Master 2 Internship – Preparation of nitride-based catalysts for ammonia production following chemical looping

ENVIRONMENT

This internship will take place between the Unit of Catalysis and Chemisty of Solids (UCCS, MATCAT team, https://uccs.univ-lille.fr/index.php/en/) and the Institute for Research on Catalysis and the Environment of Lyon (IRCELYON, C'Durable team, https://www.ircelyon.univ-lyon1.fr/en/welcome-2/).The tentative planning will be about 2 months in Lyon and 4 months in Lille.

RESEARCH TOPIC

Ammonia synthesis is currently a hot topic as an energy vector, being simpler to transport than dihydrogen. Ammonia is produced through the Haber Bosch process, the latter being highly energy-consuming mostly due to the requirement to work at high pressure (about 200 bars). Moreover, the H-B process results in the release of more than 450 million of metric tons per year of CO_2 for the required petrosourced H_2 and energy productions. Hence it is of high interest to develop new, greener alternatives to produce ammonia. One way is by using green, locally produced H_2, which can only be effective if the pressure requirement is lowered (<100 bars).

The Nitroloop research project aims at developing more efficient catalyst formulations, based on nitride-based catalysts, for low pressure (< 10 bars) ammonia synthesis. To do so, a chemical looping approach will be developed, where the nitride-based catalysts are put alternatively in the presence of a H_2 feed (unloading step), to produce NH_3; then in the presence of a N_2 feed (loading step), to refill the material with nitrogen.[1]

Within this project, the hired M2 intern will prepare vanadium nitrides at IRCELYON, as such or doped with transition metals, according to existing know-how. In a second step, the intern will go to UCCS to characterize the surface reactivity of the series of catalysts including the mobility of N-atoms. Finally, still at UCCS, the intern will evaluate the catalytic performance of the series under 1 bar of pressure as well as its long-term stability.

[1] Gao et al., Nature Energy 3 (2018) 1067.

PROFILE

We are expecting students preparing a Master or equivalent in chemistry of materials and/or heterogeneous catalysis to apply, but students with a profile in chemical engineering will also be considered. The selected student will present the following virtues: rigor, autonomy, and scientific curiosity. To apply, please send a CV and a motivation letter to the contacts provided below.

INFORMATIONS

Grant: 600 euros/month
Duration: From March 2022, 6 months
Contact: sebastien.royer@univ-lille.fr; noemie.perret@ircelyon.univ-lyon1.fr;