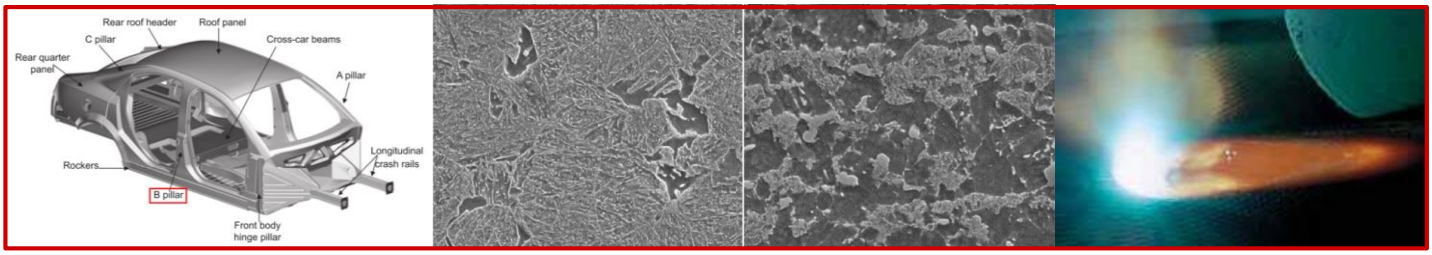
PhD opportunity: Architectured metallic sheets through localized laser processing



Abstract: Architectured materials are an emerging class of advanced materials that bring new possibilities in terms of functional properties, filling gaps in material performance maps [1]. The term architectured materials describes any heterogeneous material that exhibits improved specific properties due to a thoughtful and predetermined morphology and/or topology design [2]. Localized processing methods appear as natural candidates for developing such materials.

In the context of the SCOLASTIC project (ANR funded) aiming at developing architectured metallic materials through computational optimization and localized laser processing, we intend to investigate the localized heat treatment of ultra-high strength dual-phase and martensitic steel sheets for applications in the automotive industry.

The forming of components in the automotive industry requires metal sheets to be thinner in order to reduce the mass of cars, thus bringing new challenges for steel producers. Although dual-phase steels comply with such ambitions since they exhibit higher elastic strength, their formability drops when considering high strength grades. Localized laser treatment can induce martensite tempering, hence enabling the possibility to adjust locally the yield strength/ductility trade-off.

The approach developed could result in enhanced formability through processes based on plastic deformation, such as deep-drawing, by softening the metal sheets only where needed. Moreover, optimized patterns could enhance the overall fatigue and fracture behavior of the sheet by blunting surface cracks, and adding a plastic dissipation contribution in the effective fracture energy of the architectured material.

Keywords: architectured materials, topology optimization, finite element analysis, metallurgy, laser processing.

Background of the candidate: computational methods, engineering, materials science, applied mathematics, physics, or any other relevant field.

Location: Laboratoire PIMM, Arts et Métiers-ParisTech, Cnam, CNRS, 151 bd de l'Hôpital, 75013 Paris, France.

Funding: 3-year contract (CNRS), with a salary of ~1450€ net per month, or ~1750€ with teaching duties.

Starting date: ASAP

Contact:
Dr. Justin Dirrenberger
justin.dirrenberger@ensam.eu

References:
[1] O. Bouaziz, Y. Bréchet, J. D. Embury, Adv. Eng. Mater., **10**(1-2), pp. 24-36, 2008.
[2] B. Chéhab, H. Zurob, D. Embury, O. Bouaziz and Y. Bréchet, Adv. Eng. Mater., **11**(12), pp. 992-999, 2009.