Grain Boundary Engineering of Oxide Thin Films for Improving their Performance in Solid State Devices

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New emerging disciplines are specifically devoted to study trivial and non-trivial effects resulting from working in the nanoscale, however, the implementation of these nanostructures in real devices is still a major challenge. Thin film deposition and silicon microtechnology is probably the most promising and straightforward combination for the reliable integration of nanomaterials in real devices. In particular, the implementation of pure ionic and mixed ionic/electronic conductors (MIECs) in thin film form allows the miniaturization of multiple solid state devices. A simple combination of three oxides properly integrated in silicon enables anode/electrolyte/cathode structures for the fabrication of solid oxide fuel cells (SOFCs). These micro-SOFCs represent a new family of micro-power generators that will drive a revolution in portable power generation [1].

In this lecture, we will talk about the implementation of novel nanoionics concepts in micro-SOFCs by using micro and nanofabrication technologies. We will put special attention on the contribution of grain boundaries to the mass transport properties in interface-dominated materials such as thin films. Grain boundary engineering will be presented as a powerful tool for reducing the resistance associated to electrolytes [2] and even control the intrinsic transport nature and performance of MIEC materials [3].

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