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Carbon gel-supported catalysts for PEM fuel cell catalytic layers

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In an attempt to replace carbon blacks with a catalyst support with tunable (surface) chemical composition and adequate pore texture, which both impact the performance of PEMFC catalytic layers [1], the synthesis of carbon-xerogel (CX) supported Pt [2] and PtCo catalysts has been studied and optimized. Pt catalysts with excellent dispersion (particle size ~3-4 nm, Fig. 1a) and high mass fractions (up to at least 40% wt.) supported on texture-tailored carbon materials (pore size from 20 to 500 nm) were prepared using very simple impregnation-reduction processes in liquid phase. The obtained catalysts display excellent intrinsic catalytic activities and can be used to prepare Membrane-Electrode Assemblies (MEAs) with interesting mass transport properties compared to those elaborated from carbon black supported catalysts.

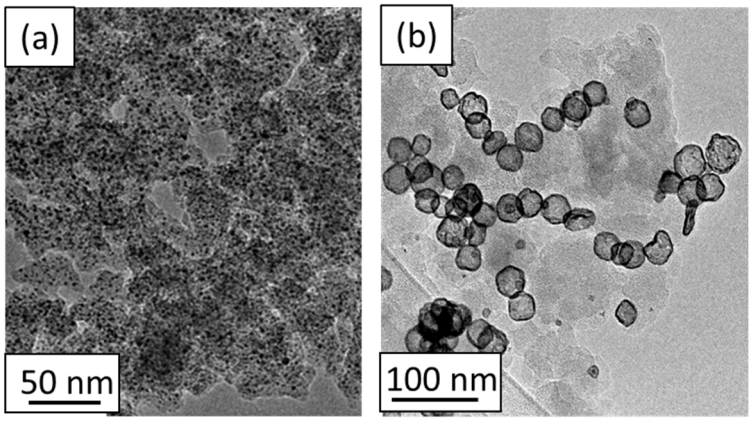

Figure 1: TEM pictures of (a) a Pt/CX catalyst (40% wt.) prepared by impregnation-reduction process and (b) hollow PtCo/C nanoparticles.

The same type of nanostructured carbon can be used to support hollow PtCo nanoparticles (Fig. 1b). These catalysts were thoroughly characterized using physico-chemical and electrochemical techniques, including accelerated stress tests on rotating disk electrodes. The hollow PtCo/CX catalysts display much better stability than Pt/CX and Pt/carbon black samples. PtCo/CX catalysts were also tested in MEA configuration for at least 50 h of accelerated stress tests, which allowed comparing the overall stability of the samples. Finally, current research goes towards the modification of the carbon surface properties, for instance by nitrogen doping *via* plasma treatments. The goal is to improve the nanoparticle stability and increase the catalyst lifetime.

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