SRF2025 TOKYO

22ND INTERNATIONAL CONFERENCE ON RF SUPERCONDUCTIVITY

September 21-26, 2025

Contribution ID: **204** Contribution code: **TUP30** Type: **Poster Presentation**

Towards Nb3Sn coated copper cavities for energy efficient SRF applications

Tuesday 23 September 2025 14:30 (3 hours)

Superconducting radio frequency (SRF) cavities which are made from bulk niobium and operated at cryogenic temperatures around 2 K, are essential components in modern particle accelerators. Due to the sustainability issues related to niobium, which is considered a critical metal, and the huge power consumption of accelerator facilities, the community has discussed alternative high(er)-temperature superconductors for many years. Recent advances in Nb_3Sn thin film technology have revitalized this discussion. In particular, the ability to coat copper with high-quality Nb_3Sn surface layers has sparked hope that we can finally move beyond conventional niobium technology. We have demonstrated that a specific magnetron co-sputtering process enables the synthesis of fully superconducting Nb_3Sn, even at low temperatures, where copper diffusion can be disregarded. When coating sapphire substrates, we achieve critical temperatures (Tc) of 17.9 K. The same process (i.e. without post-annealing) on copper yields Tc values of around 15 K and lower critical fields of approximately 200 mT at 4 K. Moving beyond flat substrates, we coated a higher order mode (HOM) antenna —a three-dimensional, mushroom-like object —with Nb_3Sn, achieving similar Tc values at all positions on its surface. We anticipate that, by 2030, Nb_3Sn-coated copper cavities will surpass the quality factor of standard Nb bulk cavities.

I have read and accept the Privacy Policy Statement

Yes

Footnotes

Funding Agency

German Research Foundation (DFG), project ID 264883531.
BMFTR, grant nos. 05H21RDRB1 and 05H24RDB.

Author: ALFF, Lambert (Technical University of Darmstadt)

Co-authors: Dr ARZUMANOV, Alexey (Technical University of Darmstadt); Mr FARHOOD, Amir (Technical University of Darmstadt); MAJOR, Marton (Technical University of Darmstadt)

Presenter: ALFF, Lambert (Technical University of Darmstadt)

Session Classification: Tuesday Poster Session

Track Classification: MC3: Cavities