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Growth and Properties of Epitaxial Dielectrics/Superconducting Thin Film Heterostructures CHANG-BEOM EOM, University of Wisconsin-Madison, KWANG-HWAN CHO, JACOB PODKAMINER, CHAD FOLKMAN — Our objective is the growth of epitaxial dielectrics on crystalline superconducting underlayers to improve the performance of superconducting Qbits. A major challenge is heteroepitaxial growth of single crystal dielectric layers with high crystalline quality and atomically sharp interfaces between the dielectric and superconducting electrodes. First, we have grown high quality epitaxial rhenium (Re) thin films on c-plane sapphire substrates by DC magnetron sputtering. The full width at half maximum (FWHM) of Re 0002 rocking curve is less than 0.5 degrees. The RMS surface roughness determined by AFM is less than 1 nm. We have also grown epitaxially various dielectric thin films on top of the single crystal Re bottom electrode by pulsed laser deposition with in situ high pressure reflection high energy electron diffraction (RHEED). In this talk, we will discuss our strategy of epitaxial growth of various single crystal dielectrics on superconducting thin films and their structural and electrical properties of the heterostructures.

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