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Development of Nb3Sn coatings on copper at INFN-LNL

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The successful development of Nb3Sn/Cu coatings for the SRF cavities of next generation particle accelerators would result in the reduction of the needed cryogenic power by a factor 3 with respect to what normally needed for bulk Nb cavities, while maintaining operation at 4.5 K. In the framework of the I.FAST and ISAS collaborations, research activities are carried out at INFN-LNL to develop new technologies for the application of Nb3Sn on Cu, including seamless spinning of cavity prototypes, surface chemical preparation, cavity coating and testing. At the same time, an optimized recipe for Nb3Sn films deposited via DCMS has been established on small samples and is discussed in this work. The recipe delivers films showing a Tc ≈ 17 K, at deposition temperatures ≤ 650 ℃, on a Cu substrate pre-coated with a 30-micron thick buffer layer of Nb. The deposition recipe is validated on bulk Nb by measuring the RF properties on a QPR sample, with the results being also discussed in this work. A surface resistance of 23 nΩ at 4.5 K (at 20 mT, 417 MHz, with quench field ˜ 70 mT) is measured, which is about 5 times larger than the baseline specifications for the LHC Nb/Cu cavities and already fulfills the requirements for the FCC-ee. Finally, the expected challenges toward the scalability of the coating recipe to an elliptical cavity prototype, and the perspectives for further recipe refinement are discussed.

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Yes

Footnotes

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