PhD position at IFP Energies nouvelles (IFPEN)
in Chemical sciences

Study of the mechanisms leading to supported copper mobility in the Chemical Looping Combustion process

The capture of CO_2 emitted by industrial facilities and its storage in deep saline aquifers are among the solutions promoted by the IPCC to contain the increase of greenhouse gas emissions. Among the various technologies that can be considered for CO_2 capture, Chemical Looping Combustion processes for power production show high potential in terms of energy efficiency thanks to the absence of a gas separation stage. This process relies on the high temperature circulation of an oxygen-carrying material between two fluidized bed reactors: in the first reactor, the fuel is oxidized by the oxygen carrier, producing CO_2 and water; in the second reactor, the reduced material is reoxidized by oxygen from the air.
Materials consisting of supported copper oxide have been identified as very promising because of their high reactivity. However, the accumulation of oxidation-reduction cycles under the process conditions results in a high mobility of copper containing phases towards the outer surface of the particles, which results in a degradation of material's properties.
The aim of this PhD thesis is to identify the mechanisms responsible for the migration of the supported Cu/CuO phases towards the periphery of the particles. This phenomenon may involve diffusion of the reactive species at the surface of the support, or inside the different crystallographic phases formed during the oxidation-reduction cycles. The proposed research strategy will rely on experimental facilities available at *IFPEN* and the *IPCMS* (materials synthesis, testing and characterizations by XRD, TEM, SEM, thermogravimetry, ...). Environmental transmission electron microscopy will especially be used to study the evolution of materials under reactive conditions.
The better knowledge of copper migration processes and physical parameters involved will lead to practical solutions allowing to enhance material properties and to design more efficient materials and industrial processes.

Keywords: Chemical looping combustion, Environmental electronic microscopy, solid state diffusion

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Doctoral School	ED 182 Physique et Physico-chimie de l'Université de Strasbourg
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PhD location	IFP Energies nouvelles, Lyon, France and IPCMS, Strasbourg, France
Duration and start date	3 years, starting preferably on October 1st, 2018
Employer	IFP Energies nouvelles, Lyon, France - Co-financing MOGPA (Make Our Planet Great Again)
Academic requirements	Master degree in Materials Science & Engineering, Physical Chemistry, Catalysis
Language requirements	Fluency in French or English, willingness to learn French

For more information or to submit an application, see theses.ifpen.fr or contact the IFPEN supervisor.
For more information on MOGPA program:
https://campusfrance.smapply.io/prog/doctoral_program_mopga/

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