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Electrosprayed films for PEMFC components

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The electrosprayed catalyst layers show macroporous morphology and hydrophobicity, which favors their performance and durability in proton exchange membrane fuel cells (PEMFC) [1]. These properties are of interest for application in automotive fuel cells, where durability and power density are highly demanding. The macroporosity gives rise to thicker catalyst layers (Figs. 1a,b). Hydrophobicity increases the rate of water transport and rejection from the cell, allowing for minimal voltage losses at high current densities (> 1 $A \cdot cm^{-2}$). Hydrophobicity also has an effect on the kinetics of electrochemical reactions. Oxygen reduction in the cathodic catalyst layer appears slightly less favored in electroprayed layers prepared with Pt/C catalyst and Nafion ionomer, compared with standard layers, because of dryer working conditions . The slower oxygen reduction has minimal impact in the response of the cell at low current densities (<0.5 $A \cdot cm^{-2}$). Hydrophobicity also causes a slowdown of degradation kinetics, like carbon oxidation and platinum dissolution, which improves durability of the cell [2]. Overall, electrosprayed MEAs show higher power densities, by above 20% with respect to standard MEAs (Fig. 1c), and higher durability.

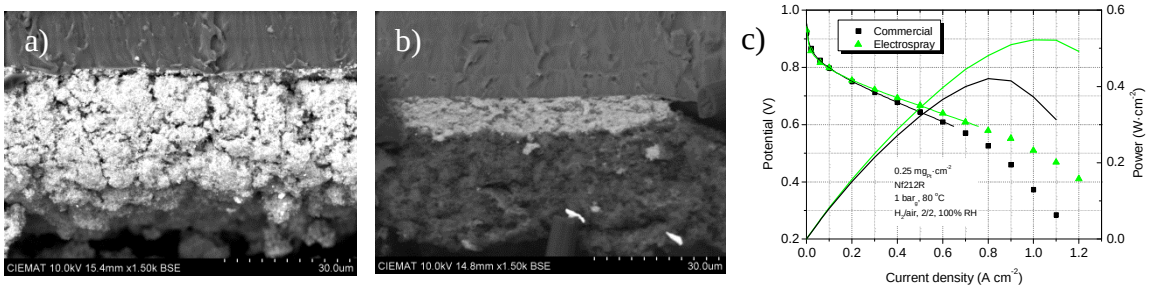

Figure 1: Cross section SEM images of a) electrosprayed, and b) commercial catalyst layers with same Pt contents (0.25 $mg \cdot cm^{-2}$). c) Polarization curves comparing both layers as cathodic catalyst layer under standard conditions.

This communication will summarize findings of our group, and collaborations with European groups, about the use of electrosprayed layers in MEAs and other cell components.

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