PhD Offer (M/F) : **Search for New Materials for Solid Hydrogen Storage through High Pressure and High-Temperature Synthesis.**

Context and thesis subject:

Hydrogen is an essential complement to electrification, offering the potential to efficiently transport and store renewable energy on a large scale. However, for its large-scale deployment to become a reality, it is essential to have safe and efficient methods for storing this very low-density gas. **Solid hydrogen storage** by chemisorption in reversible materials offers a promising solution in terms of volumetric density and safety. However, despite efforts to optimize known hydrides, certain limitations remain and no material fully meets the application requirements in terms of mass capacity, reversibility, operating conditions and cost. The project is part of the **national strategy funded by the PEPR-H2** (Priority Research and Equipment Program) focused on the development of decarbonized hydrogen (https://www.pepr-hydrogene.fr/). More specifically, the thesis is conducted within the framework of the **SOLHYD project**, which aims to research high-capacity and reversible hydrogen storage materials.

The PhD project aims to explore an original approach to the discovery of hydride materials by exploiting an under-utilized thermodynamic parameter: **pressure**. The aim of the research is to reveal **novel structural architectures** and determine their hydrogen sorption properties through experimental investigations. In addition to seeking **new performances** for H_2 storage applications, the project aims to increase the fundamental knowledge of metal-hydrogen bonding and (meta)stability of hydrides synthesized under high pressure.

The studies will be carried out at the **Institut Néel, Grenoble**, which possesses an extensive range of high-pressure equipment for synthesis and *in situ* characterization (XRD, Raman). The compounds studied are ternary, and possibly quaternary, hydrides based on light elements, and their stoichiometry may be optimized in collaboration with theoretical chemists. *In situ* diffraction studies (X-ray and neutron) using large-scale instruments are envisioned to understand reaction mechanisms. As part of the SOLHYD project, the doctoral candidate may have short-term missions to other laboratories. He/she will be required to present their work at national or international conferences.

Host laboratory and supervision:

The **Institut Néel** (UPR 2940) is a joint research center between CNRS, Université Grenoble Alpes, and Grenoble INP (http://neel.cnrs.fr), consisting of 450 people. The candidate will be supervised by a CNRS researcher and will have interactions with numerous colleagues working on different areas of material science, high pressure, and H_2 storage, not only within the Institut Néel but also with members of other laboratories involved in the PEPR.

Supervisor: Dr. Laetitia Laversenne, CNRS Researcher, laetitia.laversenne@neel.cnrs.fr

The doctoral candidate will be enrolled in the **IMEP2 Doctoral School** (Engineering - Materials, Mechanics, Environment, Energy, Processes, Production) (https://edimep2.univ-grenoble-alpes.fr/) at Université Grenoble Alpes.

Application:

Candidate profile sought: Motivated and dynamic, with a Master's degree or equivalent in Materials Science. Strong preference for experimental work. Desired knowledge in materials synthesis and analysis (SEM, X-ray diffraction). Good communication and research dissemination skills are also appreciated. Proficiency in English is necessary.

Contract and remuneration: The candidate will be employed by CNRS. Approximate gross salary: €2100/month. Contract type: Fixed-term doctoral contract, duration: 36 months.

Thesis start date: between 2/11/2023 and 15/01/2024.

Application: Please send CV, cover letter, and latest transcripts to Laetitia.laversenne@neel.cnrs.fr.