

*Post-doctoral position in experimental physics and mechanics*

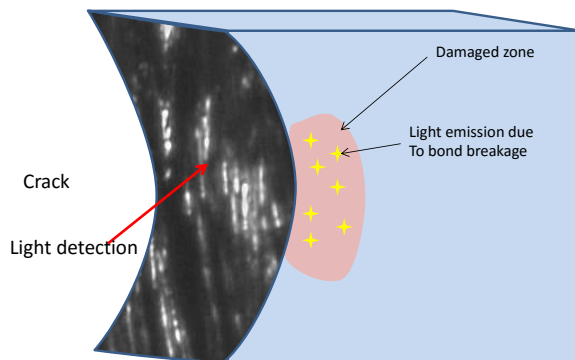
## **Optical Techniques to Understand Fracture of Soft Materials**

*Supervised by Costantino Creton and Matteo Ciccotti, Laboratoire SIMM, ESPCI Paris*

[Costantino.Creton@espci.fr](mailto:Costantino.Creton@espci.fr), [Matteo.Ciccotti@espci.fr](mailto:Matteo.Ciccotti@espci.fr)

New materials applications such as actuators<sup>1</sup>, biomedical hydrogels<sup>2</sup> and soft robotics<sup>3</sup> require more targeted mechanical properties than ordinary rubbers. In particular a good resistance to fracture combined to a very low level of dissipation during cycling and a full reversibility of the deformation<sup>4</sup>.

A recent ERC funded project (in 2016) focuses on the combined use of novel fluorescent markers, inspired by those used in biology, and quantitative optical techniques, to bring a molecular and mesoscopic picture of the deformation and fracture of soft gels and elastomers to a level that has never been seen before. We are building an interdisciplinary team of PhD students and post-docs with complementary expertise in chemistry, physics and mechanics to work together and are currently



seeking a motivated post-doc in experimental physics or mechanics to set-up and analyze state of the art optical techniques to study the nucleation and propagation of cracks in model soft materials with internal sacrificial bonds. The objective is to develop quantitative methods to study structural changes in a volume of a few hundreds of microns directly ahead of the crack tip in soft and transparent materials<sup>5</sup>. The fluorescent markers

used and developed by the chemistry team will be a combination of molecules and particles to measure strain fields but also polymer orientation and bond fracture<sup>5,6</sup>.

We will use a combination of optical tools to measure birefringence<sup>7</sup>, optical absorption and color change in 2D with high speed imaging, and then to measure local changes close to the crack tip with static images in 3D with a confocal microscope specially purchased for the project.

**Required skills :** Experience in experimental physics or mechanics of materials. Interest for interdisciplinary subjects. Solid knowledge in optics or in mechanics are a plus.

**Funding :** ERC CHEMECH project, Salary ~ 2200 €/mo net depending on experience.



1. Keplinger, C.; Sun, J.-Y.; Foo, C. C.; Rothmund, P.; Whitesides, G. M.; Suo, Z. *Science* **2011**, *331*, (6149), 984-987.
2. Calvert, P. *Adv Mater* **2009**, *21*, (7), 743-756.
3. Martinez, R. V.; Glavan, A. C.; Keplinger, C.; Oyetibo, A. I.; Whitesides, G. M. *Adv Funct Mater* **2014**, *24*, (20), 3003-3010.
4. Creton, C.; Ciccotti, M. *Rep Prog Phys* **2016**, *79*, (4), 046601.
5. Ducrot, E.; Chen, Y.; Bulters, M.; Sijbesma, R. P.; Creton, C. *Science* **2014**, *344*, (6180), 186-189.
6. Brown, C. L.; Craig, S. L. *Chemical Science* **2015**, *6*, (4), 2158-2165.
7. Kramer, S. et al. *Proc. 2010 Ann. Conf. Exp. App. Mech.*, Proulx, T., Ed. Springer New York: New York, NY, 2013; pp 167-178.

European Research Council  
Established by the European Commission

