Master Internship offer

Fig.1 Aircraft engine with composite blades

Laboratory : P' PMM, ENSMA - Poitiers;
ONERA DMSC, – Chatillon (Île-de-France)

Internship supervisors Dr Olga Smerdova, Prof Marco Gigliotti (P'), Prof Bruno Passilly, Dr Gaëlle Roger (ONERA)

Funding : funded by Institute P'

Micromechanical experimental characterization of polymers under high temperature

Application: aeronautical materials
Necessary tools and knowledge: mechanics of polymer materials; Labview experience is appreciated
Nature of work: nanoindentation tests, development of robust experimental method of polymer characterization under high temperature, interpretation of experimental results with numerical models
Continuation in PhD: not planned
Duration: 6 months

This internship is a part of a large study of modelling and durability prediction of the composite materials with organic matrix for aeronautical structures, and more precisely for aircraft engines (Fig. 1). During the flight, these materials endure high mechanical loading under temperatures close to their glass transition. Moreover, high temperatures can substantially accelerate phenomena of degradation, such as the chemical reaction of oxidation, which modifies a local mechanical behavior of the material and produces a gradient of properties from the surface exposed to the environment. Thus, it is necessary to be able to characterize these gradients and to measure accurately material properties under the real life conditions in order to correctly model its constitutive behavior.

To do so, the high temperature nanoindentation technique can be used. The nanoindentation is a complex nano or microscopic scale test, whose results are not always easy to interpret. Moreover, the mechanical behavior of the polymer is very sensitive to the temperature. To obtain a reliable indentation curve, a thermal equilibrium between the tip of indenter and the specimen must be guaranteed. That is why, one has to deal with a number of experimental challenges while developing this test.

The Department of Composite Materials and Structures of ONERA has been developing the nanoindentation systems able to characterize the metals and ceramics behavior under very high temperatures since several years. The Institut P', on the other hand, has a significant experience in indentation of polymers and their composites under room temperature. Therefore, the aim of this internship is to mutualize the experience of both institutions and to develop an experimental method of the medium temperature nanoindenation applied to the polymer composites. The intern's mission will include the experimental development, the tests of aeronautical polymers and a choice of a visco-elastic or visco-elasto-plastic model to interpret the experimental results. The intern will spend at least a half of time at the ONERA (Chatillon, Paris suburb) and the other half of time at the Institut P' (ENSMA, Poitiers). The intern will be supervised by the researchers of both institutions, who will regularly meet and discuss the project advancement together with the intern.

For any addition information, please contact:
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