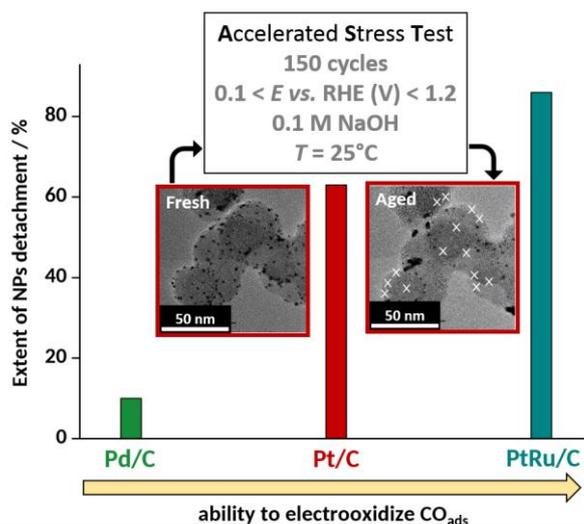


Degradation of PGM-Based Carbon Supported Electrocatalysts in Alkaline Media Studied by *in situ* Fourier Transform Infrared Spectroscopy

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Liquid alkaline fuel cells and electrolyzers are promising technologies for energy conversion and storage due to fast oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) kinetics, a wide choice of fuels in addition to hydrogen (alcohol, sodium borohydride, hydrazine borane) and a wide choice of polymer chemistry. However, Platinum Group Metal (PGM)-based electrocatalysts are still the most efficient to reach good catalytic activity but they suffer from a poor durability. Indeed, past studies revealed that 60 % of the electrochemical surface area (ECSA) of Pt/C electrocatalyst was lost after 150 cycles of cycling voltammetry between 0.1 and 1.23 V vs. RHE in 0.1 M NaOH, mostly owing to the detachment of the Pt nanoparticles (NPs) from the carbon substrate [1]–[4]. Thanks to *in situ* Fourier transform infrared spectroscopy (FTIR), we provide spectroscopic evidences of the production of carbonates at the Pt/C interface, leading to the rupture of the anchoring site between the Pt NP and the carbon support. Moreover, no band related to carbonates were detected on the FTIR spectra of unsupported catalyst, demonstrating that the carbonate formation is promoted by the presence of the Pt NPs at the carbon surface. Combining these results with Identical Location Transmission Electron Microscopy and CO_{ads} stripping techniques for Pt/C and other electrocatalysts (Pd/C and PtRu/C) allowed us to establish a straightforward relation between the ability of a catalyst to electrooxidize CO_{ads} and its extent of degradation during potential cycling. As an example, a more pronounced extent of nanoparticles detachment is reported for PtRu/C (with respect to Pt/C and Pd/C) which is able to electrooxidize CO at lower potential than Pt/C and Pd/C.



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