PT-DOPED CEO_2 ULTRA THIN FILM CATALYSTS PREPARED BY DIRECT LIQUID INJECTION CHEMICAL VAPOR DEPOSITION (DLI-CVD)

B. Domenichini, N. Zanfoni, V. Potin, P. Simon, L. Imhoff, S. Bourgeois
ICB, CNRS-Univ. Bourgogne/Franche Comté, Dijon, France

Chemical vapor deposition by direct liquid injection (DLI-CVD) is a film synthesis technique which has the advantage of being able to regulate extremely low molecule flow rates while using a very wide variety of cheap precursors. Indeed, a simple injector system can be used to introduce even solid precursors into the reaction chamber as they have been initially dissolved in a non-reactive liquid. The flow rate of each of the precursors, the reactor temperature, additional gas flow rates and the pressure in the reaction chamber are then many parameters which influence the nature and properties of the films. In particular, the oxidation state of the metallic elements, the film porosity, possible heterogeneities, the crystallinity, ... can be controlled.

In recent years, DLI-CVD was developed to synthesize complex solids such as catalysts or electrolyte materials involved in fuel cell technology. For instance, ceria was widely studied as well as ceria doped with noble metal like Pt which enhances the catalytic activity by improving the reducibility of the surface [1]. In this context, the talk will emphasize about the following points:

(i) how DLI-CVD is a good solution to control the morphology of films, especially by allowing the increasing of the porosity,

(ii) how processes involved at the substrate/film interface can be followed,

(iii) how multi-step DLI-CVD protocols allow to localize specific species in the particle top most layers only [2],

(iv) how depositions carried out directly on transmission electron microscopy carbon grids allow to have a direct observation at the atomic scale of the film growth in the three space directions (see pictures below in the case of ceria).