Seminar abstract (6th of June at 1.45 pm)

Marcia Boukangou: Microstructural and texture characterization in a Ti 10-2-3 billet

Ti-10-2-3 alloy is highly used in airframe forging applications such as landing gears. The billets are obtained by forging: transformation of an ingot by compressions followed by rotations often of 90. The goal is both to reduce the section, but also to refine its microstructure. The disadvantages of this process is that it creates a heterogeneous deformation and a shear in certain radial direction and has consequences on the mechanical properties (anisotropy) of the final product. The aim of this work is to study the heterogeneities of microstructure and crystallographic texture in two different radial directions in the billet.

Seyyed Biriaie: Architecturing of Metals by Severe Plastic Deformation

Architectured materials are composed of two or more materials, which open new possibilities to fill gaps in the material property space and can offer multi-functional performances because of the variety of feasible combinations of materials. Producing architectured materials by severe plastic deformation (SPD) is a new research field in the SPD research community. In the LEM3 laboratory, there exists a unique SPD experimental platform which has the potential to produce architectured materials. We are using the SPD technique called High Pressure Tube Twisting (HPTT) for this purpose, invented in the LEM3 laboratory. By applying HPTT, the purpose of this work is to manufacture tubes consisting of aluminum and copper to achieve new material structure with new mechanical properties. Rolling was also tempted to bond the two different metals at room temperature, with full success. An academic aspect of the study is the full bonding that can be achieved between two different metals deformed to extreme strains by HPTT. It is shown experimentally that it is possible to get excellent adhesion between aluminum and copper just by deforming them to extreme strains at room temperature. The plastic flow and the interface bonding between different materials under the condition of severe plastic deformation was studied experimentally by metallography, tomography, scanning electron microscopy, and EBSD. A theoretical study was also conducted to find out the strain gradient within the tube wall, focusing on the jump in the shear strain at the interface. This analytical study permits to understand the results of our experiments.

Tania Sola Saiz: Study by Raman spectroscopy of oxides obtained by friction between a steel ball and materials with hyper-deformed surfaces by ultrasonic shot peening

SMAT (Surface Mechanical Attrition Treatment) is a superficial treatment which modifies the structure and introduces residual stress into the surface in addition to change the tribology behaviour of the material. All the experiences in this study have been carried out in a titanium alloy (Ti6Al4V) and in two aluminium alloys (Al 2024 and Al 7075). The goal of this study is to characterise the oxides formation during the friction tests at different number of cycles. Furthermore, it is expected to predict the wear behaviour of the oxides on the sample surface and the steel friction ball. Raman spectroscopy (RS) is a non-destructive technique which uses the inelastic dispersion of a monochromatic light to characterise chemical bonds. This technique manages to identify and isolate the allotropic oxides present in the analysed sample.

Daouda Diba: Modeling of the residual stresses generated during TIG welding of brazed plates for heat exchangers

Stainless steel plate-fin heat exchangers (PFHE) are nowadays used as heat exchangers. Though researches have been focused on heat transfer performance, fluid flow, optimization of structural design, etc., limited attention has been paid to the generation of residual stresses during brazing and welding operations. Owing to the composition mismatch between the Nifiler metal and the stainless steel base metal, residual stresses can arise during the welding process and affect their properties and integrity. Therefore, it is important to have an accurate estimate of the properties of the filer material in a wide range of temperature before simulating welding operation of these brazed plaques. The objective of this study is to determine experimentally the mechanical properties of the Nifiler metal, to simulate the TIG welding process and to compare the calculated residual stress distribution obtained by finite element software ABAQUS with experimental values determined by X-ray analyses.