# Hydrogen CLathrate hydrates in confined environment: A promising approach for HYdrogen storage ($CLAHY_2$)

The main goal of the **$CLAHY_2$** project is the design of nanoporous materials (preferentially activated carbon materials and metal-organic frameworks – MOFs) with proper textural and chemical properties able to promote the nucleation and growth of hydrogen clathrate hydrates in a confined environment. By taking advantage of confinement effects in the inner cavities of these nanoporous materials, hydrogen clathrate's nucleation and growth will be promoted under milder pressure and temperature conditions than the bulk systems, and more importantly, under extremely fast kinetics. This nature inspired approach will open the gate towards hydrogen storage in solid form under mild pressure and temperature conditions to be applied in mobile (e.g., trains) or stationary devices.

The three years PhD period will be divided in two periods, i.e. a first period (18 months) at the University of Alicante (Spain), working under the supervision of Prof. Silvestre-Albero, and a second period (18 months) at ILL (France), working under the supervision of Dr. Czakkel. The first period will be mainly devoted to the synthesis and characterization of nanoporous materials and their preliminary testing in the adsorption of hydrogen under dry and wet conditions. During the second period at ILL, the most promising materials will be evaluated as a host structure to promote the nucleation and growth of hydrogen clathrates. Through the combined use of inelastic neutron scattering (INS) and neutron diffraction (ND), the characteristic vibrational modes of the enclathrated hydrogen and the crystal structure will be identified under different experimental conditions. If needed, there will be also the option to perform short secondments in the associated institution outside the proposed schedule. We are seeking for a motivated PhD student with background in chemistry, chemical engineering or materials science. The PhD student will be engaged in one of the doctoral programs at the University of Alicante, and he/she will need to fulfil all the requirements defined by the University to get the PhD degree (international conferences, transversal courses, etc.). At ILL the PhD student will take part of the usual PhD activities (clip session, seminars, etc.) and will have to follow the annual HERCULES course. Working language will be English. **It is mandatory to have a Master degree in Materials Science or any related field.**

Additional details about the specific conditions for the PhD and the application procedure, please consult the following link:

https://www.ill.eu/careers/all-our-vacancies/phd-recruitment/phd-work-at-the-ill

If you are interested in joining the CLAYH2 project, please send the CV and a motivation letter to the following email addresses (with including the reference ESP-3-2023 in the subject of the mail):

Dr. Orsolya Czakkel - Email: czakkelo@ill.fr

Dr. Joaquín Silvestre-Albero, UA – Email: joaquin.silvestre@ua.es

Deadline: May 31st, 2023