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Characterization of a niobium thin film deposited on 6 GHz SRF cavities

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Niobium thin film deposited on copper cavity has the potential to replace bulk niobium superconducting cavity in particle accelerators. Bulk niobium has a typical heat conductance of about 75 W/m.K at best, while for copper is as high as 300-2000 W/m.K and the cost of copper is a fraction of that of niobium. INFN Legnaro has been producing special seamless 6 GHz copper cavity from a single 2mm sheet of Cu. The cavity goes through normal BCP treatment prior to deposition. RF tested at 1.8 K of the deposited cavity is carried out at INFN. Finally the cavities are cut and the film at the iris and the cell are characterised using scanning and transmission electron microscopy (SEM & TEM), Electron backscattered diffraction, X-ray tomography, X-ray diffraction and DC SQUID magnetometry.

It is shown that the growth of the columnar Nb grains is influenced by the positioning of the Nb source. The grains located close to the curve midpoint (cell position) tend to orient perpendicular to the substrate/Nb interface, whereas grains at either end of curve (iris position) tilt toward the source. Furthermore, the initial fine grain Nb formation in the early stages of deposition gives way to the formation of columnar grains and the niobium texture plots indicate a preferred 011 crystal orientation parallel to the columnar grain growth direction.

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