Development of planar SOFC device using screen-printing technology.

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The aim of this study is to investigate the potentialities of screen-printing technology to manufacture planar SOFC device. It has been chosen to work with widely studied materials, particularly YSZ as electrolyte, LSM as cathode and N-YSZ cermet for the anode. A key point for the fuel cell application is to control the deposit process of these materials in order to reach the specifications dealing with electrical properties, porosity and gas reactivity. As it is difficult to obtain dense electrolyte thick films by screen-printing, this technique was firstly used to elaborate the porous electrodes and the collectors constituted by a gold grid. These layers were deposited onto sintered YSZ pellets and two types of fuel cells were produced : conventional two-chamber devices where anode and cathode atmospheres are separated and original single chamber fuel cells (SCFC) where the electrodes are deposited on the same electrolyte face and are in contact with the same surrounding atmosphere. Two test benches were developed to study the cell performances (available current and power) in separate hydrogen / oxygen atmospheres for conventional device or in a unique methane / oxygen mixture for single chamber device. At this point of the study, performances are not optimized and weak power density are available , around 1,2 mW/cm^2 for SCFC at 800°C with a ratio of methane to oxygen equal to 1,5. Performances of two-chamber devices presented are also weak due to the electrolyte thickness around 1mm and low temperature of test 500°C. However, the results confirm the feasibility of SCFC and developed test benches constitute a tool for further investigations of modified devices, especially with YSZ electrolyte thick film supported on interconnect materials as no tightness is required for SCFC, or multi-layered electrodes.