Investigating Nanofabrication Techniques for Low Dissipation Superconducting Qubits

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Extending qubit lifetimes (T_1, T_2) remains a core challenge in developing large-scale quantum computers with superconductors. In this talk, we discuss a variety of techniques shown to increase lifetimes for superconducting qubits. We investigated specific combinations of previously reported fabrication techniques on the quality of hundreds of thin film superconducting resonators and qubits. We report that a manufacturing process that integrates multiple small improvements together can produce resonators with average internal quality factors of $Q_{\text{int}} > 1\times10^6$ and qubits having T1 ≥ 110 μs. Further investigation of decay channels at key interfaces and improvements to nanofabrication of these structures may yield further improvements to qubit coherence.

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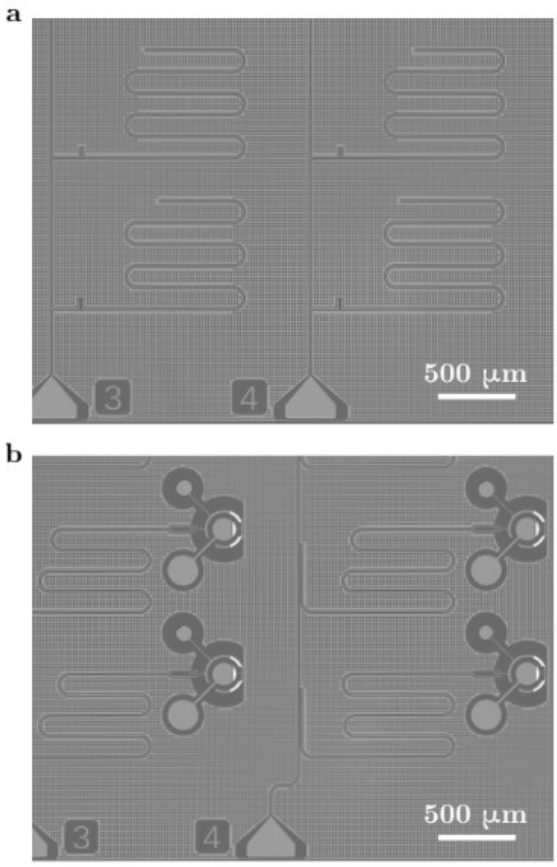

Device design. a, Optical image of a resonator device. **b,** Optical image of a qubit device.