SINCHEM PhD subject

The chemical-loop approach in bio-alcohols reforming

HOME INSTITUTION: Università di Bologna, Bologna, Italy. Supervisors of the PhD student in Bologna: Prof. Fabrizio Cavani and Dr. Stefania Albonetti

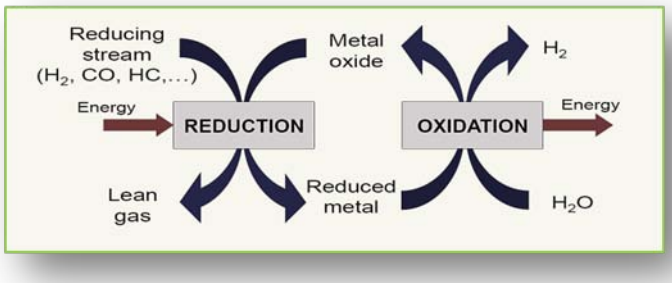
HOST INSTITUTION 1: Ecole Nationale Supérieure de Chimie de Montpellier, Institut Charles Gerhardt (ICG), Montpellier, France. Supervisors of the PhD student in Montpellier: Dr. Francesco Di Renzo and Dr. Françoise Quignard (team « Matériaux avancés pour la catalyse et la santé », MACS),

HOST INSTITUTION 2:. IRCELYON Associated partners. Supervisors of the PhD student in Lyon: Dr. Jean-Marc Millet.

PROJECT DETAILS

The aim of the PhD thesis will be to study and evaluate a new process for the generation of hydrogen with intrinsic sequestration of carbon. More specifically, the research work will investigate the "chemical-loop" approach for the reforming of bioethanol into CO/CO_2 and H_2 produced separately. Therefore, the aim is to make the production of H_2 simpler and economically more convenient than it is currently done by conventional methane reforming. Moreover, an additional advantage in terms of sustainability is the use of bioethanol as the source of hydrogen, instead of natural gas.

The chemical-loop approach, already investigated in the literature for the transformation of natural gas, would be well adapted and economically more favourable starting from bioalcohols. The approach consists in separating the two distinct steps of a reforming process. The first step is the reduction of a mixed oxide material with bioethanol, with production of CO, CO_2 and H_2O. The second step is the reoxidation of the reduced oxide with water, and generation of a concentrated stream of H_2.



The aim of the research work will be to define conditions and materials that may lead to an optimized process, allowing producing an hydrogen stream that does not require any additional purification or separation treatment. The PhD student will investigate the chemistry of the process, by means of both in-situ and ex-situ techniques, and the characteristics of the mixed oxides, in terms of both redox properties, morphology and chemical-physical features, with the aim of preparing catalytic materials with the optimal properties to make the chemical-loop process highly efficient.

The PhD thesis will be done in collaboration among (a) the Catalytic Processes Development Team, Bologna University, (b) the team «Matériaux avancés pour la catalyse et la santé», Ecole Nationale Supérieure de Chimie de Montpellier and (c) the team of «Refining and Innovative Valorisations of Hydrocarbons», Institut de recherchers sur la catalyse et l'environnement de Lyon (IRCELYON).