

## ULHyS - LUE PhD thesis proposal

Title	<b>Development of platinum-free cathodes for hydrogen fuel cells</b>
Supervisor	A. CELZARD- IJL
Laboratory	IJL
Co-Supervisor	F. XU - LEMTA
Sci. Environment	The City College of NY, USA
Doctoral school	EMMA
Description	<p>This project is embedded in the framework of the global excellence program devoted to hydrogen energy “Université de Lorraine Hydrogen Science and technology”. This PhD will give the opportunity to a motivated student to go through innovative electrodes formulation for PEM fuel cells to the test in a fuel cell under operation. The high cost of platinum-based electrocatalysts in hydrogen fuel cells along with the sluggish kinetics in the cathodic oxygen reduction reaction (ORR) hinders the widespread commercialization of fuel cells. <u>The first objective</u> of this thesis project is <u>developing high-performance platinum-free catalyst for ORR</u> based on biosourced carbon materials doped with of N- and B- groups. These heteroatoms break the electroneutrality, improve the electrocatalytic durability and enhance the ORR activity of the carbon materials by 1.5–1.6 times. The work proposed is based on two preliminary studies published by the IJL team in American Chemical Society catalysis (IF=10.6) and will benefit of existing collaborations with Prof Bandosz (The City College of NY, USA). <u>The second objective is optimising free-platinum based electrode inks formulation in order to make reproducible membrane electrode assemblies (MEAs) and testing then in a PEMFC (Proton Exchange Membrane Fuel Cell)</u>. A spray coating bench will be used for depositing electrodes layers. Few consortia have the possibility of preparing, characterizing and testing small- and medium-sized ORR electrodes. <u>The combined experience of IJL-Epinal on the preparation of carbon materials and electrochemical testing at small scale combined with the experience of LEMTA in MEA characterization and testing in instrumented fuel cell will allow going a step further in the rapid development of alternatives to Platinum-based electrodes, which is recognized as a major bottleneck in the reduction of the cost of the PEM fuel cells core technology.</u></p>
Strategy position	Platinum-free catalysts – fuel cell testing - Proof of Concept
Keywords	Hydrogen fuel cells; platinum-free catalyst; biosourced carbons; membrane electrode assembly