FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:
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LEM3, UMR 7239, CNRS Research Topic for the ParisTech/CSC PhD Program

Field (cf. List of fields below): Materials Science, Mechanics, Fluids
Subfield: Mechanical engineering

Title: Calorimetric manifestations of failure mechanisms within thermoplastic composite materials: application for fatigue life prediction of composite automotive components

ParisTech School: ENSAM – Arts et Métiers ParisTech
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Short description of possible research topics for a PhD:
This PhD project aims at investigating the leading failure and damage mechanisms involved during the short-term (impact) and long-term (fatigue, creep, etc.) deformation of fiber-reinforced thermoplastics (e.g. internal storage and release of energy, irreversible phenomena due to dissipation, thermomechanical coupling, etc.). Coupled to efficient mathematical framework and its related algorithms, this research work will involve two full-field measurement techniques (digital image correlation and infrared thermography) and finite element modeling investigations. The outcomes of this research work will mark a major leap forward into the thermomechanical consistency of some classical constitutive models used in the automotive industry for structural durability prediction. It also will shed a greater insight on the various relations that may exist between the internal microstructural transformations occurring into the composite material and the energy terms arising from the inelastic deformation.

Required background of the student:
Applicants should have, or expect to achieve at least a Master's degree (or an equivalent overseas degree) in Mechanical Engineering, Materials Science, Applied Mathematics or a related subject. Candidates with suitable experience and strong capacity in numerical modeling, experimental testing and/or measurement skills are particularly welcome to apply.

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

1. A Benaarbia, A Chrysochoos, G Robert. Fiber orientation effects on heat source distribution in reinforced polyamide 6.6 subjected to low cycle fatigue. **Journal of Engineering Mathematics** 90 (1), 13-36
2. A Benaarbia, A Chrysochoos, G Robert. Thermomechanical behavior of PA6. 6 composites subjected to low cycle fatigue. **Composites Part B: Engineering** 76, 52-64
3. MF Arif, N Saintier, F Meraghni, J Fitoussi, Y Chemisky, G Robert. Multiscale fatigue damage characterization in short glass fiber reinforced polyamide-66. **Composites Part B: Engineering** 61, 55-65
4. MF Arif, F Meraghni, Y Chemisky, N Despringre, G Robert. In situ damage mechanisms investigation of PA66/GF30 composite: Effect of relative humidity. **Composites Part B: Engineering** 58, 487-495
5. G Chatzigeorgiou, N Charalambakis, Y Chemisky, F Meraghni. Thermomechanical Behavior of Dissipative Composite Materials. Elsevier. Book ISBN: 9781785482793. Edited by **ISTE Press – Elsevier. 2018**. https://doi.org/10.1016/B978-1-78548-279-3.50001-4