

Integration of thin film functional oxides for micro Solid Oxide Fuel Cells applications

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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 this lecture, we will talk about the implementation of novel nanoionics concepts in energy devices by using micro and nanofabrication technologies.

The implementation of pure ionic and mixed ionic/electronic conductors in thin film form allows, first of all, the miniaturization of bulky devices giving them new functionalities. In particular, a simple combination of three oxides properly integrated in silicon enables anode/electrolyte/cathode structures for solid oxide fuel cells (SOFCs). μ SOFCs represent a new class of power generators for portable applications able to cover the increasing energy demand of omnipresent mobile devices.

In this talk, we will present the integration of SOFCs in microelectronics carried out at IREC-IMB. The integrated thin film electrolytes showed an unusual negligible contribution at low temperatures and the thin electrodes presented greatly improved performances, probably due to a grain boundary dominated behaviour. Microtechnology integration has reduced the size and thermal mass of the devices allowing quick and low energy consumption start-ups, crucial for portable applications. An outline and feasibility of the whole system will be also presented.

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