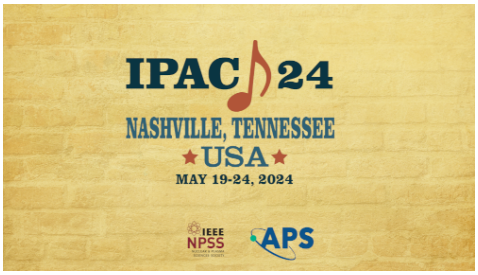

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Characterization of single-cell elliptical niobium thin film cavity at cryogenic temperatures

Sunday, 19 May 2024 16:00 (2 hours)

Niobium thin films play a crucial role in both macroscopic SRF cavities for particle accelerators and microscopic superconducting qubits used in quantum computing applications. This study aimed to investigate the RF performance of a 1.3 GHz single-cell elliptical Nb thin film cavity deposited using the DC bias High-Power Impulse Magnetron Sputtering (HiPIMS) technique. Experimental testing of the cavity was conducted in a helium dewar of Vertical Cavity Test Stand (VCTS), at temperatures of 2 and 1.5K. Prior to testing, the cavity was backed in-situ at 340℃ for 1-hour, or vacuum furnace baked at 600℃ for 3-hour. The RF results obtained from the Nb thin film cavity were compared with those from a bulk Nb cavity, providing insights into the distinctive characteristics and potential advantages of Nb thin film cavities under cryogenic conditions. At low fields, Nb thin film cavity exhibited better performance than bulk Nb cavities. Baking treatment at 340℃ has increased the quench field by approximately 25%. Furthermore, backing the cavity at 600℃ led to a notable increase in the Quality factor (Q) and a remarkable improvement in the quench field, with a boost of approximately 35%. These findings are significant and warrant further investigation for their potential impact on SRF technologies.

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