

Post-doctoral position

Center for Materials Forming, Mines Paris

Shaping natural fibers using conventional plastics processes

financed by Carnot M.I.N.E.S.

Since 2020, the AGEC French law ("Strategic objectives for waste management and prevention of waste generation") has set the objective of phasing out single-use plastics by 2040. Therefore, it is necessary for the plastics industry to find new natural materials that can be processed using conventional plastic processes such as injection molding, extrusion, and additive manufacturing. This will ensure a future for a large number of French manufacturers. One possibility is to use 100% bio-based materials.

The objective of the project is to produce materials based on cellulose fibers initially dispersed in water by using conventional plastics processing. The researches will focus on formulation, visualization of fiber flows, and process modeling.

The postdoctoral researcher will use the experimental and numerical resources at CEMEF to study and model the flows of natural fiber suspensions. The work program consists of two parts: i) Experimental study of natural fiber suspension flows and ii) Numerical modeling of fibers' flow.

- In the first part, the flow of fiber "pulp" dispersed in water will be investigated: the study will focus on the rheological behavior of concentrated aqueous suspensions of natural fibers using conventional rheometers and transparent cells that allow for fiber visualization during flow.
- In the second part, first, a "simple" rheological model will be applied to describe the behavior of suspensions. Subsequently, more complex models that account for the shape and flexibility of fibers will be tested using experimental data. Numerical predictions obtained using the C++ library CIMLIB_CFD developed at CEMEF will be applied to model the flow. Special attention will be given to the description of fiber behavior (orientation, movement, agglomeration) within the matrix.

This highly interdisciplinary project is at the interface of materials science and numerical modeling. The project will be carried out in two CEMEF groups: Computing and Fluids (CFL) which has significant expertise in modeling of fluid dynamics, and Bio-based polymers and composites (BIO) which performs world-recognized research on bio-based polymers.

Keywords: Natural fibers, rheology, rheo-optics

Profile: Knowledge in materials science, polymers (cellulose and natural fibers is a plus), rheology as well as basics in numerical simulation; fluent in English; highly motivated; pro-active; PhD diploma

Duration: 9 months, starting in autumn 2023

Gross annual salary: 32 k€

Locations: CEMEF, Mines Paris, Sophia Antipolis, France

People involved: Franck PIGEONNEAU et Tatiana BUDTOVA

Contact: Franck PIGEONNEAU franck.pigeonneau@minesparis.psl.eu

Please send your detailed CV, motivation letter and at least two e-mail addresses of reference persons.