Ph.D position Project EIPHI GS ProdHyg

Job title	Doctoral Research Position in Molecular Chemistry and Materials
Job type (PhD, Post-doc, Engineer)	PhD
Contract duration (months)	36 months
Qualifications (Master, PhD)	Master
Job hours (full time/ part time)	Full Time
Employer	UBFC Université Bourgogne–Franche-Comté
Financing Institutions	Région Bourgogne Franche-Comté & Graduate School EIPHI
Host Laboratory	Institut de Chimie Moléculaire de l'uB (ICMUB)
URL Host Laboratory	http://www.icmub.com/fr
Address Host Laboratory	9 avenue Alain Savary 21000 Dijon
Job description	The economic and industrial opening targeted as a priority is in the field of secure chemical storage in the solid state of hydrogen, H2, as a clean and secure energy carrier using amine-boranes and metal hydrides. The catalysts for the production and synthetic use of H2 will be networks of low volatility nanomaterials or nanoparticles embedded in thin films synthesized under clean conditions. The non-toxic nature of the metals used in first intention such as ruthenium or nickel is also a key point of the project to supplement the rare metallic resources (platinum, rhodium) and extremely expensive. This fits into the following context: France is aiming for carbon neutrality in 2050 (law n ° 2019-1147 of 8 November 2019 relating to energy and climate). The government has defined its trajectory for the next ten years via the multi-year energy program (PPE, decree n ° 2020-456 of April 21, 2020). Among the objectives set is the development of low-carbon and renewable hydrogen (H_2) (non-fossil manufacturing energy) for industrial, energy and mobility uses. This transformation of the economy should not overshadow the risks associated with the use of H2. Regarding proven industrial processes in the industry, the analysis from the ARIA database of 372 events involving H2 (accidentally produced or generated in the gaseous or liquid state under pressure or cold), reminds us of the dangers of H2. Thus, 73% of the phenomena generated are fires and / or explosions. 27% concern non-ignited H2 leaks or stresses caused by H2 on materials, without human consequences. 15% of fires and / or explosions killed at least one person, 43% injured. In addition to the regulations relating to the storage of H2 in installations classified for the protection of the environment (ICPE), the design and operation of H2 distribution stations are governed by the order of 22 October 2018. The thesis project plans to synthesize networks of metallic nanoparticles of ruthenium and nickel (inexpensive metals with controllable toxicity) stabilized at the surface by functionalized diamondoids (nanodiamonds). This, in order to produce solid catalysts which can be recovered by filtration and which can be recycled. Network formation provides for further stabilization of the overall structure and control of individual nanoparticle growth. The characterization of these original networks and their use in the

	production of H2 by hydrolysis (action in water) of amine-borane, then their easy separation and their recycling after separation is a major objective of the thesis. Indeed, 50% of industrial catalysis production costs come from purification difficulties. Here, the synthesis of insoluble networks will be an advantage, and will avoid placing on a support of conventional heterogeneous catalysis or the steps of metallic impregnations and calcinations are energy-intensive, consuming toxic solvents to be evaporated off, and difficult to control compared to organometallic approach under mild conditions that we propose. This work already has a proof of concept in the synthesis of networks of ultra-active and selective gold nanoparticles in catalysis of cyclization of unsaturated molecules with high benefit.
Supervisor(s)	Pr. J.-C. HIERSO
Candidate profile	The candidate should hold a master degree in molecular chemistry or Materials Sciences. He/she must have a strong background and practice in materials chemistry synthesis (CVD, PVD) and characterization. An interest or an experience in of organic and/or late transition metal chemistry including characterization methods (NMR) is necessary. A good knowledge of English and French or Spanish is highly recommended. International candidates are welcome, a European PhD diploma could be validated by study periods in Spain and Germany. The thesis will be written in English.
Keywords	Metal chemistry ; Dihydrogen; Catalysis; Decarbonated energy ;
Application deadline	1st June 2022
Application Depending on the type of position	Please send the following documents (all in one PDF file) by e-mail to jean-cyrille.hierso@u-bourgogne.fr : 1) For EU candidates: Copy of your national ID card or of your passport page where your photo is printed. For non-EU candidates: Copy of your passport page where your photo is printed. 2) Curriculum Vitae (may include hyperlinks to your ResearchID, Research Gate Google Scholar accounts). 3) Detailed list of publications (may include hyperlinks to DOI of publications). 4) Letter of motivation relatively to the position (Cover Letter) in which applicants describe themselves and their contributions to previous research projects (maximum 2 pages) 5) Copy of your Master degree if already available. 6) Coordinates of reference persons (maximum 3, at least your master thesis supervisor): Title, Name, organization, e-mail. If you have questions regarding the application, please contact the supervisor.