



Contribution ID: 51

Type: **not specified**

Oxidation Studies of Au Capped Nb Surfaces

Niobium surfaces readily form thick, non-superconducting oxide layers that can severely degrade radio frequency performance. These oxides create surface hot spots, which can lead to vortex nucleation and ultimately cause cavity quenching. We aim to prevent this deleterious Nb oxide formation by capping Nb surfaces with thin gold layers. We deposited gold layers ranging from ultra-thin (0.25 and 1 monolayer, ML) to thick (10 ML) on various Nb surfaces. Following annealing treatments, we employed scanning tunneling microscopy to characterize the surface morphology and electron spectroscopy to quantify the passivation efficacy under atmospheric exposure. Our findings indicate that, despite these treatments, both pre- and post-annealing surfaces still formed the niobium pentoxide phase.

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