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Improved Phase Qubits with Re-Al_2O_3-Al Junctions with Epitaxial Barriers.[1] K. CICAK , M.S. ALLMAN , JEFFREY S. KLINE , SEONGSHIK OH , K.D. OSBORN, 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 — In our efforts to identify and eliminate sources of decoherence in our qubits we have established that dielectric loss, both from substrate and from insulating layers in the device, can compromise qubit coherence. This has lead to significant improvements of our phase qubits. Now we show that the structural quality of the Josephson junction barrier itself can significantly improve qubit performance in a specific way. As compared to qubits with amorphous barriers, our latest measurements using qubits fabricated with epitaxial Josephson tunnel barriers show a significant decrease in density and coupling strength of individual spurious resonator defects.

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