Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name :	Sun	Given names :	Zhidan
Status (prof., assistant prof., …) :	Associate Professor		
Laboratory :	LASMIS	Website address :	http://lasmis.utt.fr
Institution :	Université de Technologie de Troyes (UTT)	Website address :	www.utt.fr

Scientific competence of the supervisor:

Mechanics of materials, Physical metallurgy, Mechanical testing, Fatigue of materials, Finite element modelling, Numerical simulation

Two major publications in the field proposed for the PhD :

1. T Gao, Z Sun, H Xue, D Retraint, International Journal of Fatigue 139 (2020) 105798
2. Z Sun, J Zhou, D Retraint, Materials Transactions 64 (2023) 1739-1753

Website address of the personal page : https://www.researchgate.net/profile/Zhidan-Sun

Supervisor's email : zhidan.sun@utt.fr; delphine.retraint@utt.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-12

Title : Ultrasonic fatigue properties of materials processed by surface mechanical attrition treatment

Subject :

Mechanical surface treatment techniques such as SMAT (Surface Mechanical Attrition Treatment) are efficient in improving the mechanical properties, especially fatigue properties, of materials. In industrial systems, many mechanical components can withstand up to 10^8 - 10^9 cycles before failing. The consequences of these failures can be catastrophic, particularly in the aerospace industry where safety is paramount. Therefore, it is essential to carry out fatigue tests in the gigacyclic domain (>10^7 cycles) to optimally design these mechanical components.
This project falls within the framework of the correlation between surface treatments and the enhancement of material fatigue resistance. Specifically, this study will investigate the effect of SMAT on resistance and fatigue life in the gigacyclic domain in order to optimally design mechanical components for gigacyclic loading conditions. Fatigue tests under different load ratios will be coupled with detailed microscopic investigations using tools such as X-ray diffraction (XRD) and electron backscatter diffraction (EBSD). The gigacyclic fatigue behavior of the SMAT processed material, particularly crack initiation mechanisms, will be analyzed in relation to its microstructure. The effect of SMAT will be highlighted by comparison with untreated material. Special attention will be given to the behavior of the region affected by SMAT, including the nanostructured layer, in relation to residual stress relaxation during fatigue testing.

Keywords :

Mechanical surface treatment, Ultrasonic fatigue, Residual stress, Work hardening, Finite element modelling

Expected collaborations :

Background required from the applicant :

Applicants must have competences in Materials Science and Engineering and/or Mechanics of Materials.

Existence of a PDF file detailing the proposal ("yes" or "no") : no

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