Protective $La_{0.8}X_{0.2}CoO_3$ (X = Ca and Sr) Coatings Deposited on Ferritic Steel by Electrophoresis for use as Interconnecting Materials in Intermediate-Temperature SOFCs

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Ferritic steel is the most commonly used material for manufacturing interconnectors for intermediate temperature SOFCs: at the operating conditions it forms a protective superficial layer of chromium oxide that is highly conductive (1). This way the performance of the fuel cell stack does not deteriorate too much over time.

Nevertheless, this kind of material exhibits problems due to Cr evaporation under the form of volatile oxides and hydroxides. A possible solution to prevent this inconvenient, which is detrimental for the performance of the fuel cell stack, is the deposition of a protective layer of perovskite on the surface of the interconnector by several spraying methodes, which usually operate at very high temperatures.

Perovskite can also be useful because the diffusion (2) of some elements into the underlying oxide can determine the formation of compounds that can increase the oxide conductivity (3,4).

In this work $La_{0.8}Ca_{0.2}CoO_3$ is studied as an alternative protective coating to the Sr-doped lanthanum manganite usually employed for this use. Cobaltite is a good electronic conductor, also an ionic conductor (though the ionic conductivity is kept low by choosing 20 at% A-site doping), and its sintering is easier than for the other perovskites (Chromites for example).Ca is also a cheaper and better densifying agent than Sr.

Powders have been deposited by electrophoretic deposition (3), using a solution of ethyl alcohol – acetylacetone – iodine. This deposition method presents the advantage of avoiding exposure of steel at the high temperatures used in usual spraying techniques, so that the oxide does not grow too much.

After deposition the coated samples have undergone sintering at different conditions in inert atmosphere.

The deposition has been performed both on preoxidized and non preoxidized samples. The perovskite layer resulted to be very homogeneous, dense and tighly bonded to the substrate, as shown in figs. 1 and 2.

Microanalysis of sample's cross section reveals a strong diffusion of the various layers into one another, according to the literature (2).

Resistance mesurements at high temperatures reveal a good conductivity of the coated samples.

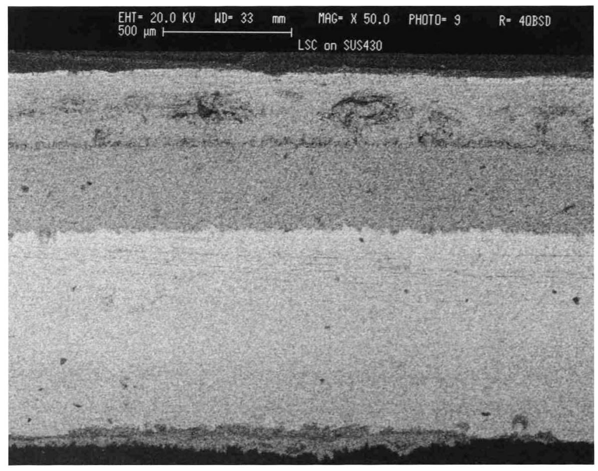

Fig. 1: SEM cross - section of ferritic steel SUS430 coated with $La_{0.8}Sr_{0.2}CoO_3$

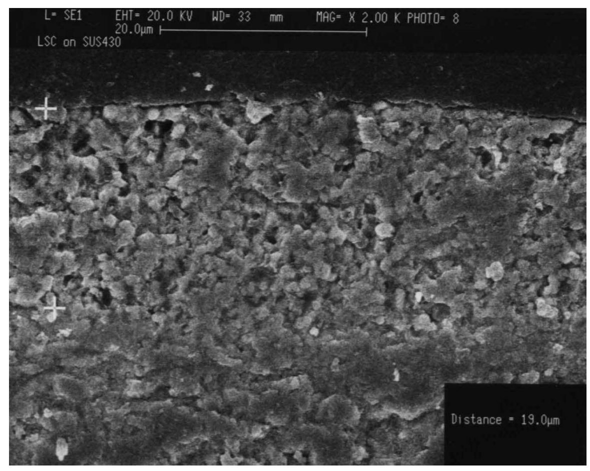

Fig. 2: SEM micrograph of $La_{0.8}Sr_{0.2}CoO_3$ coating deposited by EPD

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