

The Laboratoire d'Étude des Microstructures et de Mécanique des Matériaux, (LEM3, CNRS, Université de Lorraine) located in Metz (France) is a center for experimental and theoretical research combining mechanics of solids and metallurgy. The worldwide scientific excellence of the LEM3-Université de Lorraine was recognized in 2019 by the Shanghai Ranking: 43rd in "Metallurgical Engineering" and 69th in "Mechanical Engineering".

The Helmholtz-Zentrum Geesthacht (HZG) is operating the German Engineering Materials Science Centre (GEMS), a centre for materials research based on the complementary use of synchrotron radiation and neutrons in Germany. Instruments using synchrotron radiation are operated at the HZG outstation at DESY in Hamburg, instruments using neutrons are located at the HZG outstation at the Forschungsneutronenquelle Heinz Maier-Leibnitz (MLZ) in Garching near Munich, the most powerful German neutron source.

To support our research, we are looking for : **a PhD Student**

“Texturing of a TiAl alloy via hot deformation and phase transformations”

Global presentation of the PhD topic:

Driven by the requirements for reducing fuel consumption and CO₂ emissions by aero engines and auto engines, TiAl alloys have been developed to meet the challenging requirements, owing to their low density (3.8-4.0g/cm³), high specific strength and stiffness, excellent creep resistance and good resistance against oxidation. The β -solidifying TNM alloys as representative of the third generation γ -TiAl alloys have demonstrated much enhanced wrought processing ability, and improved mechanical properties at elevated temperatures. Recently, it has been evidenced that when the γ lamellae are oriented to the load direction the mechanical properties of the alloys can be greatly increased, thus, lamella orientation control has become an interesting topic for property optimization. Several possibilities exist. All require to deform the alloy at high temperatures. Thus, the proposed PhD topic will focus on the microstructure and texture evolution during hot deformation and variant selection of γ lamellae during α to γ phase transformation of TNM alloys. The aim of this PhD work is to reveal the mechanisms of hot deformation and restoration (recovery and recrystallization) processes and variant selection during phase transformation to finally realize lamella orientation control for the optimization of the mechanical properties.

Description of the work

The PhD work will be jointly supervised by LEM3 Université de Lorraine (Metz - France) and GEMS at MLZ (Garching near Munich - Germany). The work will be conducted by sample treatment (thermomechanical processing and heat treatment) in Garching using the dilatometer, multiscale in-situ and ex-situ texture evolution characterization by neutron diffraction/scattering and SEM EBSD in Garching and in Metz, ex-situ microstructural and crystallographic characterization by SEM EBSD, TKD and TEM in Metz and crystallographic analysis and calculations by linear algebra.

Organization of the PhD

The candidate will be registered to Université de Lorraine for the doctoral degree. The candidate will perform the required experimental and analysis work defined above under the supervision of the French and the German supervisor and co-supervisors. The candidate will also be trained to operate the related characterization equipment, including the dilatometer, the neutron diffraction facilities in Garching and SEMs in Metz.

Start date: from January 2021. The candidate will stay the first two years at GEMS in Garching (near Munich) Germany and the last year in Metz.

The **net salary** is about 1900 €.

Profile of the candidate

The candidate should be majored in materials science and possess solid background in physical metallurgy and basic knowledge on programming and linear algebra. The candidate should have a good command of English.

Further information and application:

For further information and application send a resume and your exam scores (bachelor and master), please contact:

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