



Laboratoire des Sciences de l'Ingénieur pour l'Environnement
UMR-CNRS 7356

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The LaSIE Laboratory at La Rochelle University proposes a 6 months internship at master degree level starting from January 2022 which will lead to a Ph.D position starting in October 2022 supported by the French army (DGA AID).

Restriction: The applicant should be citizen from a European country or Swiss

ADMIRHE Project in partnership with UTEP (university of Texas, El Paso) and US army.

Context

This project is part of several themes put forward by the DGA (Directorate General of Armaments), precisely materials, chemistry and energy. High-performance structural materials are needed in lightweight design, cost-saving and energy-saving strategies. In this context, the question of the impact of hydrogen on the durability of metals and alloys has become of significant importance in many application sectors. It leads engineering to develop a systematic approach to determine the intrinsic parameters to any damage and the conditions for which they occur. On this theme, the LaSIE laboratory is carrying out cutting-edge studies (3 projects from the National Research Agency and two regional projects, 1 international project) on the diffusion and trapping of hydrogen in interaction with crystalline defects (vacancies, dislocations, precipitates, grain boundaries, triple junctions, surface, interfaces, inter-phases,...).

The objective of this project is to design nickel superalloy microstructures less sensitive to hydrogen embrittlement based on the study of the diffusion of hydrogen in grain boundary networks (GB) and triple junctions (TJ).

After a rigorous classification of the influence of grain boundaries and triple junctions on experimental hydrogen diffusion using a variety of bi- and tri-crystal sample, FEM models will examine different connectivity architectures to test and achieve the optimal microstructure in relation to the distribution and connectivity of the different systems (the models are well advanced). Finally, with the expertise of our collaborators at the WM Keck Center for 3D innovation at UTEP, new arrangements of engineering-controlled GBs and TJs using additive manufacturing will provide a way to build original structural patterns to verify the correlation between the microstructure and diffusivity of a defined lattice.

Work:

In this context, the objective of the internship is first of all to master the methods of electrochemical permeation and thermal desorption spectroscopy by working on samples of mono and bi crystals as well as on samples from additive manufacturing along. The intern will also have to take charge of the hydrogen diffusion models in finite element computation (in python). This work will be continued as a thesis after having grown bi- and tri-crystal samples constructed by crystal growth via a Czochralski-type oven.

Qualifications :

Master in mechanics of materials, material sciences, mechanical engineering.

Strong interest experimental studies with comprehensive skills in programming (python)

Resumes and cover letters have to be sent to :

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