

thinfilms and NEW IDEAS for SRF

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Ar-Nb ion energy distribution and thin film properties in HiPIMS with a positive voltage pulse

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The Wide Open Waveguide (WOW) Crab cavity [1] has been designed in the framework of the Future Circular Collider study. It features a thin Nb film sputtered on bulk copper [2]. The main advantages with respect to bulk Nb include the improved thermal stability, and the reduction of the cavity frequency sensitivity to the external liquid He bath pressure variations as well as to the Lorentz force detuning. However, the complexity of the geometry, including concave and convex surfaces on meter scale, constitutes the main drawback. The necessity to get a dense and defect-free Nb film to satisfy the Radio-Frequency (RF) specifications requires dedicated investigations to identify and optimize the coating technique as well as the cathode design.

In this work we focus on High Power Impulse Magnetron Sputtering (HiPIMS) with the inversion of the voltage after the main negative pulse to accelerate the ions towards the substrate. This is a potential candidate to avoid the biasing of the cavity during the coating process. The evidence of a high energy population of Ar and Nb ions is first presented by implementing an energy and mass analyser. Features of thin films obtained from DCMS (with and without biased substrate) and from HiPIMS (with and w/o biased substrate, with and w/o reverse voltage) are compared. In particular, Focused Ion Beam (FIB) analysis has been performed on coated samples tilted at 0°, 45° and 90° with respect to the target.

[1] R. Calaga, Proceedings of Chamonix 2012 workshop on LHC Performance.

[2] A. Grudiev, et al. Proceedings of SRF 2015, Whistler, BC, Canada.

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