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Development of NbTiN based multi-layered structures for SRF applications

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Theoretical interest has stimulated efforts to grow and characterize thin multi-layer superconductor/insulator/superconductor (SIS) structures for their potential capability of supporting otherwise inaccessible surface magnetic fields in SRF cavities. The technological challenges include realization of high quality superconductors with sharp, clean, transition to high quality dielectric materials and back to superconductor, with careful thickness control of each layer. Choosing NbTiN as the first candidate material, we have developed the tools and techniques that produce such SIS film structures and have begun their characterization. Using DC magnetron sputtering and HiPIMS (high power impulse magnetron sputtering), NbTiN and AlN can be deposited with nominal superconducting and dielectric parameters. Hc1 flux penetration field enhancement is observed for NbTiN layers with a Tc of 16.9 K for a thickness less than 150 nm. The optimization of the thickness of each type of layers to reach optimum SRF performance is underway. This talk describes this work and the rf performance characteristics observed to date.

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