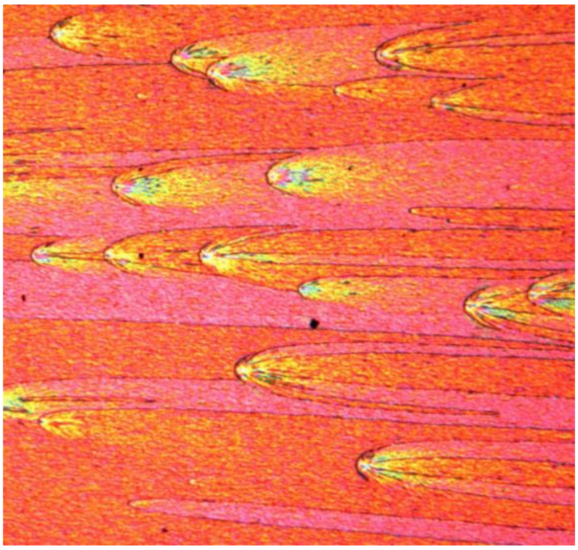
CEA Saclay –Service de Physique de l'Etat Condensé (SPEC) (page web)
Laboratoire *SPHYNX*

INTERNSHIP/PHD POSITION

UNDERSTANDING HOW DYNAMIC FRACTURE PROPERTIES EMERGE FROM MICROSTRUCTURAL TEXTURE IN BRITTLE MATERIALS



Dynamic crack growth (failure velocity of the order of the sound speed) is the fundamental mechanism responsible for catastrophic breakdown in the so-called brittle materials (glasses, ceramics, composites, rocks, some polymers…). Yet, a deep understanding of the underlying fast scale phenomena is still missing -- Stress enhancement at crack tip, together with the dynamic stress redistribution during failure (via acoustic waves), indeed, yield complex couplings between many time and length scales, from specimen size down to structural scale, that are difficult to grasp theoretically and probe experimentally.

This PhD aims at filling this gap. The objectives are: (i) To identify the various dissipation mechanisms and their subsequent activation as failure speed increases in both oxide and polymer glasses; (ii) To characterize the modification induced by a material texturation, as e.g. when one goes from an homogeneous glass to a ceramics made of the same material; and (iii) To further rationalize how microstructural texture selects fracture energy at the macroscopic scale, and its subsequent variation with crack speed. In this context, we will adapt some of the experimental setups and fractography methods that were developed over the past five years in CEA to probe the dissipation processes developing during rapid failure together with their coupling over all the relevant space and time scales. Theoretical tools issued from out-of-equilibrium statistical physics (elastic interface models in random potential) will be adapted to rationalize their description. The approach will be applied to both analog materials of modulated structure, and on real material of geophysical and/or industrial interest.

This Ph.D. thesis takes place astride Statistical Physics, Continuum Mechanics and Materials Science. The candidate will have the opportunity to use, - and to familiarize himself with -, both the theoretical and experimental techniques developed in these three fields. It falls in with an international context – collaboration with the University of Texas (Austin, USA) and the EPFL at Lausanne (Switzerland) are being currently developed.

This Ph. D thesis has been identified as a central subject by CEA. **CEA has secured PhD funding** for the candidate that would be selected on this subject (3-years contract, monthly gross salary: 2043,54 € in 1st 2nd years, 2104,62 € in 3rd year).

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