

Dimensionality and Superconducting Parameters of YBa₂Cu₃O₇ Foams

Authors : Michael Koblishka, Anjela Koblishka-Veneva, XianLin Zeng, Essia Hannachi, Yassine Slimani

Abstract : Superconducting foams of YBa₂Cu₃O₇ (abbreviated Y-123) were produced using the infiltration growth (IG) technique from Y₂BaCuO₅ (Y-211) foams. The samples were investigated by SEM (scanning electron microscopy) and electrical resistivity measurements. SEM observations indicated the specific microstructure of the foam struts with numerous tiny Y-211 particles (50-100 nm diameter) embedded in channel-like structures between the Y-123 grains. The investigation of the excess conductivity of different prepared composites was analyzed using Aslamazov-Larkin (AL) model. The investigated samples comprised of five distinct fluctuation regimes, namely short-wave (SWF), one-dimensional (1D), two-dimensional (2D), three-dimensional (3D), and critical (CR) fluctuations regimes. The coherence length along the c-axis at zero-temperature ($\xi_c(0)$), lower and upper critical magnetic fields (B_{c1} and B_{c2}), critical current density (J_c) and numerous other superconducting parameters were estimated from the data. The analysis reveals that the presence of the tiny Y-211 particles alters the excess conductivity and the fluctuation behavior observed in standard YBCO samples.

Keywords : Excess conductivity, Foam, Microstructure, Superconductor YBa₂Cu₃O_y

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