

PhD Opening

Experimental investigation of adhesive wear in elastic-plastic contacts

Laboratoire de Mécanique des Solides, Ecole Polytechnique, Palaiseau

We invite applications for a PhD position in experimental mechanics. The thesis will focus on the investigation of adhesive wear in elastic-plastic junctions, in metals and polymers. Experiments will be conducted on additively manufactured materials and at different length-scales. The thesis is embedded into the project *SINFONIA*, funded by the National Research Agency. The position is available starting from **January 2022** and open until fulfilment.

Context Wear is ubiquitous in any mechanical system that experiences relative motion of its components. Wherever two solid surfaces slide or roll against each other, frictional resistance arises and results in the occurrence of wear (Figure 1). The amount and rate of material loss is a key factor for determining the safety and lifespan of many systems and devices, ranging from machinery parts for engineering applications to medical implants and prostheses. The unwanted occurrence of wear also comes with a high ecological impact, as the non-disposable chemicals used to lubricate are often discarded into the environment. This thesis will contribute to understand how those phenomena originate, with the aim to promote both scientific advancement and technological development.

Job description As a successful candidate, you will perform experiments to understand how wear originates and evolves. This will require you to carry out your investigations at different length-scales, from the sub-micron scale (AFM experiments) all the way up to the millimeter/centimeter scale (pin-on-disk tribometer and Brockley experiments). Specimens will be additively manufactured by using different technologies (nano 3D-printing, polyjet prototyping, direct energy deposition) and materials (polymers and metals). Our purpose will be two-fold:

- Understanding the relationship among material microstructure, surface morphology and wear.
- Using this understanding to design rough contacts with targeted wear behavior.

Your work will benefit of the numerical activities of the group (atomistic and phase-field simulations [1, 3]).

You will be under the joint supervision of Véronique Doquet, DR CNRS, and Stella Brach, CR CNRS, at the *Laboratoire de Mécanique des Solides* (École Polytechnique, Palaiseau).

Your profile

- MSc in mechanical engineering or mechanics of materials.
- Good understanding of fracture mechanics, solid mechanics and materials science.
- Experience in experimental mechanics and materials characterization is an advantage.
- Sound knowledge of the English language is expected.

Application Interested candidates should contact both Véronique Doquet (veronique.doquet@polytechnique.edu) and Stella Brach (stella.brach@polytechnique.edu) with the following documents: (i) cover letter, (ii) curriculum vitae with academic record for the past three years, (iii) contact details of an academic reference.

The review of applications will start immediately, therefore early submissions are encouraged.

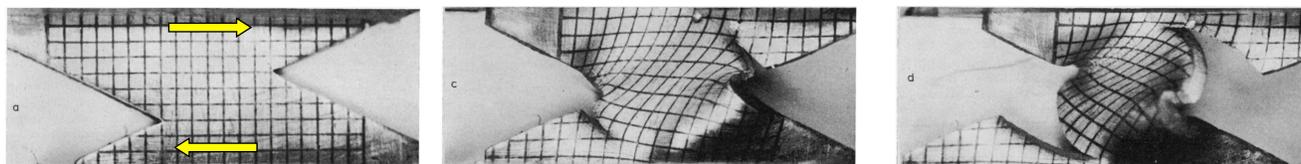


Figure 1: Brockley and Fleming experiment: adhesive wear in sliding contacts [2].

[1] S. Brach et al. In: *Computer Methods in Applied Mechanics and Engineering* 353 (2019), pp. 44–65.

[2] C. Brockley and G. Fleming. In: *Wear* 8.5 (1965), pp. 374–380.

[3] S. Collet, J.-F. Molinari, and S. Brach. In: *Journal of the Mechanics and Physics of Solids* (2020), p. 104130.