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Characterization of (Re)BCO conductor for development of 32T superconducting magnet

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In order to successfully use (Re)BCO conductor in the 32T all-superconducting user magnet, a variety of its properties should be controlled in the required 10 km of tape within specific tolerances defined by the coil design. So far we have evaluated short samples from more than 102 conductor 60-110 m piece lengths, each manufactured by SuperPower Inc. We observe only a small variability of α values ($I_c(H) \propto B^{-\alpha}$) $<\alpha>$=0.82; σ_α=5.2%. $I_c(4K, 17T, 18^o)$ extrapolated from data measured up to 13.5T for samples from different production runs has a mean of 290A and standard deviation σ_{4K}=17%, but $< I_c(77K, SF) >$=131A, σ_{77K}=8.4%. The normalized to the average difference between I_c from each end of each tape is small (σ_{r77K}=4.8%) at 77K, SF but about twice as large for $I_c(4K, 17T, 18^o)$ where σ_{r4K}=9.3%. The highest values and lowest spread of $I_c(4K, 17T, 18^o)$ occur for tapes with smallest spread of T_c, larger α values, smaller angle between ab-planes and tape plane, and lower CuO grain density. These measurements have been performed within the context of quality assurance (QA) procedures developed for (Re)BCO conductor, which includes magnetic field dependence measurements of critical currents at 4.2K up to 13.5T at 18^o from the tape plane, a critical orientation for the 32T coil design, the self-field joint resistance at 77 K, residual resistivity ratio of Cu stabilizer, dimensional tolerances, and its uniformity. Optimal choice of tape and its orientation for stacking in top and bottom coil parts based on Ic statistics will be discussed.

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