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Niobium Thin Film Characterization for Thin Film Technology Used in Superconducting Radiofrequency Cavities[1] YISHU DAI, St. Olaf College, ANNE-MARIE VALENTE-FELICIANO, Thomas Jefferson National Accelerator Facility — Superconducting RadioFrequency (SRF) penetrates about 40-100 nm of the top surface, making thin film technology possible in producing superconducting cavities. Thin film is based on the deposition of a thin Nb layer on top of a good thermal conducting material such as Al or Cu. Thin film allows for better control of the surface and has negligible response to the Earth's magnetic field, eliminating the need for magnetic shielding of the cavities. Thin film superconductivity depends heavily on coating process conditions, involving controllable parameters such as crystal plane orientation, coating temperature, and ion energy. MgO and Al2O3 substrates are used because they offer very smooth surfaces, ideal for studying film growth. Atomic Force Microscopy is used to characterize surface's morphology. It is evident that a lower nucleation energy and a long coating time increases the film quality in the r-plane sapphire crystal orientation. The quality of the film increases with thickness. Nb films coated on r-plane, grow along the (001) plane and yield a much higher RRR compared to the films grown on a- and c-planes. This information allows for further improvement on the research process for thin film technology used in superconducting cavities for the particle accelerators.

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