Contribution ID: **54** Type: **not specified**

Zr-Nb Surface Alloys for Thermally Stable, Low-Loss SRF Cavities

Superconducting radiofrequency (SRF) cavities are limited by losses that originate in the top ˜100 nm of the niobium surface. Zr–Nb alloys offer a promising route to reducing these losses by passivating the surface with ZrO2 and suppressing lossy Nb2O5. In this project, we alloy Zr into Nb through evaporation and thermal diffusion, building on methods developed for Nb3Sn films. Our goal is to produce smooth, thermally stable, Zr-rich surfaces and investigate their chemical and structural properties using in situ and ex situ tools. Ultimately, we aim to establish a pathway toward SRF cavity surfaces with improved performance and reduced oxide-related losses.

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