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Electrolyte Gated Transistors based on Solution Processed Mesoporous Tungsten Trioxide Thin Films CLARA SANTATO, DILEK ISIK, Ecole Polytechnique Genie Physique, FABIO CICOIRA, Ecole Polytechnique Genie Chimique — Tungsten trioxide (WO3) is an important material for electrochromic displays, gas sensors, and photoelectrochemical cells. Despite intensive research efforts, the charge transport properties of nanostructured WO3 films, as well as of other metal oxide films, are still largely undiscovered. Electrolyte gating provides a powerful platform to study the charge transport properties of nanostructured WO3 films permitting to achieve high charge density regimes. In turn, this opens the possibility to improve the film transport properties for a wide range of applications. Here we report on electrolyte gated transistors making use of WO3 films as the semiconductor and H2SO4(aq) 1M as the gate dielectric. WO3 films, prepared by sol-gel method, were deposited on source and drain patterned ITO substrates. The liquid electrolyte was confined using a PDMS well. Atomic force microscopy and scanning electron microscopy images show a mesoporous film structure where the electrolyte can easily penetrate. The mesoporous structure permits an efficient electrolyte gating compared to bulk WO3 films because of the higher surface available for electrical double layers, which are the underpinning of the electrolyte gating. Upon application of gate bias in the 0-1 V range, with an applied drain voltage ranging between 0-1 V, we were able to tune the conductivity in the WO3 transistor channel: electrolyte gating of the films led to clear transistor behaviour. Electrolyte gating of WO3 electrochromism is presently under investigation.

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