Contribution ID: **511** Type: **Contributed Oral Presentation**

Suppression of Magnetization and Creep in Bi2212 strands

Wednesday 12 July 2017 10:45 (15 minutes)

Interfilamentary bridging in Bi2212 conductors influences the magnetization of magnets built using these conductors. Previous work has shown that the magnetization depends linearly on sample length and twist pitch, and a length-independent parameter describing the connectivity between superconducting filaments was introduced. However, this parameter has not yet been correlated to the bridged microstructure of Bi2212 wires. In this work, we use quantitative SEM studies made on cross sectional and longitudinal sample mounts of 85 x 18 filament Bi2212 wires to correlate the connectivity parameters, calculated for helical Bi2212 samples of various lengths (L) and twist pitches (Lp) and generated by inputting M-H and transport measurement results into a mathematical model, with their microstructures. In addition to generating homogeneous high magnetic fields, magnets used in accelerators should generate time-invariant magnetic fields. Flux creep has been shown to be significant in high temperature superconductors even at low temperatures, and thus it may cause the magnetic field of the magnet to drift with time. In this work, we show that not only the magnetization, but also the magnetic relaxation rates of Bi2212 strands are L and Lp dependence. Magnetization decay over 1200 s was measured as a function of L and Lp in transverse applied magnetic fields of 0-12 T. Magnetization decay was observed to increase by about 40% for samples with the largest L or Lp as compared to the samples with the smallest L and Lp. These results are interpreted in terms of weak bridging current induced anisotropy.

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Session Classification: M3OrA - Focused Session: Latest Development in Flux Pinning II: LTS, Fe-based, Creep in HTS