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Interface studies of Nb-AlN-NbTiN multilayers grown by PEALD

Thursday 25 September 2025 14:30 (3 hours)

Superconducting–Insulating–Superconducting (SIS) multilayers offer a promising approach to surpass the accelerating gradients and quality factors of standard bulk-Nb SRF cavities†. Plasma-enhanced atomic layer deposition (PEALD) stands out as a key technique for the next-generation thin-film-based SRF cavities, providing conformal coatings on highly structured, three-dimensional substrates without shadowing effects and with sub-nm thickness precision. This poster contributes to thin-film SRF R&D through dedicated material studies. The results presented correspond to Nb–AlN–NbTiN multilayers grown by PEALD, focusing on the S–I and I–S interfaces. Depth-resolved X-ray photoelectron spectroscopy (XPS) and cross-sectional energy-dispersive X-ray spectroscopy (EDX) are employed to assess the film stoichiometry and detect any interdiffusion or deposition residues. Side effects induced by high-temperature post-deposition annealing–required to obtain high-Tc NbTiN‡–are systematically investigated. Lastly, complementary studies on Superconducting–Superconducting (SS) Nb–NbTiN bilayers–grown without the AlN interlayer–underscore the crucial role of AlN as an effective diffusion barrier.

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Yes

Footnotes

†A. Gurevich, "Enhancement of rf breakdown field of superconductors by multilayer coating", Applied Physics Letters 88, 12511 (2006)

‡I. González Díaz-Palacio, M.Wenskat, G. K. Deyu, W. Hillert, R. H. Blick, and R. Zierold, "Thermal annealing of superconducting niobium titanium nitride thin films deposited by plasma-enhanced atomic layer deposition" , Journal of Applied Physics 134, 035301 (2023)

Funding Agency

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