



PhD in Polymer Material-Chemical Engineering –
ANR funding – 3 Years from the end of 2022/ Monthly gross salary ~ 2135 €
LRGP-UNIVERSITÉ de Lorraine//IMP-CNRS INSA de Lyon

APPLICATION DEAD LINE : 25 August 2022

Recycling in short circuit of used plastic mixtures by additive manufacturing

The PhD will contribute to the ANR "Global approach for the recycling in short circuit of used plastic by additive manufacturing" which concerns the valorization in short circuit of household polymer wastes currently not recycled, such as PLA, PE, PET, in particular when they are mixed, requiring the development of "formulation-processes" couples for their valorization.

The research work will take place in collaboration between the laboratories LRGP, Nancy and IMP, INSA Lyon. The two laboratories are working in the field of polymer processes, reactive or not, allowing the elaboration and the shaping of polymer materials as well as the improvement of their end-use properties. The work will take place alternately between the two laboratories in accordance with the different periods of the project.

In this context, the first objective of the PhD will be to characterize different raw streams of thermoplastic wastes from sorting household centres in order to select some mixtures for a valorization by 3D printing.

After the selection phase of the mixtures for the study, another part of the work will consist in compatibilizing virgin polymers representative of these streams, with the objective to design formulated "model" mixtures suitable for 3D printing. The elaboration of these blends will be carried out by twin-screw extrusion. The rheological, thermal, mechanical and morphological properties of these materials will be characterized. The formulations giving the best results will be transposed to mixtures made of polymer wastes. The systematic study of virgin and waste polymer blends will allow not only to optimize the formulations and extrusion conditions but also to evaluate the robustness of the formulation with respect to the variability of the material streams coming from the sorting facilities. The robustness of the elaboration conditions of the blends will be validated by tests on the equipments available in the two laboratories, at different scales.

Finally, the materials obtained will be 3D printed, either in the form of granules (FGF) or in the form of filament (FFF). The properties of the parts produced will be measured and will allow the qualification of the recycled materials and their shaping process.

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Any initial application should be made by email and accompanied by a CV and the results obtained during the university education (Engineering school or Master studies and previous years). The candidate should have an engineering degree or a Master 2 research degree, in materials science, chemical engineering or polymer processing. Skills in current polymer characterization techniques are desirable. For example: thermal analysis by DSC; morphological characterization (SEM); mechanical testing. Experience in melt rheology and thermoplastic processing would be appreciated.