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# Bipolar HiPIMS-deposited Nb3Sn films: What we know so far

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"As part of efforts to reduce both energy and helium consumption in future particle accelerators, such as the Future Circular Collider (FCC), investigations into alternative methodologies to bulk Nb and Nb/Cu technologies are of paramount importance. Thanks to its higher transition temperature (Tc) and lower BCS surface resistance (RBCS), Nb3Sn coated cavities should produce a quality factor at 4.2K similar to the quality factor of bulk Nb at 2K. This will significantly decrease the cryogenic requirements of future particle accelerators, making them more viable.

The majority of research into Nb3Sn coatings has focused on depositing a Nb3Sn layer onto bulk Nb cavities via a Sn diffusion process, with encouraging results so far [1]. At CERN, a different approach of depositing a Nb3Sn layer onto Cu cavities has been pursued. Initial work focused on using DC MS to elaborate the Nb3Sn films [2]. However, given the densification of the deposited layers observed by using HiPIMS to elaborate Nb layers on Cu, and the subsequent improved quality factors [3], recent efforts have focused on using Bipolar HiPIMS for Nb3Sn deposition. We report the effects of different deposition parameters on the resultant Nb3Sn films.

[1] S. Posen et al., "Advances in Nb 3 Sn superconducting radiofrequency cavities towards first practical accelerator applications,"Supercond. Sci. Technol., vol. 34, no. 2, p. 025007, Feb. 2021, doi: 10.1088/1361-6668/abc7f7.
[2] E. A. Ilyina et al., "Development of sputtered Nb3Sn films on copper substrates for superconducting radiofrequency applications,"Supercond. Sci. Technol., vol. 32, no. 3, p. 035002, Mar. 2019, doi: 10.1088/1361-6668/aaf61f.
[3] M. Arzeo et al., "Enhanced radio-frequency performance of niobium films on copper substrates deposited by high power impulse magnetron sputtering,"Supercond. Sci. Technol., vol. 35, no. 5, p. 054008, May 2022, doi: 10.1088/1361-6668/ac5646."

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