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Thickness Dependent Superconductor-Insulator Transition in $\mathbf{K_{0.33}WO_3}$ PHILLIP WU, CHRIS HART, KATHERINE LUNA, KO MUNAKATA, THEODORE H. GEBALLE, MALCOLM R. BEASLEY, Department of Applied Physics, Stanford University, Stanford, California 94305, USA and Geballe Laboratory for Advanced Materials, Stanford University — We observe a thickness dependent superconductor to insulator transition in K-doped tungsten bronze superconductors. Via a two-step deposition and post-annealing procedure, K-doped WO_3 films with reproducible transport properties are obtained. Reducing the film thickness by reducing the film deposition time results in a superconductor to insulator transition. Scanning electron microscopy (SEM) images show that KWO_3 crystallites become both thinner and less connected as the deposition time is reduced. Suppression of the density of states at the Fermi level observed using point contact tunneling spectroscopy in the superconducting films demonstrates that disorder-induced increased Coulomb interactions are present. Using the theory of Belitz [1] for the reduction of Tc due to disorder, we can infer that the film with highest observed Tc has a relatively large disorder dependent electron-phonon interaction parameter $\tilde{\lambda} \sim 1.2$. Understanding microscopically why certain films display higher Tc will aid in the search for the trace high Tc superconducting anomalies observed in lightly surface doped bronzes. This work supported by an AFOSR under DoD MURI grant FA9550-09-1-0583.

[1] D. Belitz. Phys. Rev. B 40, 111 (1989).

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