European Fuel Cell Car Workshop | March, 1st - 3rd 2017, Orléans, France

Recent development on gadolinia doped ceria barrier layer to reduce the degradation rate on high temperature electrolysis systems

P. Coddet[1], J. Vulliet[2], A. Caillard[1], A.-L. Thomann[1]
[1] GREMI (Groupe de Recherches sur l'Energétique des Milieux Ionisés) – UMR7344 CNRS / Université d'Orléans, 14 rue d'Issoudun 45067 Orléans, FRANCE
[2] CEA DAM, Le Ripault, F-37260, Monts, FRANCE

pierre-laurent.coddet@univ-orleans.fr

Keywords: High temperature electrolysis, Cell manufacturing, Gadolinia doped ceria, Magnetron sputtering

Hydrogen is an abundant resource on earth available in water, hydrocarbons and biomass. Thanks to fuel cell, hydrogen can be used to produce electricity and heat for stationary or mobile applications. Hydrogen can also be directly used as combustible (i.e. in space shuttle main engine). Among the lifecycle of hydrogen (production, transport, storage, use), one of the main step concerns the production of pure hydrogen.

Hydrogen can be produced by steam reforming from fossil energy, electrolysis thanks to electricity and gasification from biomass. Among those technologies, direct production from biomass is still under development. Even if a lower cost can be obtained, production through reforming generates carbon dioxide. Electrolysis system is a more environmentally friendly solution (especially when electricity is produced via renewable or nuclear energy). Systems operating at higher temperature (about 800°C), presenting the more interesting energetic ratio are developed. However the lifetime of electrolysis cells and more generally the systems durability must be improved. To reach this goal, deleterious interfacial reactions between YSZ (yttria stabilized zirconia) electrolyte and LSCF (doped-lanthanum cobaltite) electrode must be avoided.

In this work, a focus is made on the deposition of GDC (gadolinia doped ceria) barrier layer to limit the degradation rate due to interfacial reactions between electrolyte and electrodes. Recent development for thin GDC layer (below 500 nm) manufactured by magnetron sputtering will be presented. The thin oxide layers were characterized and the cells performances were measured in HTE (high temperature electrolysis) and SOFC (solid oxide fuel cell) modes. To evaluate the influence of the GDC layer characteristics, the performances were compared with a similar cell manufactured with a 2 µm thick GDC barrier layer manufactured by screen printing.