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Measurements of RF magnetic field limits of Nb and Nb3Sn

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Measuring fundamental RF field limits of candidate superconductors for SRF cavities is challenging as local defects and thermal heating can lead to premature quench at field well below the ultimate limit of a superconducting material. Cornell has developed, fabricated, and commissioned a unique sample host cavity that allows for exposing superconducting material samples to very high RF fields (>0.5 T) in very short RF pulse operation. Using high pulsed RF power, these high field are reached at the sample within a few microseconds. This very short pulse operation diminishes the effects of localized defects and thermal heating, thereby allows exploring fundamental field limits as function of temperature. In this talk we will present details form the design and commissioning of this system. We will show detailed measurement results of the (fundamental) RF field limit vs T for electropolished niobium and for Nb3Sn. For Nb, our results demonstrate that the high-field Q slope induced quench observed in SRF cavities is not fundamental but a result of thermal instability; the material itself is cable of supporting fields well above 200 mT, in agreement with the predicted superheating field of clean niobium.

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Yes

Footnotes

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