LASER-ASSISTED CHEMISTRY TO DESIGN ADVANCED SINGLE-ATOM CARBON-BASED CATALYSTS

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Nowadays, the transition from combustion energy conversion technologies based upon the use of fossil sources to clean technologies, has driven a growing demand for the development of outstanding catalysts that radically change the current concepts of catalysis. Single-atom catalysts are recently emerging as a new frontier in heterogeneous catalysis science.[1] Especially, carbon-based materials have proven to be excellent candidates for supporting single-atom catalysts due to their unique structural and electronic properties. However, fabricating single-atom catalysts, providing 100% metal centers dispersion under synthesis and catalysis conditions are highly challenging. This work is set on the establishment of the laser pyrolysis processing as one-pot and up-scale alternative in the synthesis of a single-atom catalyst with multiple catalytic active sites M-N_x (M= Fe) dispersed on a solid carbon support. Spatial uniformity and high temperature (> 500ºC) in the reaction zone, short millisecond scale residence times, and high heating/cooling rates are the most important advantages of this strategy to control uniform atomic-scale distribution of the metal atoms. The results suggested a promising route towards tailored generating of single-atom catalyst, which may enable a wide variety of applications since there are many possible combinations of metals and dopant atoms.[3] Finally, promising applications of the as-prepared catalysts for oxygen reduction reaction (ORR) is described.

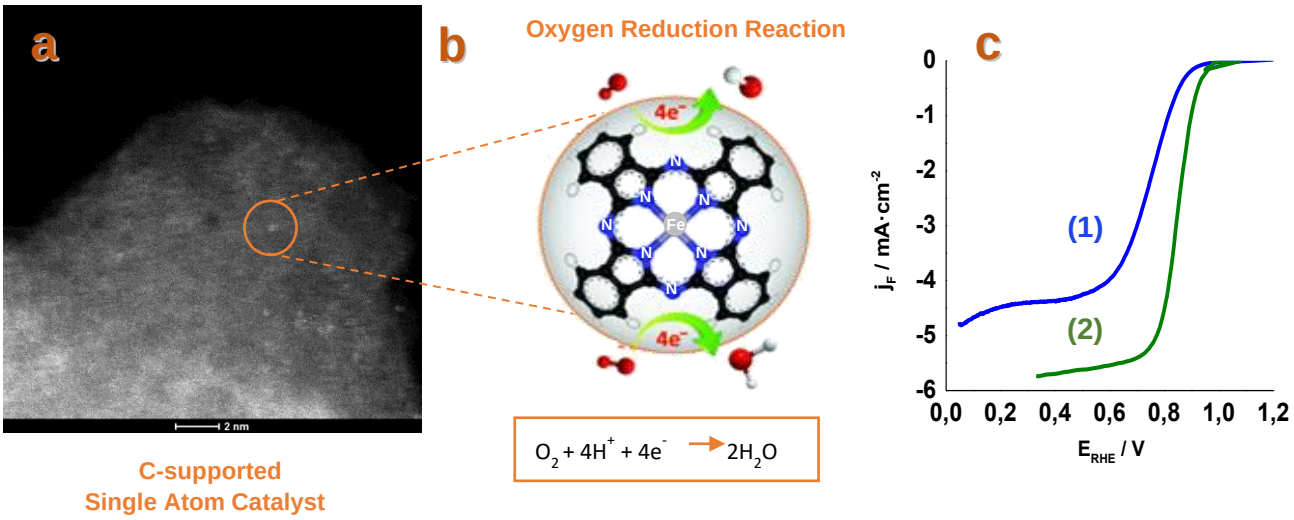

Figure 1. A) STEM image corresponding to Fe-N/C single atom catalyst, B) Detailed scheme of ORR reaction mechanism in the cathode of fuel cells and C) ORR polarization plots in 0,1M KOH of (1) Fe-N/C catalyst and (2) reference Pt/C catalyst. Test conditions: Disk rotation 1600 rpm, catalyst loading 0,6 mg/cm^2.

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