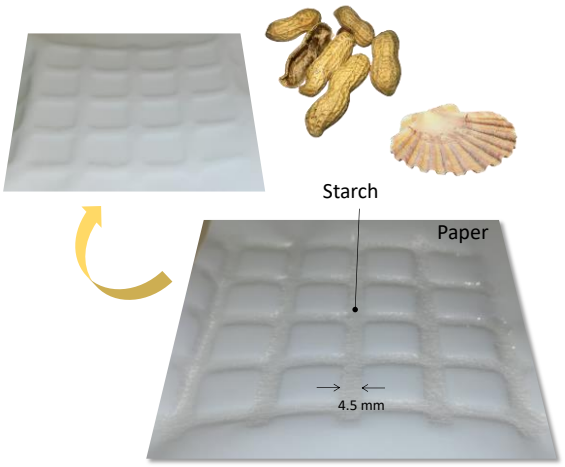
5-month internship from February 2025 – Domaine Universitaire Grenoble

Architectured papers by printed bio-sourced patterns:

Characterization of complex fluids to design lightweight packaging

Context. To meet environmental challenges, it is essential to drastically **reduce the use of plastics, energy expenditure and the consumption of natural resources**. Although paper offers a very interesting bio-based, recyclable and biodegradable alternative to plastic packaging, the paper industry must nevertheless continue its transformation to reduce its water and energy consumption, as well as its use of natural resources. In this context, the LGP2 laboratory, the 3SR Lab and the Centre Technique du Papier (CTP) are working on the development of a **low-cost bio-inspired approach to significantly reduce the weight of paper and board packaging** while maintaining its mechanical performance. A very effective way to increase the bending stiffness to weight ratio of a flat structure by embossing or forming a network of 'ribs' on the surface. Previous work[1] showed that printing starch gel on the surface of paper leads to an embossed shape (see figure), thus increasing the bending stiffness of the structure. This process aims to achieve a weight reduction in packaging of approximately 30%, resulting in savings in both raw materials and energy.



Project description. The internship will last 5 to 6 months, starting in February/March 2025 and will take place in 3SR and LGP2 laboratories., Laboratory of process engineering for biorefinery, bio-based materials and functional printing, on the Grenoble university campus, in the Functional Printing team (FunPrint).

The internship is structured into three main parts:

- Sample manufacturing: production of starch gel and paper substrate
- Fluid characterization: starch properties during the drying phase, focusing on rheology and elastoplastic behaviour,
- Paper properties: analysis under various humidity conditions to simulate the impact of water within the gel on the paper.

Candidate profile. Master or engineer degree in material science, rheology, mechanical characterization. Great interest in experimental science, autonomy and initiative are necessary skills for the project.

To apply. CV + lettre de motivation to Clément Turpin (clement.turpin@grenoble-inp.fr), Nadège Reverdy-Bruas (nadege.reverdy-bruas@grenoble-inp.fr), Laurent Orgéas, Jérémie Viguié (jeremie.viguie@lgp2.grenoble-inp.fr)

[1] Viguié et al. (2021) Forming architectured paper by printing a starch patterned grid: a new low-cost approach for lightweighting packaging. *Cellulose*.