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Fracture of a solid with vanishing shear modulus[1] MAXIME LEFRANC, OLIVIER DAUCHOT, ESPCI Paristech, ELISABETH BOUCHAUD, ESPCI Paristech & CEA-Saclay — The dissipative processes -damage, secondary crack openings- taking place ahead of a propagating crack tip in an amorphous solid are not yet completely characterized, despite the ubiquity of these materials in industrial applications. Questions regarding the extent of the process zone and the nature of the plastic events were addressed with models and numerical simulations but have never been confronted with experiments. In order to tackle this problem, we have designed a novel on-chip experiment that enables altogether to check the physical chemistry of the tested soft materials, to grow controlled cracks at a prescribed velocity, and to visualize the crack tip and its surroundings from a macroscopic to a microscopic scale. Although this experiment is aimed at studying crack propagation in model amorphous materials like colloidal glasses or gels, we have first studied fracture of polymeric gels. From the analysis of crack morphology and crack-induced deformation fields, we have disclosed the relevant time and length scales and investigated their evolution in the vicinity of the sol-gel transition, where the shear modulus vanishes.

[1]ANR project "F2F"

Maxime Lefranc
ESPCI Paristech

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