# Electrophoretic deposition of $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}$ ultra-divided particles on $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}$ perovskite membrane

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In the last decades, numerous mixed ionic and electronic conducting materials with perovskite structure have been investigated for their potential application as membrane materials for oxygen separation applications [1]. However, none of them meet to all criteria for industrial applications, in particular high oxygen semi-permeation fluxes, good chemical stability, suitable mechanical properties under a large range of oxygen partial pressure at high temperature and low cost.

The improvement of oxygen flux through the membranes involves that the rate determining step of oxygen transport through the membrane must be clearly identified. Then, it is possible to increase the oxygen flux through the membrane, with the elaboration of judicious membrane designs. If the oxygen flux through the membrane is limited by oxygen surface exchange kinetics, the surface morphologies of membrane have a large impact on the oxygen semi-permeation flux [2]. In the literature, numerous solutions have been reported, as the coating of porous layer obtained by as painting, screen printing, spin coating, dip-coating, electrodeposition [3]… Reichmann et al. shows that the bulk diffusion coefficient increases with the grain size whereas the surface exchange kinetics increases when the grain size decreases [4]. In this way, we assume that the optimal architecture of membrane material corresponds to large grains (> 1 µm) in the bulk and small grains (~ 100 nm) at the membrane surface. The goal of this work is to develop thin $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}$ layer on $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}$ membrane by electrophoretic deposition process and study electrochemical performances using a specific setup.

This work presents the elaboration of membrane coatings using an ultra-divided powder (Φ = 500-200 nm), made by citrate synthesis, with electrophoretic deposition process. The coating process parameters (voltage and time of deposition) are controlled to obtain the homogenous layers from 100 µm to 2 µm in thickness. Finally, electrochemical performances of membranes have been measured using a specific device developed jointly between the SPCTS and the LEPMI. This device allows the determination of oxygen semi-permeation flux, oxygen diffusion coefficient, surface exchanges kinetics at both membrane surfaces.

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