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**Benchmarking Lifetimes in Hybrid Transmons**[1] WILLIAM LIVINGSTON, ALLISON DOVE, IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, Department of Physics, University of California, Berkeley CA 94720, USA. — High quality titanium nitride, aluminum, and niobium films deposited on silicon have resulted in single photon, low-temperature resonator quality factors exceeding one million. These materials have the potential to enhance long qubit lifetimes when combined with subsequent shadow evaporation to deposit Josephson junctions with polycrystalline aluminum electrodes and an amorphous aluminum oxide tunnel barrier. We investigate the performance of three-dimensional transmon qubits with capacitive elements produced in a subtractive process that yields high quality factor linear resonators. We report the coherence times of such hybrid qubits made with these three capacitor materials and compare them to devices fabricated in a conventional single step, lithographic process. We also investigate the potential role of quasiparticle confinement induced by the gap gradient between the junction electrodes and the capacitors by way of temperature dependent measurements and operation in different configurations of electromagnetic shielding.

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