

## Internship Offer - 6 months 2019

~ March-September

### Possible Phd thesis after the internship

**Extending the in service-life of power transmission parts by laser shock peening:**

**Experimental analysis of the processing**

Location : Arts et Métiers ParisTech – Laboratory PIMM (Paris)

**Context:** This internship offer is part of the TRANSFUGE project led by the IRT-M2P and aimed at developing innovative material solutions and processes in the field of power transmission and bearings. More specifically, this internship is part of the sub-project focused on the laser shock peening on high strength steels involving IMAGINE-OPTIQUE and THALES optical and laser technologies and NAVAL end-users. GROUP, SAFRAN and AIRBUS.

**Project**

Among surface treatments, laser shock peening (LSP) consists of focusing a high intensity pulsed laser (ns) (GW / cm<sup>2</sup>) on the surface to generate high-pressure plasma (GPa). In response to its expansion, a shock wave is induced in the material. After its passage, a field of residual stresses is induced more deeply than those induced by conventional shot peening. The LSP is therefore a process improving the fatigue properties of the parts. In the industry, two configurations of LSPs are used: (i) configuration with small impact sizes with a high repetition rate and no coating protecting against thermal effects of the plasma, and (ii) configuration with large impacts size, a low repetition rate and with coating. The first configuration induces thermal and mechanical effects whereas the second induces only mechanical effects. As a result, the distribution of residual stresses under the surface is different for these two configurations. The generation of these residual stress profiles in depth with respect to the process conditions in the case of high strength steels used in the case of power transmission parts and bearings is poorly known and requires studies for understanding the process relationships - residual stress profile.

## Objectives of the internship work

The objective of the internship work is to test different process conditions (impact size, laser energy, repetition ratio) laser on the profile of residual stresses generated in depth on test samples and to better understand the relationships between the process parameters and the profile of residual stresses of high strength steels. The effects of surface roughness and microstructural changes under the surface due to LSP will also be studied.

Two types of LSP treatments will be performed:

- Coated treatment for the study of mechanical effects
- Uncoated treatment inducing mechanical and thermal effects

The objective is to approach the laser conditions which can allow the transportation of the laser beam by means of an optical fiber facilitating the LSP operation on parts of complex geometry such as gears and the maintenance of parts on site. Depending on the results, this exploratory work should be continued as part of a PhD thesis.

## Application

The person hired will begin in February-March 2019. We are looking for a young student of the M2 level or equivalent training in optical or materials or mechanical, highly motivated by experimental analyzes using different techniques: laser shock, X-ray diffraction, microscopy, metallography, microhardness.

**To apply, thank you to send your resume, cover letter and any documents you deem appropriate (publications, academic achievements ...) to [veronique.favier@ensam.eu](mailto:veronique.favier@ensam.eu) and [laurent.berthe@ensam.eu](mailto:laurent.berthe@ensam.eu)**