

PhD offer in Materials engineering

Cell'Eau: Understanding the role of water in the consolidation of lignocellulosic fibrous network

Context

To address environmental challenges, it is essential to drastically reduce the use of petroleum-based polymers, particularly in the packaging sector. In this context, paper offers a bio-based, recyclable, and biodegradable alternative with excellent specific properties. It is also very easy to functionalize its properties to suit its application. While its manufacturing process is well-established, it is energy-intensive and requires significant amounts of water.

Water is yet a key element in papermaking, as it is responsible for the development of the mechanical properties of the paper network. Its progressive removal during wet pressing and drying generates capillary pressure, bringing cellulosic fibers into intimate contact at small scale. The viscoelastic behavior of cellulosic fibers also contributes as wet fibers are in a rubbery state, making their cell walls easily deformable under capillary pressure. These two phenomena ultimately lead to the creation of strong fiber-fiber bonds and the development of mechanical properties at the network scale.

Objectives

To decrease the environmental impact of papermaking, one key direction is to try to decrease water consumption. The objective of the Cell'Eau PhD project is therefore to better understand the role of water in the development of the mechanical properties of papers during their fabrication. The goal is to determine the optimal amount of water required to obtain papers with high mechanical performances, with the aim of minimizing water consumption and thus moving towards more sustainable and efficient papermaking processes. The project's objectives are to:

- Produce non-consolidated lignocellulosic fiber networks,
- Quantify and locate water within the fibers and lignocellulosic fiber networks,
- Evaluate the mechanical properties of fiber networks consolidated with controlled amounts of water,
- Evaluate the influence of water on the properties of lignocellulosic fibers.

Location: The PhD will take place in the LGP2 premises (Process Engineering Laboratory for Biorefinery, Bio-based Materials and Functional Printing) in Grenoble, on Gières' campus. LGP2 is a joint research unit (UMR 5518) associating CNRS and Grenoble INP, and is certified for Quality, Safety, and Environment. LGP2's research focuses on the transformation and valorization of plant biomass such as biorefining, the development of bio-based materials (papers, cardboards, composites, films, non-wovens), as well as on printing processes for surface functionalization.

Profile: Engineering or Master degree in Materials Science. The candidate must be comfortable with experimental work. Knowledge on paper material, papermaking process as well as basic concepts in materials mechanics are not mandatory but will be appreciated.

Starting on 01/10/2026 for 36 months

Send CV, cover letter, and latest transcripts to quentin.charlier@grenoble-inp.fr and raphael.passas@grenoble-inp.fr

Application deadline: 17/04/2024