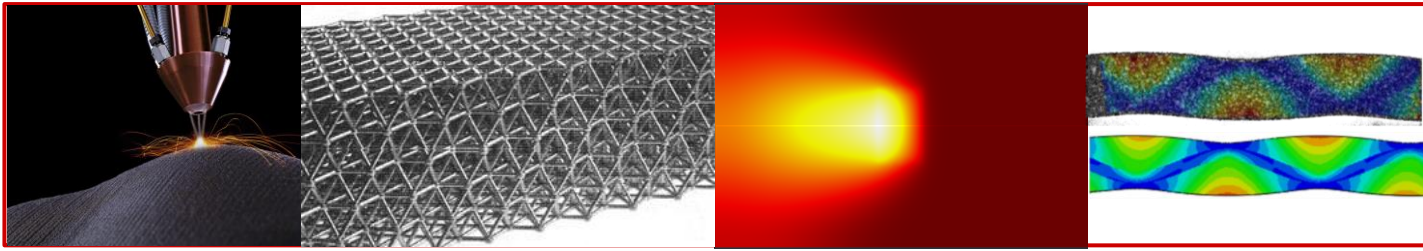


PhD opportunity: Localized laser treatment of additively manufactured architected materials



Abstract: Additive manufacturing has revolutionized the way materials are fabricated by enabling the creation of complex geometries and architectures that were previously impossible to produce using traditional manufacturing techniques. Architected materials, which are characterized by their tailored architectures and hierarchical structures, have been shown to possess enhanced material properties, such as strength, toughness, and stiffness. However, the inherent porosity and defects in additively manufactured materials [1] can limit their mechanical properties. Laser heat-treatment has been proposed as a promising solution to improve the mechanical properties of additively manufactured materials by locally architecting alloy phases, which can enhance the material properties in specific regions of the material [2].

The objective of this project between France (PIMM) and Germany (KIT) is to develop architected materials using additive manufacturing and localized laser heat-treatment and investigate the microstructural and mechanical properties of these materials.

Four phases are considered:

- 1) Material design and fabrication using AM
- 2) Microstructural characterization
- 3) Localized laser treatment
- 4) Mechanical testing and modeling

The project will contribute to the understanding of the effect of localized laser heat-treatment on the microstructural and mechanical properties of architected materials. The project will also provide insights into the optimization of laser parameters for the fabrication of architected materials with tailored mechanical properties. The results of this project will have practical implications for the development of high-performance materials for a range of engineering applications.

Keywords: architected materials, additive manufacturing, metallurgy, materials processing.

Background of the candidate: mechanical engineering, metallurgy, applied physics, materials science or any other relevant field.

Location: Laboratoire PIMM, Arts et Métiers, Cnam, CNRS, 151 bd de l'Hôpital, 75013 Paris, France / Institute of Applied Materials (IAM-WK), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Funding: 3-year contract, with a basis salary of ~2000€ net per month.

Starting date: October 2023

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References:

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- [2] Wang, Z., Bouaziz, O., Dirrenberger, J., & Lapouge, P. (2023). Corrugation reinforced architected materials by direct laser hardening: a study of geometrically induced work hardening in steel. *steel research international*, 2200695.