

# CHARACTERIZATION OF THE MECHANICAL PROPERTIES OF VARIOUS STEEL GRADES BY ELECTROMAGNETIC & ULTRASONIC NON-DESTRUCTIVE TECHNIQUES

Research laboratory: UNIVERSITÉ DE LILLE, L2EP  
Company: VALLOUREC RESEARCH CENTRE FRANCE

## 1.1 Research project

Tubular products commercialized by Vallourec go through rigorous destructive tests to ensure that their mechanical properties comply with the specifications. Being able to measure non-destructively some of the mechanical properties of steel, for example the Young's Modulus (E), the Elastic Limit (Ys) and the Ultimate Tensile Strength (UTS), would fulfill a strong industrial need.

In order to reach this objective, magnetic and ultrasonic techniques exist, whose measured signals can be linked to the mechanical properties of the steel. There are however many influencing parameters, such as the steel grade and microstructure, the sample geometry, the surface finish or the residual stresses.

The objective of this Ph.D thesis is to find a reliable method for measuring accurately some of the mechanical properties of a selected number of Vallourec steel grades.

The Ph.D student will share his time between the L2EP laboratory and VRFCF.

## 1.2 Funding

« CIFRE » thesis contract

## 1.3 Presentation of L2EP and Vallourec Research Centre France

### UNIVERSITY OF LILLE, L2EP

The Laboratory of Electrical Engineering and Power Electronics (L2EP) is structured into 4 research teams, covering all aspects related to the field of electrical energy (design, modeling and management of electrical energy). The team "Numerical Tools and Methods", involved in the proposed PhD project, has been developing for 25 years models of electrical devices mainly based on the finite element method. The development of these models requires a very good knowledge of ferromagnetic materials which play a key role within electrical devices. In that context, the team conducts research activities for the characterization and modeling of these materials. To that end, an experimental platform has been developed for the implementation of different characterization methods and techniques, including multi-physical characterizations. The team activity is recognized in this research field, which is reflected in particular by numerous industrial collaborations.

### VALLOUREC RESEARCH CENTRE FRANCE

Vallourec is a world leader in premium tubular connections for the energy market. It also supplies tubular products for the mechanical, automotive and building industries.

With over 18,000 employees in 20 countries, fully integrated production units and cutting-edge R&D, Vallourec provides its customers with innovative global solutions.

The historical R&D centre of Vallourec, "VALLOUREC RESEARCH CENTRE FRANCE" (VRFCF), is located in Aulnoye-Aymeries (59), about 1h10mn from Lille by train. With about 150 employees, it is dedicated to metallurgy, resistance to corrosion, surface treatments, thermal processes and

numerical simulations of products and processes. Its experts work in close ties with Vallourec mills all over the world to respond to their research and technical needs.

#### **1.4 Profile of the candidate**

The candidate will:

- Have a diploma (Master's degree, diplôme d'ingénieur or equivalent) relevant to the Ph.D thesis topic, with a good academic record
- Demonstrate his/her motivation to make a Ph.D
- Have a good level of written and oral English
- Be either fluent in French, or willing to learn

Applicants shall send their resume, a cover letter and their academic results of the past 3 years to both:

- Abdelkader Benabou: [abdelkader.benabou@univ-lille.fr](mailto:abdelkader.benabou@univ-lille.fr)
- Olivier Lazzari: [olivier.lazzari@vallourec.com](mailto:olivier.lazzari@vallourec.com)

#### **1.5 Deadline for application**

30/06/2020