Café Scientifique

ECL, W1, amphi 203

Jeudi 8 février, 13h00-14h00

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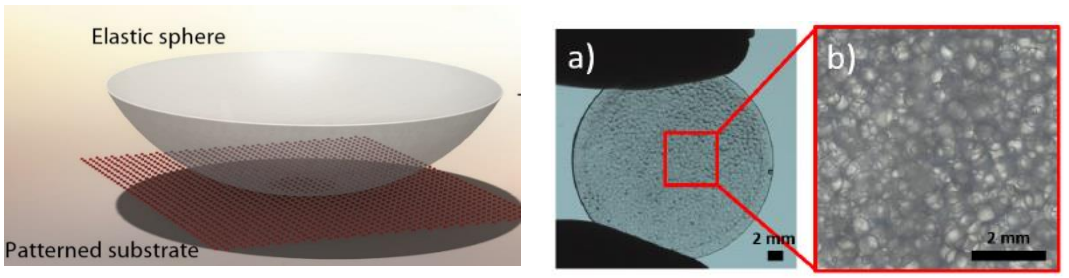
Adhesion of 2D/3D textured elastomers

Simultaneous control of adhesion strength and detachment dynamics of soft adhesive materials is a key improvement lever for industrial applications especially during assembly and converting processes. In our group, we investigate how patterned substrates with micro-structured 2D or3D topography heterogeneities can be used to control the adhesion properties of elastomers. The impact of the micro-structuration of an elastomer interface on the adhesion energy has been investigated in various rubber-like elastomer/rigid solid joints, increasingly since the early 2000's. The most studied microstructure is an array of cylindrical pillars of identical dimensions. This kind of pattern has been inspired by biomimetism of the Gecko strong ability to stick in a reversible manner to various kinds of material thanks to the fibrillar microstructure of its feet. In the Gecko effect, the hysteretic loss of the elastic energy stored in the fibrillar asperities during separation from the solid is the essential mechanism to obtain an adhesion energy much larger than the interfacial adhesion energy. However, the opposite effect, i.e. a decrease in adhesion, may also be obtained. By changing the length scales of the micro-structured pattern (diameter of the cylindrical pillar at fixed pillar density), it is possible to tune the adhesion energy from 20% to 400% of the one for a smooth elastomer substrate. Patterned elastomer surfaces have also an impact on the adhesive shear resistance measured in sliding experiments on a rigid solid. In this seminar, I will present our last results on our knowledge about the contact mechanics between a smooth lens and a surface-textured elastomer [1,2] and more recent results on the link between adhesive properties and volume texturation of silicone emulsions obtained by reactive blending [3].



Left : schematic view of a contact between an elastic lens and a textured surfaces Right: Solid emulsion of PEG droplets in a continuous solid phase of PDMS.

[1] R. Ledesma-Alonso, E. Raphaël, L. Léger, F. Restagno, and C. Poulard, "Stress concentration in periodically rough Hertzian contact: Hertz to soft-flat-punch transition", in Proc. R. Soc. A, 2016, vol. 472, p. 20160235.
[2] L. Dies, F. Restagno, R. Weil, L. Léger, and C. Poulard, "Role of adhesion between asperities in the formation of elastic solid/solid contacts", The European Physical Journal E, vol. 38, no. 12, p. 1–8, 2015.
[3] A. Giustiniani, P. Guégan, M. Marchand, C. Poulard, and W. Drenckhan, "Generation of Silicone Poly-HIPEs with Controlled Pore Sizes via Reactive Emulsion Stabilization", Macromolecular Rapid Communications, vol. 37, no. 18, p. 1527–1532, 2016.

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