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Growth of Epitaxial Re/AlOx/Re(or Al) Trilayers for Josephson Junction Phase Qubits[1] S. OH, K. CICAK, K. OSBORN, J. A. STRONG, R. W. SIMMONDS, D. P. PAPPAS, NIST, R. MCDERMOTT, K. B. COOPER, M. STEFFEN, M. ANSMANN, J. M. MARTINIS, UCSB — Our group has recently shown that there exist two-state fluctuators in amorphous AlO_x based superconducting qubits, which adversely affect the qubit behavior. So far researchers in superconducting qubit community have been focusing on improving circuit designs and measurement schemes to minimize decoherences, while relying on amorphous AlO_x barriers. However, sooner or later these intrinsic materials-based decoherence sources could become a major bottleneck for any serious qubit operations. In order to solve this problem, we have started to develop a new type of Josephson junctions with epitaxial AlO_x barriers. We describe our effort to grow epitaxial Re/AlO_x/Re(or Al) system using various analysis tools such as LEED, RHEED, AFM, STM and AES. Preliminary Josephson junctions made out of these trilayers have already shown as good I-V characteristics as the conventional Al/AlO_x/Al junctions in terms of sub-gap quasiparticle current.

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