

Project supervisors: Marco GIGLIOTTI & Yannick PANNIER

Department: Institut Pprime, Physique et Mécanique des Matériaux, Axe Endommagement et durabilité

Institution proposing the post-doc: ISAE-ENSMA ENSIP UFR SFA Autre(s) :

Hosting institution: ISAE-ENSMA SP2MI Campus CEAT Niort Angoulême

Duration: 1 year

Modelling real microstructures from RX micro-tomography images for robust FEM simulation of coupled multi-physics phenomena

RX microtomography has become an essential technique for the investigation of materials behaviour, particularly concerning damage and durability issues. This technique has been successfully employed for example to describe the morphology of cracks and defects for several classes of materials (composites, polymers and metal alloys), but has been little used in the context of the characterization of the degradation phenomena associated with exposure to aggressive environments, aging and multiphysics couplings.

The Pprime Institute in Poitiers – thanks to the recent acquisition of X-ray micro-tomographic facilities (partly financed by Equipex Gap Program) - has already acquired a number of skills in the use and analysis of these data, especially concerning the segmentation of images and quantitative analysis of the evolution of defects during testing (area cracked surfaces, lengths of cracks, porosity rate ...).

To go further in the use of these data and for the interpretation of the observed phenomena, it is essential to build realistic finite element models starting from microstructures obtained by X-ray micro-tomography images. Building of such models requires the development and the implementation of a number of advanced tools for segmentation, mesh, and specific numerical skills. The postdoctoral fellow is expected to be familiar with these tools and will massively contribute to their development: moreover he will carry out simulations of coupled thermo-diffuso-mechanical behaviour in order to clarify the effect of the microstructure of the material on the degradation phenomena related to exposure to aggressive environments.

Skills: X-ray Micro-tomography, Mesh microstructure, FEM simulations, Coupled Problems

Link with the LABEX program

This topic is a part of the LABEX action 2 “Heat and mass transfer” since it deals with thermo-diffuso-mechanical couplings for structured composites, with complex microstructure. The aim of the research is to clarify the effect of the microstructure (complexity of the conduction/diffusion path, polymer matrix subjected to constraining effects by the fibrous reinforcement network) on the thermo-diffuso-mechanical behavior of the material and to better understand the degradation phenomena associated with exposure to aggressive environments.

Gross salary: around 2500 € / month

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