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Optimizing Flux Pinning of YBa2Cu3O7-δ (YBCO) Thin Films with Unique Large Nanoparticle Size and High Concentration of Y2BaCuO5 (Y211) Additions

Monday, 29 June 2015 09:00 (2 hours)

Addition of second-phase nanosize defects to YBa2Cu3O7-z(YBCO) superconductor thin films is known to enhance flux pinning and increase current densities (Jc). The addition of Y2BaCuO5 (Y211) was studied previously in (Y211/YBCO)N multilayer structures, and in Y211+YBCO films deposited from pie-shaped targets. This research systematically studies the effect of Y211 addition in thin films deposited by pulsed laser deposition from YBCO1-xY211x (x = 0 - 20 vol. %) single targets, at temperatures of 785 - 840 ℃. Interestingly, the resulting size of Y211 particles is 20 to 40 nm, with reduced number density. This is in contrast to 10 to 15 nm in previous studies of Y211, and 5 - 10 nm for other 2nd-phase defect additions. A slight increase of Jc(H,T) was achieved, compared to previous optimization studies. Results and comparisons of flux pinning, intrinsic stresses imaged by TEM, current densities, critical temperatures, and microstructures will be presented. The overall low intrinsic stress on YBCO from Y211 lattice mismatch is smaller than previously studied 2nd-phase defect additions known, which is hypothesized to be the driving force in achieving the unusually large 2nd-phase nanoparticle size and volume fraction thus-far in YBCO thin films.

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