

Electrical and Electrochemical Properties of Cu-SDC Anode for SOFC with Ceria Based Electrolyte

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The direct electrochemical oxidation of methane in solid oxide fuel cells, working at intermediate temperatures, represents an important breakthrough in the development of new distributed power sources. However, serious problems connected with carbon deposition at the anode leading to a rapid deactivation of the cell and the decrease of power densities arise.

The direct oxidation of the methane could be described by the following general scheme:



That means that the anode material should promote the CH_4 oxidation (favoring the rupture of C-H bond) without favoring the pyrolytic carbon deposition. Obviously, it should also possess a good mixed conductivity for providing both transportation of O^{2-} ions from the electrolyte to the anode and electronic conductivity.

Cu-ceria cermets seem to be good candidates as anode materials for several reasons [1,2]:

- doped cerium (IV) oxide is a good ionic conductor, demonstrating also mixed conductivity under reductive atmosphere. Some works also mention its electrocatalytic activity towards methane oxidation;
- Cu works just as current collector, having no activity towards methane oxidation.

However, the performance of Cu-ceria anodes strongly depends on the interconnection of both phases, especially near the anode – electrolyte interface.

Present work reports our studies of the Cu-SDC-anodes (SDC= $\text{Ce}_{0.8}\text{Sm}_{0.2}\text{O}_{1.9}$) behavior, deposited onto CeO_2 -based solid electrolyte. Thus, electrical and electrochemical properties in dependence on processing conditions (temperatures of preliminary sintering and firing, electrode composition etc.) and also the performance of a single SOFC in the temperature range 500-700°C were studied in details.

REFERENCES

1. A. Trovarelli, Catal. Rev. Sci. Eng., **38**, 439 (1996).
2. S. Park, J.M. Vohs and R.J. Gorte, Nature, **404**, 265 (2000).