Characterization of Tantalum Films for transmon molecule implementation

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Abstract

We are developing a transmon molecule with a novel coupling mechanism enabling a non-perturbative cross-Kerr interaction between the gubit and readout cavity [1][2]. The device combines tantalum capacitive pads with aluminium junctions [3], using Ta films grown on sapphire via electron beam evaporation. We characterize the films using XRD, AFM, and R(T) measurements to assess structural, surface, and superconducting properties. evaluate microwave To losses, we fabricated resonators with quality factors ranging from 0.7×10^6 to 7×10^6 . I will internal auality factor present and resonance frequency measurements versus power (Fig. 1) and temperature (Fig. 2) to dielectric probe losses and superconducting behaviour.

References

- A R. Dassonneville et al, Phys. Rev. X 10, 011045 (2020).
- [2] C. Mori, V. Milchakov, et al. High fidelity readout in the high-power regime using a transmon, to be submitted.
- [3] A. Place et al. Nature communications 12.1 (2021)



Figure 1: Internal quality factor of a tantalum resonator as a function of microwave power





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