

Supporting Information

Structure and Formation Mechanisms in Tantalum and Niobium Oxides in Superconducting Quantum Circuits

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Superconducting qubits, Surface encapsulation, Tantalum oxides, Niobium oxides, STEM-EELS, CALPHAD, Crystal-field splitting

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S1: Principal component analysis of O K edge EELS spectra across the TaO_x-Ta interface.

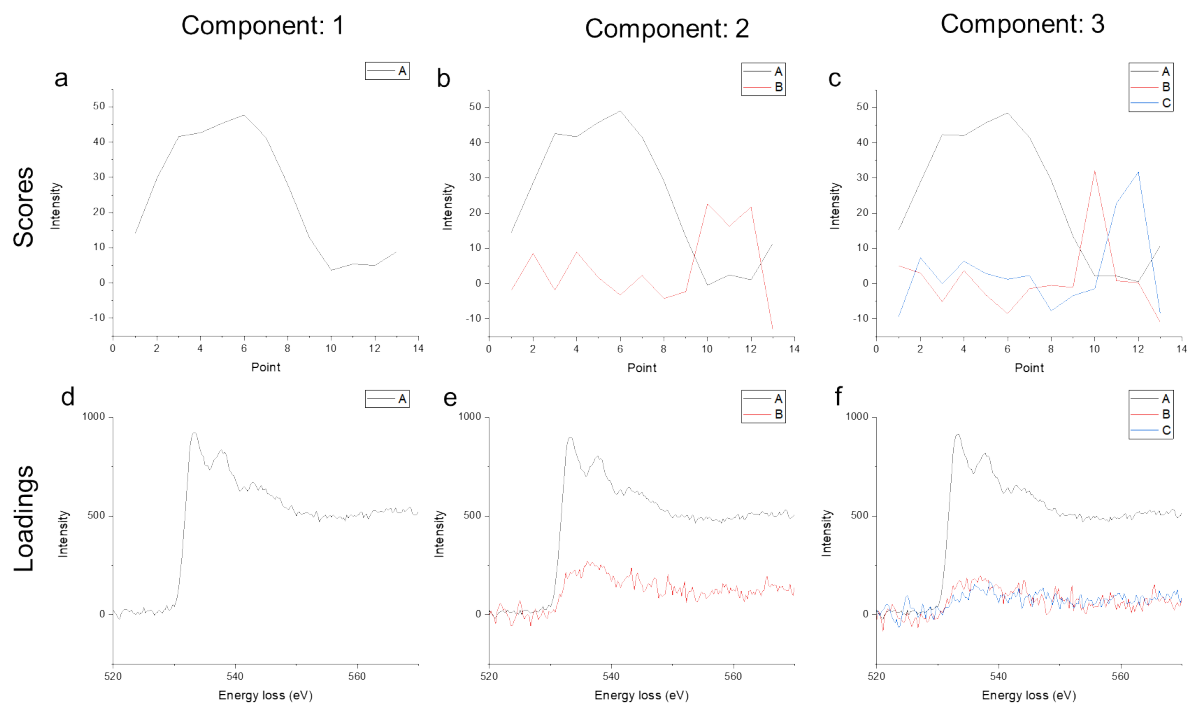


Fig. S1. Principal component analysis of O K edge EELS spectra across the TaO_x-Ta interface. a-c, Scores as a function of points from the outermost point of TaO_x layer to Ta metal when component number are 1-3, respectively. **d-f,** Loadings showing each O K edge in respect to the component number 1-3. **f** Note that the O K edge spectra of B and C in component number 3 barely differ, indicating that two components are sufficient to comprise the TaO_x-Ta interface.