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Tailoring the production of Nb superconducting films for SRF cavities: mass/energy spectroscopy and film characterization

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SRF cavities are commonly coated with superconducting materials (e.g., niobium) using magnetron sputtering. In this process, various power supplies are employed such as DC, pulsed DC or HiPIMS. The sputtered ions are ejected from the target to the cavity or sample surface with an energy dependent on the power conditions and pressure range. In this study, we investigated the efficiency of such deposition by tracking the mass and energy of the main ions produced (e.g., Kr⁺, Kr²⁺, Nb⁺, Nb²⁺) using mass spectroscopy with time resolved measurement when applicable.

Additionally, a retarding field analyzer was also used to measure the ions energy (peak and mean) with information on the IV-characteristics of the plasma formed. We report the optimal conditions suitable to enhance both ions energy and film growth for different power supplies and pressure conditions ranging from 1e-3 mbar to 1e-1 mbar. To support the gas phase analysis, the produced film surfaces were analyzed and characterized by XPS and SEM.

Footnotes

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Europe

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