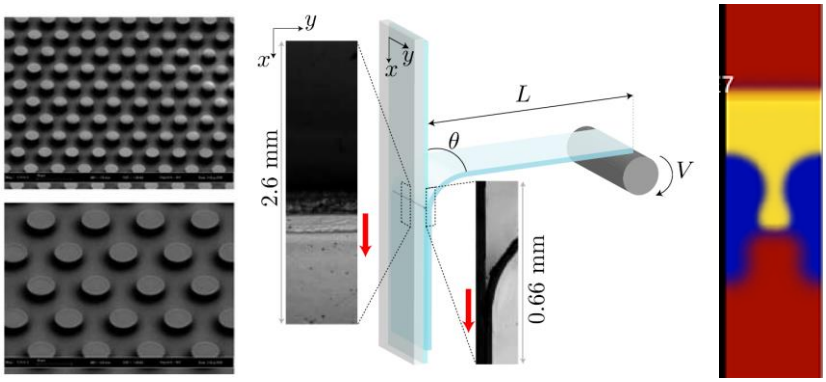
Postdoctoral position in Soft Matter

Control of soft polymer adhesion is a key for gluing and sealing applications in the automotive, aerospace, marine and construction industries, as well as home appliances or medical applications. Industrial processes such as adhesive tape making or transfer printing for optoelectronics and flexible macroelectronics are especially demanding as they require simultaneous control of adhesion strength and detachment dynamics at high speeds, during assembly and converting processes. Changing the chemical composition of the adhesive or the chemical nature of the interface has been the main industrial strategy to optimize the adhesion strength to surfaces.

Another possible lever to control adhesion is to use a 3D micro-structured topography as substrate. This requires understanding the interplay between the dissipation mechanisms due to the large deformation of fibrils and the one due to the viscoelasticity of the substrate, as well as the impact of the pattern geometry on the viscous flow and wetting properties of the adhesive on the substrate.



Left: Micro-patterned substrates. Middle: Peeling experiment. Right: Simulation of adhesive detachment from a pillar

The research project will consist in two parts, an experimental one and a numerical one. The postdoctoral student will perform experiments to measure the peeling force of an adhesive tape on micro-patterned substrates, with variable geometries and softness of the substrate, and at various peeling velocities from a few μm/s up to m/s. Fast-imaging of the peeling front will be performed for the highest peeling speeds in order to measure the impact of the patterned substrates on a multiscale stick-slip instability. He/She will also run a numerical code that predicts the detachment process of the adhesive at the scale of the microstructure. This numerical model, developed specifically for the project, combines phase-field and finite difference methods. Comparisons between numerical and experimental results will help determine the key parameters of the model.

The experimental part will be located mainly at the Physics Laboratory of ENS Lyon under the supervision of Stéphane Santucci, and the numerical part will be under the supervision of Thierry Biben at Institute of Light and Matter, UCBL.

The suitable candidate will have preferably a background in physics or chemical physics. Experience in image analysis, use of numerical tools or lithography techniques is a plus. The expected starting date for this position is Aug. 29th, 2022. The net annual salary will be 24 to 28 k€ depending on previous research experience.

Applications must be sent to: Loic.Vanel@univ-lyon1.fr