***SPHYNX*, CEA Orme des Merisiers, Service de Physique de l'Etat Condensé**
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INTERNSHIP POSITION

INFLUENCE OF CHEMICAL COMPOSITION ON THE MECHANICAL PROPERTIES OF 3D PRINTED MATERIALS

Reducing the density of materials is a promising route to reduce our energy footprint. One solution is to replace massive materials with lattice materials formed by carefully arranged micro-beams. Among them, random architectural structures inspired by bone structure have the best assets with isotropic mechanical response and unprecedented performance in terms of elastic modulus to density ratio while meeting the challenges of the circular economy. These metamaterials are manufactured by 3D printing and, of all the manufacturing technologies available, printing by UV polymerisation of organic liquid resin is the most promising.

These resins can be loaded with nanoparticles to modulate the properties of the resulting metamaterials and enhance their mechanical strength. In this context, a variety of resins has been generated, but the mechanical performance of the printed material has not yet been evaluated. In addition, many printing parameters are also known to affect the final properties. Thus, the characterization of the mechanical properties of these resins is necessary to control the performance of these new materials

The objective of the internship is to evaluate by Dynamic Mechanical Analysis (DMA) the viscoelastic properties such as Young's modulus, shear modulus, compressional and shear viscosity, and glass transition temperature of the new resins formulated in the laboratory. The aim is to establish the link between the formulation and the mechanical properties. The internship will be divided into two parts: 1) the study of mechanical properties as a function of different formulations; 2) the study of mechanical properties as a function of different printing parameters.

This internship project is experimental and will be carried out at the *Service de Physique de l'Etat Condensé* (SPEC) of the CEA Saclay of the University of Paris-Saclay, located at the Orme des Merisiers centre, 91191 Gif sur Yvette, France, in collaboration with the *Nanosciences and Innovation for Materials, Biomedicine and Energy* (NIMBE) laboratory of the CEA Saclay and the *Pôle Universitaire Leonard de Vinci* (France), and will involve researchers of different expertise. The successful candidate will have to integrate into this consortium and interact with the whole. In return, he/she will benefit from a highly multidisciplinary framework: additive manufacturing, physics, chemistry and mechanics of polymers, and mechanics of continuous media and experimental mechanics. A strong taste for experimentation and manipulation is also required.

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