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Further Microwave Resonator Studies of Loss Mechanisms to Improve Qubits[1] K.D. OSBORN, M.S. ALLMAN, K. CICAK, JEFFREY S. KLINE, SEONGSHIK OH, G. PROKOPENKO, M.A. SILLANPAA, A.J. SIROIS, J.A. STRONG, J.D. WHITTAKER, National Inst. of Standards and Tech. - Boulder, JOHN M. MARTINIS, UC Santa Barbara, Dept. of Physics, D.P. PAPPAS, R.W. SIMMONDS, National Inst. of Standards and Tech. - Boulder — Microwave resonators have been previously used to identify materials that limit the coherence time of Josephson phase qubits. For example, amorphous silicon dioxide was found to exhibit an unsaturated loss tangent of 0.005 in resonators at low temperatures. Minimized use of this dielectric has shown improved phase qubit performance as well as using lower loss materials like silicon-nitride. Furthermore, superconducting aluminum, the major superconductor used in many present types of qubits, forms a native surface oxide which may also contribute to dielectric loss. To prevent any native oxides on superconducting circuits, we have fabricated resonators with superconducting wiring that has been covered with a thin layer of gold. We will measure the power dependence of resonant peaks in these circuits in order to determine losses in these systems as well as investigate various substrate materials and compare these results to losses from silicon-oxide and silicon-nitride.

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