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Epitaxial growth of V and MgO films for Josephson junction qubits JEFFREY KLINE, SEONGSHIK OH, DAVID PAPPAS, NIST — The growth of ultrathin epitaxial aluminum oxide tunnel barriers on rhenium has been proven to reduce the number of spurious resonators in Josephson phase qubits when compared to qubits fabricated with amorphous tunnel barriers. Other epitaxial tunnel barrier materials such as MgO may also improve device performance. The superconductor V is latticed matched to MgO and was studied in this work. Vanadium films were deposited on MgO(001) substrates by UHV magnetron sputtering in argon gas. Magnesium oxide tunnel barriers were deposited by reactive sublimation of magnesium in a controlled oxygen background. To achieve epitaxy, the substrate was held at elevated temperature during the deposition. Surface science characterization tools such as Auger electron spectroscopy, scanning tunneling microscopy, and reflection high energy electron diffraction were used for in-situ analysis of the films.

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