

Sensitivity to trapped flux in high-purity large-grain niobium based on cavity measurements

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Surface resistance arising from trapped flux is experimentally measured, by which the sensitivity to trapped flux is derived. Measurements are carried out with single-cell L-band SRF cavities made of high-purity large-grain niobium materials, immersed in a uniform externally applied magnetic field generated by a solenoid whose axis overlaps the cavity axis. The surface resistance is found by using the standard technique for Q_0 measurement and the customary G/Q_0 analysis. Q_0 values at a fixed low surface field are used. The trapped flux is found by measuring flux densities at a selected location using a single-axis fluxgate magnetometer attached to the cavity outer surface: $B_a [1 - (B_{sc} - B_{nc}) / (B_{sc}^{(0)} - B_{nc})]$, where B_a is the applied external field, B_{nc} and B_{sc} is the local flux density measured just above and below T_c , respectively, during a field-cooling of the cavity whose Q_0 is then measured, $B_{sc}^{(0)}$ is measured in a separate zero-field-cooling by keeping the cavity in the same location and turning on the identical applied field B_a at a temperature well below T_c . Several magnetometers are placed at various locations. It is found that the sensitivity to trapped flux in high-purity large-grain niobium to be 1.9 nOhm/microTesla on average. This is to be compared to 3-9 nOhm/microTesla in high purity fine-grain niobium and 10-50 nOhm/microTesla in nitrogen-doped high-purity niobium reported by other groups. We will discuss the measurement results as well as the measurement techniques.

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