Contribution ID: **4** Type: **not specified**

Nb3Sn Multilayer Sequential Sputtering at Jefferson Lab

Tuesday, 9 October 2018 11:55 (25 minutes)

Nb3Sn-coated Nb SRF cavities are studied due to their potential of providing a higher accelerating gradient over Nb SRF cavities. Magnetron sputtering can be a feasible alternative to conventional tin vapor diffusion process to fabricate Nb3Sn for SRF cavities. By depositing Nb and Sn layers separately and annealing afterward, the stoichiometry of the coated films can be controlled to create Nb3Sn. To understand the formation of Nb3Sn at higher annealing temperatures, a comparative study of deposition and processing conditions is required. We have sputtered Nb and Sn multilayers and post-deposition annealed at 850, 950, 1000, 1100 and 1200 ℃ for 3 hours. The structural properties of the annealed films were characterized by X-ray diffraction (XRD) and compared to as-coated films. The film microstructures and compositions were examined by scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS). The superconducting transitions of the films were measured by surface resistivity data obtained down to cryogenic temperatures. A new cavity deposition system with a cylindrical magnetron has been designed to implement the sequential sputtering technique onto a single-cell cavity.

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Session Classification: Other SC Materials beyond Niobium: Nb3Sn

Track Classification: Other superconducting materials beyond niobium