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Electric Field Effect Modulation of Charge Transport in Atomically Thin $Bi_2Sr_2CaCu_2O_{8+\delta}$ ASHER MULLOKANDOV, SOLOMON ENDLICH, JOEL CHUDOW, YUANBO ZHANG, PHILIP KIM, Columbia University, Department of Physics — We investigate the superconducting properties of mesoscopic $Bi_2Sr_2CaCu_2O_{8+\delta}$ (BSCCO) crystallites of thickness ∼2.5-4 unit cells. The crystals are mechanically extracted from the bulk, deposited on a silicon oxide substrate, and 4-probe measurements are conducted with gold contacts. In films that are 3 to 3.5 unit cells thick, the transition from the metallic to the superconducting state is observed at a critical temperature of ∼95K, while for 2.5 unit cell crystals the resistance versus temperature curve indicates semiconducting behavior. We also investigate resistance (conductance) variation and critical temperature shifting due to carrier density modulation via an applied gate field at temperatures from 300K to helium temperature. Electric field effect modulation of transport properties in these thin crystallites will be discussed in different temperature ranges.

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