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Josephson phase qubits incorporating high-Q crystalline dielectrics U. PATEL, Y. GAO, L. MAURER, S. SENDELBACH, D. HOVER, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706, K.H. CHO, C.B. EOM, Department of Materials Science and Engineering, University of Wisconsin, Madison, Wisconsin 53706, R. MCDERMOTT, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706 — The energy relaxation times of Josephson phase qubits are currently limited by spurious coupling of the qubit to unsaturated two level system (TLS) defects of the amorphous dielectrics. It is expected that incorporation of defect-free crystalline dielectrics into qubit circuits will dramatically improve coherence. Here, we describe the growth and characterization of novel crystalline dielectrics for superconducting qubit applications, including grown Al2O3 on epitaxial Re underlayers. We discuss the incorporation of epitaxial dielectrics into phase qubit circuits, and present data on qubit coherence.

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