

Research Topic for the ParisTech/CSC PhD Program

***Field (cf. List of fields below):**

Materials Science, Mechanics, Fluids

Subfield: (Applied Physics, Chemistry, Mathematics, Mech. Eng. etc...)

Mech. Eng.

Title:

Study of the infusion process for composites using a thermoplastic liquid resin

ParisTech School:

Ecole Nationale Supérieure d'Arts et Métiers

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(Lab, website): LAMPA, <http://lampa.ensam.eu/>

Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)

Preservation of natural resources forces the composite industry to search and examine eco-friendly components and processes. For that fibers coming from plants and recyclable resins are more and more investigated. Thermoplastics are good candidates but their processes impose the use of an injection molding process restricting the size of the parts to be manufactured. Recently, a new thermoplastic liquid resin is proposed by Arkema but a lot of studies have to be done in order to optimize the manufacture of the parts with it.

This subject proposes:

- 1) To model the flow of this new liquid resin into a fabric with bio-fibers (analytical and numerical approaches);
- 2) To instrument the process in order to validate the previous simulations;
- 3) To optimize the process using the validated modellings;
- 4) To realize mechanical tests on samples manufactured by the optimized process to validate the quality of the material.

Required background of the student: (Which should be the main field of study of the applicant before applying)

The applicant should have a good background in non-Newtonian fluid mechanics, porous media and composite materials and should be interested in both numerical simulations and experimental techniques.

A list of 5(max.) representative publications of the group: (Related to the research topic)

- S. Champmartin, A. Ambari and J.Y. Le Pommelec. New procedure to measure simultaneously the surface tension and contact angle. Review of Scientific Instruments, 87: 055105, 2016.
- A. Oukhlef, S. Champmartin and A. Ambari. Yield stress fluids method to determine the pore size distribution of a porous medium. Journal of Non-Newtonian Fluid Mechanics, 204: 87-93, 2014.
- S. Champmartin, A. Ambari and R.J. Chhabra. Levitating spherical particle in a slightly tapered tube at low Reynolds numbers: Application to the low-flow rate rotameters. Review of Scientific Instruments, 83: 125103, 2012.
- A. Monti, A. El Mahi, Z. Jendli, L. Guillaumat, "Mechanical behaviour and damage mechanisms analysis of a flax-fibre reinforced composite by acoustic emission", Composites Part A: Applied Science and Manufacturing, volume 90, july 2016, pp 100-110.