NiCu/CGO anodes for direct oxidation of hydrocarbons and alcohols.

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The diminishing reserves of fossil fuels and the rising concerns about the environment and global warming have focused attention on the possibility of making more efficient use of methanol, natural gas or higher hydrocarbons. Thus, fuel cells could be an optimal choice as an electrical source, which is still under-utilized presently. Furthermore, the ideal fuel for fuel cells, from both the technical and environmental points of view, is hydrogen. However, one of the main technological drawbacks in so called “hydrogen economy” is related to the cost of hydrogen and its storage and/or transportation. Therefore, in the near future, fuel cells most probably will be supplied with an alternative fuels such as methanol or other alcohols for application in portable devices and fossil fuel or bio-gas which is usually converted to a hydrogen-rich fuel through a steam reforming unit operation for stationary application. Our strategy in the field of Solid Oxide Fuel Cells (SOFCs) is currently targeted to search for new anode electrodes with suitable performance towards the direct oxidation of dry hydrocarbons and alcohols avoiding the reforming step. The reforming process increases the complexity of the whole device and increases the cost. Another important issue leading to important cost reduction is a possible decrease of working temperatures (≤ 800°C) using alternative electrolyte materials respect to the traditional ones that work at 900-1000°C. Thus, our efforts were started from the synthesis of nanoparticles and nanocomposites that were used for the fabrication of innovative fuel cells prototype systems, suitable for dry methane and alcohols application as anodic fuel, avoiding preliminary reforming operation unit. The colloidal and sol-gel chemistry was used to synthesize the raw nanomaterials. This kind of “chimie douce”/“gentle chemistry” give the possibility to decrease significantly the crystallization temperature of oxides obtaining extremely fine materials. It is also a cheap and fast method for depositing layers of controlled thickness and composition and might become a generic process for layer formation in fuel cell construction. Also, it is investigated the exhausting gas cell composition which are compared with the theoretical thermodynamic conditions and correlated with the electrochemical performance.