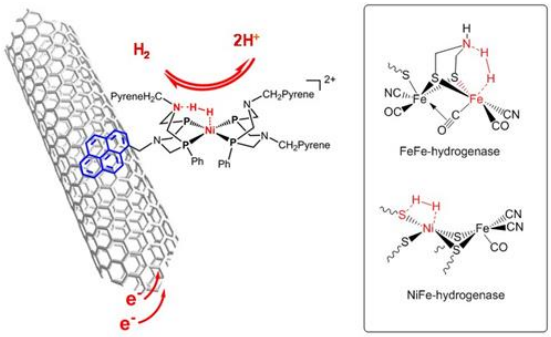
Post-doctoral position available at CEA Grenoble

Physico-chemical characterization of catalytic layers of proton-exchange membrane fuel cell (PEMFC) integrating bio-inspired anode catalysts

CEA is actively committed to the development of hydrogen proton-exchange membrane fuel cells (PEMFCs). Efforts in the Fundamental Research Division, in particular in the SolHyCat team (www.solhycat.com), aim at designing new catalytic materials for hydrogen oxidation (HOR) based on Earth-abundant elements for the purpose to replace platinum-group metals (PGMs). A bio-inspired approach for PGM-free HOR catalysts has been developed, mimicking the structure of the active sites of hydrogenases that only contain iron and nickel metal atoms and these bio-inspired nickel diphosphine complexes are immobilized onto carbon nanotubes (figure 1). The HOR activity of these complexes have been proven under PEMFC relevant conditions (Artero, Palacin et al. *Science*, 2009, **326**, 1384). Now the optimization of both the intrinsic catalytic properties of the catalyst and its integration within the catalytic layer are required to further improve the performance.



Structure of the anode catalysts and representation of the active sites of hydrogenase that served as inspiration for their design

In this Post-doc project, we propose to study the integration of these bio-inspired catalysts in PEMFC active layers mainly using TEM based techniques. First, the distribution of the PGM-free catalyst on individual carbon nanotubes will be observed at atomic scale using spherical aberration corrected microscope (FEI-Titan Ultimate) operating at low voltage. These analyses will allow the optimization of the grafting process of the bio-inspired catalysts onto CNT structure. Secondly, in order to optimize the integration of these catalysts into the PEMFC active layers, the electrode structures will also be analyzed using STEM/X-EDS, focusing in particular on the electrode porosity and the homogeneity of the ionomer (electrolyte) distribution through the electrode.

This work includes also synthesis and electrochemical tests of the catalysts in strong collaboration with the SolHyCat team and the candidate will be involved in other characterization experiments using various techniques such as XPS and neutron scattering.

We are looking for a dynamic candidate who is interested in both the characterization techniques and the PEMFC catalyst layer developments. The candidate must possess PhD degree. A background in TEM characterization is essential and experiences in relevant materials will give an extra merit. The position is awarded by CEA and is available for a 12+12 months period.

Interested candidates should send curriculum vitae, list of publications (preprints of unpublished papers are also accepted, but in a separated list) and arrange to two to three references addressed to:

Hanako Okuno (hanako.okuno@cea.fr) and Vincent Artero (vincent.artero@cea.fr)