PhD position at IFP Energies nouvelles (IFPEN)

in *Materials Engineering*

Study of corrosion risks in biomass transformation and plastics recycling processes

As part IFPEN activities on Energy Transition Sustainable Development, a PhD position is proposed in the Electrochemistry and Materials Department at IFP Energies Nouvelles in Solaize, 10 km from Lyon, in collaboration with APERAM (CIFRE funding).

The work aims at studying specific corrosion risks encountered in biomass transformation and plastic recycling processes. These processes involve high levels of chlorides, organic acids, and water at temperatures up to 300 °C. These environments may induce severe risks of chloride stress corrosion cracking (Cl-SCC) for austenitic stainless steels, which needs to be further investigated.

The first part of the PhD work will comprise studying the conditions (temperature, pressure, phase composition) found in industrial processes, to precisely identify the environmental conditions that may induce risks of Cl-SCC. This part of the work will benefit from internal support provided by Process Design and Thermodynamic Experts at IFPEN. At the same time, laboratory methods will be developed to experimentally reproduce Cl-stress corrosion cracking at high temperatures. Different types of methods will be evaluated, from simple specimens under static loading (e.g. U-bends) to samples mounted on tensile test machines and exposed to dedicated cells. Here the objective will be to elaborate simple and robust procedures for the second part of the PhD work aimed at investigating the impact of environments representative of biomass transformation and/or recycling of plastics. For instance, a comparison between inorganic and organic chlorides will be carried out, as well as the impact of weak organic acids. Furthermore, remediation strategies could be examined, such as alternative metallurgies.

This work will be carried out in close collaboration between APERAM (employer of the candidate), IFPEN (Electrochemistry and Materials Dpt), and the MEMO team from CIRIMAT Laboratory at ENSIACET-INP Toulouse under the supervision of Pauline HUGUENIN (APERAM), Jean KITTEL (IFPEN) and Prof. Christine BLANC (CIRIMAT).

Keywords: Corrosion, Chloride stress corrosion cracking, plastic recycling, biomass transformation

Academic supervisor	Prof. Christine BLANC, ENSIACET, ORCID : 0000-0003-2183-0671
Doctoral School	ED482, SDM (Sciences de la Matière) Université de Toulouse
IFPEN supervisor	Dr Jean KITTEL, jean.kittel@ifpen.fr, ORCID : 0000-0002-8023-1153
PhD location	IFPEN Lyon, France
Duration and start date	3 years, starting in the fourth quarter 2024 (Novembre 4)
Employer	APERAM
Academic requirements	University Master degree in Materials or Mechanics
Language requirements	English level B2 (CEFR)
Other requirements	Skills in corrosion and chemistry is an additional asset

To apply, please send your cover letter and CV to the IFPEN supervisor indicated here above.

About IFP Energies nouvelles

IFP Energies nouvelles is a French public-sector research, innovation and training center. Its mission is to develop efficient, economical, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, see our WEB site.

IFPEN offers a stimulating research environment, with access to first in class laboratory infrastructures and computing facilities. All PhD students have access to dedicated seminars and training sessions.