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Improving the Quality Factor of Superconducting Resonators[1]
ANTHONY MEGRANT, CHARLES NEILL, RAMI BARENDS, BEN CHIARO, MIKE LENANDER, CHRIS PALMSTROM, JOHN MARTINIS, ANDREW CLELAND, UC Santa Barbara, UCSB SUPERCONDUCTING QUANTUM INFORMATION GROUP TEAM — Superconducting resonators hold great promise for quantum information storage in quantum computing. Improving the coherence lifetimes is therefore of central interest. We have focused on improving the interface between the resonator's underlying dielectric and superconducting metallization, as simulations have shown this interface to be a major source of loss, possibly associated with two-level states. After mitigating for stray light and magnetic fields, we have achieved low power intrinsic quality factors in excess of one million at single photon energies, with high power Q's in excess of ten million. Attaining such high quality factors is dependent on substrate preparation before depositing the superconductor, as well as the deposition method. We will describe the fabrication method and characterization of resonators that consistently achieve quality factors above one million.

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