# Key Microstructural Features of Bi2212 and Bi2223: Why is the Jc of Highly Textured Bi2223 Smaller than that of Isotropic High Jc Bi2212 Round Wires?

F. Kametani, J. Jiang, D. Abraimov, M. Matras, E. E. Hellstrom, D. C. Larbalestier

Applied Superconductivity Center, National High Magnetic Field Laboratory, Florida State University, USA

Email: kametani@asc.magnet.fsu.edu

***Abstract*** – By utilizing the over pressure technique, $Bi_2Sr_2CaCu_2O_x$ (Bi2212) round wires without macroscopic texture recently achieved $J_c$ of 4000 A/mm$^2$ 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 $Bi_2Sr_2Ca_2Cu_3O_x$ (Bi2223). In order to understand whether HAGBs in Bi2212 are superior to those in $Bi_2Sr_2Ca_2Cu_3O_x$ or $REBa_2Cu_3O_{7-\delta}$, 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.

***Keywords*** – BSCCO, Bi2212, Bi2223, microstructure, EBSD