ENGINEERING ELECTROCHEMICAL NANOSCALE OXIDES

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Oxides are playing an increasingly critical role as functional components in the fields of energy conversion/storage, microelectronics, sensors/actuators and catalysis. In turn, their electrical (ionic & electronic), optical and catalytic properties depend sensitively on their defect structure and oxygen nonstoichiometry, typically frozen in during processing, and rarely well defined. This is particularly true for thin films and nanoparticles/wires, where conventional methods, appropriate to bulk materials, do not apply. In this presentation, we review in-situ optical, electrochemical and dilatometric methods, developed or refined in our laboratory, to monitor, analyze and control nonstoichiometry, defect equilibria, transport and optical properties of oxide thin films and nano-sized particles. Examples include materials of interest as electrodes in fuel cells, and as components of sensors, catalysts and memory devices.