Research Topic 08 for the ParisTech/CSC PhD Program

FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:
ali.siadat@ensam.eu AND yvon.velot@ensam.eu

Subfield: New Forming Process and Processus Eng., and material Eng,

ParisTech School: LCFC METZ

Title: Identification of parameters control and Improvement from thixoforging process of aluminums
Advisor(s): (name, email, website) Eric BECKER, eric.becker@ensam.eu
Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)
Thixoforging is a manufacturing process of metal alloys at semisolid state. Semisolid state is obtained by heating the material from the solid state, up to a temperature within the solidus-liquidus temperature range. Since always, Industry minimizes manufacturing process plan and increases mechanical behaviour. In this topic, the thixoforging process offers important perspectives. It is on the way of industrial development between casting and forging process thanks the typical rheological behaviour of the semisolid material. For thixoforging, the liquid fraction is quite low, less than 20% and it is generally obtained by heating from raw material with an inductive furnace.
This research work must contribute to improve comprehension of the aluminium behaviour during thixoforging and define the application field for this process. To achieve this goal, experimental testing with device will must be use and develop. The main thixoforging parameters to shape these alloys will be identify and study such as the forming speed, the initial steel temperature, the initial tool temperature, etc. The quality of the thixoforged parts must be study and characterize by the macrographic and micrographic observations of their metallurgical structure and mechanical tests or with other means that will be choise. The tests can be compared with simulations in order to determine and improve the predictive model capacity implemented in Forge2007®software.

Required background of the student: (Which should be the main field of study of the applicant before applying)
Which should be the main field of study of the applicant before applying) The student must be have a background in forming process, steel and aluminum material (and in preference in semi-solid state), and perhaps eng. Software Catia® and Forge®. He need have a good approach with experimental studies.

A list of 5 (max.) representative publications of the group: (Related to the research topic)

- Becker, E., Bigot, R., Rivoirard, S., Faverolle, P. (2017). EXPERIMENTAL INVESTIGATION OF THE THIXOFORGING OF TUBES OF LOW-CARBON STEEL. Journal of Materials Processing Technology, 1 Oct 2017, PROTEC15423
- Gu, G. C., Pesci, R., Becker, E., Langlois, L., & Bigot, R. (2014). In Situ Microstructure Observation of Steel Grades in the Semi-Solid State for Thixoforging Process by Using Confoncal Laser Scanning Microscopy. Solid State Phenomena, 217-218, 15–22. doi:10.4028/www.scientific.net/SSP. 217-218.15. ISBN: 978-303835220-4.
- [Favier, V., Becker, E., & Bigot, R. (2014). Investigation of Parameters Promoting Hot Cracking during Semi-Solid Forming Processes. Solid State Phenomena, 217-218, 281–285. doi:10.4028/www.scientific.net/SSP.217-218.281.
- Bigot, R., Becker, E., & Langlois, L. (2013). Some approaches on industrialization of steel thixoforging processes. Solid State Phenomena, 192-193, 521-526, ISBN: 978-303785481-5.
- Neag, A., Favier, Véronique, Pop, M., Becker, E., Bigot, R, 2012. Effect of experimental conditions on 7075 aluminium response during thixoextrusion. Key Engineering Materials 504-506, 345–350. ISBN: 978-303785366-5.