Title	**Platinum free electrocatalysts based on Fe-Nx modified mesoporous carbon as cathodic material in proton exchange membrane fuel cell**
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Project description:

Proton exchange membrane fuel cell (PEMFC) wide spreading is still hindered by the bottleneck of the oxygen reduction reaction (ORR). Actually, large amounts of precious Pt metal are required to promote the sluggish kinetics, causing the PEMFCs to be economically uncompetitive with conventional technologies. The physical amount of platinum existing on the Earth is barely enough to cover the world demand in the next forty years for fuel cell vehicles. Nitrogen doped mesoporous carbons are emerging as a new class of Pt free materials for ORR. In particular, it was observed that doped carbons containing small amount of transition metals, such as Fe or Co, can catalyze the O_2 reduction to H_2O at overpotentials comparable to that of the most active Pt catalyst.

In this research project, nitrogen doped mesoporous carbons containing small amount of Fe and/or Co (M@N-MC,) will be prepared from 1D and 2D coordination polymer prepared by thermal or hydrothermal synthesis of suitable carbon and metal precursor. The synthesis involves the employment of nitrogen containing polydentate ligands able at complexing iron or other metals, affording a robust network, which, after pyrolysis at high temperature, yields a porous carbon structure functionalized with Fe-Nx sites. The electrochemical characterization will include activity test at rotating ring disk electrode and stability tests combined with Raman and XPS spectroscopies and TEM microscopy. The 1D and 2D coordination polymer properties will be tailored in order to obtain high surface area, high stability and catalytic activity towards oxygen reduction reaction.

Publications:

(1) Perazzolo, V.; Durante, C.; Pilot, R.; Paduano, A.; Zheng, J.; Rizzi, G. A.; Martucci, A.; Granozzi, G.; Gennaro, A. *Carbon* **2015**, 95, 949–963.

(2) Perazzolo, V.; Grądzka, E.; Durante, C.; Pilot, R.; Vicentini, N.; Rizzi, G. A.; Granozzi, G.; Gennaro, A. *Electrochim. Acta* **2016**, 197, 251–262.

(3) Perini, L.; Durante, C.; Favaro, M.; Perazzolo, V.; Agnoli, S.; Schneider, O.; Granozzi, G.; Gennaro, A. *ACS Appl. Mater. Interfaces* **2015**, 7, 1170–1179.

Collaborations

1) Toyota Motor Europe
2) Technische Universität Berlin

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