

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Thin film processing of Re/Al₂O₃/Re/Ru epitaxial trilayers into superconducting qubits¹ JEFFREY S. KLINE, FABIO DA SILVA, DAVID S. WISBEY, MICHAEL R. VISSERS, DAVID P. PAPPAS, National Institute of Standards and Technology, Boulder, Colorado — We present a new recipe for processing thin film Re/Al₂O₃/Re/Ru epitaxial trilayers into superconducting qubits. To maintain compatibility with current in-plane tunneling (CIPT) measurements, we use a thin top electrode consisting of 30 nm Re and 5 nm Ru. The Ru cap protects the Re film underneath from tarnishing when exposed to atmosphere and has an electrically conductive native oxide. The Ru cap also protects the mesa from unwanted etching during the overetch portion of the CHF₃+O₂ reactive ion etch (RIE) used for the via etch of the SiO₂ insulator layer. Unintentional sidewall redeposition of base and top electrode material during the mesa etch is avoided through the use of a two step process. First the Ru cap is argon ion milled, but the tunnel barrier is not breached. Next, the Re top electrode and Al₂O₃ tunnel barrier are etched by an SF₆ RIE. We compare RA-products measured by CIPT (trilayer unprocessed) to RA-products obtained from tunnel junctions processed using our new recipe.

¹This work was funded by the U.S. government and IARPA.

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Date submitted: 20 Nov 2009

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