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Short Course: Fracture and adhesion - An introduction (with comments on size effects)

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FRACTURE AND ADHESION – AN INTRODUCTION
WITH COMMENTS ON SIZE EFFECTS

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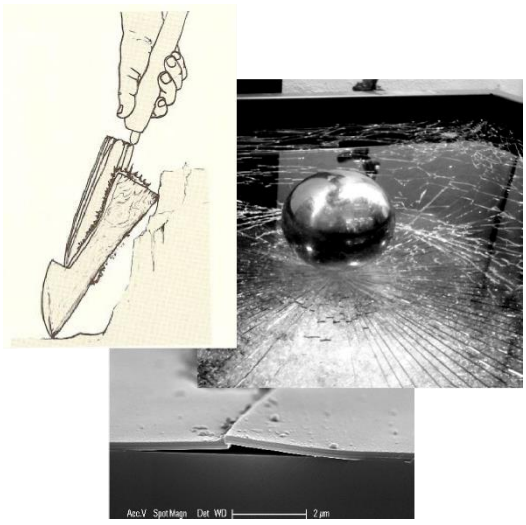
This presentation is meant as a short, handwaving introduction to fracture mechanics and adhesion, a closely related problem. The similarity between the two notions will be underlined throughout the talk.



Fracture processes throughout ages and lengthscales (ill. from J. Pelegrin (1993) and Saint-Gobain Recherche)

Trying to avoid technical details, we will first focus on the more general picture, *ie* how energy flows from the stressed body to the crack tick as the crack propagates (and also how it may flow from the crack tip to the body if allowed to – in the rare cases where the crack closes). We will also examine how these considerations lead to the important notion of crack stability (or otherwise). Illustrations to this first part will be drawn from the behaviour of well-known macroscopic systems from our daily experience.

Further building up on this energy flow picture, we will next explore the effect of system size on fracture processes, showing how energy storage and flow are impacted when system size shrinks. For simplicity, we will focus on thin film fracture and adhesion, where the size is reduced in one dimension only. This simpler case allows for easy approximate calculations. It is also very relevant for applications.

Finally, we will move away from the elastic description we had adopted so far to briefly consider how more advanced material constitutive behaviour couples in with fracture and adhesion. Here, we will suggest how fracture energy is enhanced through material dissipation, and how size issues can mitigate this effect.