212 grain structure may help explain the strong grain-to-grain coupling that we have found and lead to further improvements in performance.

Primary author: Dr KAMETANI, Fumitake (National High Magnetic Field Laboratory)

Co-authors: LARBALESTIER, David (National High Magnetic Field Laboratory); ABRAIMOV, Dmytro (National High Magnetic Field Laboratory); Prof. HELLSTROM, Eric (National High Magnetic Field Laboratory); JIANG, Jianyi (National High Magnetic Field Laboratory); Mr MATRAS, Maxime (National High Magnetic Field Laboratory)

Presenter: Dr KAMETANI, Fumitake (National High Magnetic Field Laboratory)

Session Classification: Wed-Mo-Orals Session 9

Track Classification: M-03: BSCCO wires and tapes processing and properties