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Microstructural characterization of Nb3Sn thin films using 3D FIB tomography

Monday 22 September 2025 14:30 (3 hours)

The accelerating gradient of Nb_3Sn superconducting radiofrequency (SRF) cavities is currently limited, and the underlying cause remains an open question in the field. One leading hypothesis attributes this limitation to the presence of tin-deficient regions within the Nb_3Sn coating, which can suppress the superheating field. Due to the relatively large coherence length of Nb_3Sn, defects near the surface may significantly interact with the RF field. However, these subsurface defects have proven difficult to characterize. In this contribution, we present an unprecedented level of detail into the structure and distribution of subsurface tin-deficient regions to better understand their influence on cavity performance. We employ 3D focused ion beam (FIB) tomography to analyze the subsurface microstructure of Nb_3Sn thin films. This technique enables three-dimensional reconstruction of both the tin distribution and the grain structure within the film. By correlating compositional variations with grain morphology, we gain insights into the formation mechanisms of tin-deficient regions and their potential role in limiting SRF cavity performance.

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Footnotes

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