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Nb3Sn on Cu Coating By Magnetron Sputtering From Target Synthesized via Liquid Tin Diffusion

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Nb3Sn on Nb thin films cavities by Tin Vapor Diffusion already show performance at 4.2 K comparable to Nb bulk cavities at 2 K, but a real breakthrough would be the use of copper (instead of Nb) as substrate, to enhance the thermal conductivity, opening up the possibility to cool down the cavity using cryocoolers instead of the more expensive helium bath.
Magnetron sputtering is the most studied technology for this purpose, however coating substrates with complex geometry (such as elliptical cavities) may require targets with non-planar shape, difficult to achieve with classic powder sintering techniques due to the brittleness of Nb3Sn.
In this work, carried out within the iFAST collaboration, the possibility of using the Liquid Tin Diffusion (LTD) technique to produce sputtering targets for 6 GHz elliptical cavities is explored. The LTD technique is a wire fabrication technology, already developed in the past at LNL for SRF applications, that allows the deposition of very thick and uniform coating on Nb substrates even with complex geometry. Improvements in LTD process, proof of concept of a single use LTD target production, and characterization of the Nb3Sn film coated by DC magnetron sputtering with these innovative targets are reported in this work.

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