Brittle fracture of transient networks

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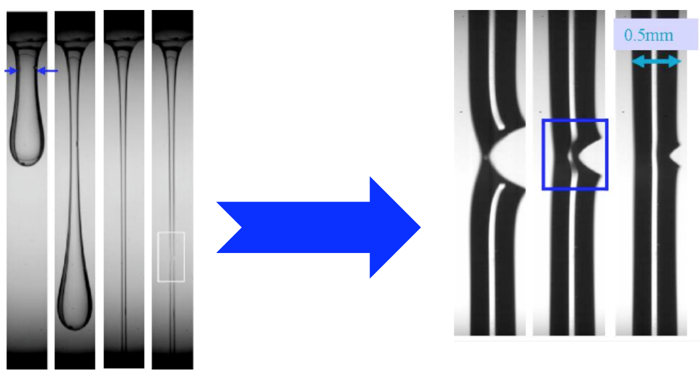
Transient self-assembled networks constitute a class of complex materials spontaneously forming *reversible* equilibrium 3-D networks which are transiently capable of transmitting elastic forces over macroscopic distances. Among this class of viscoelastic materials, two very distinctive mechanical responses to high shear rates can be observed: the stress, as measured with a rheometer, is a smooth monotonic function of the shear rate, or the stress is an uneven, erratic function of it leading to a possible classification of these materials in two groups: *(i) ductile fluids* (smooth response with high shear, corresponding to a large amount of plastic deformation) versus (ii) *brittle fluids* (elastic deformation before fracture occurs).

We focus here on bridged microemulsions (BME) consisting of oil in water microemulsion droplets connected by hydrophobically endcapped hydrosoluble telechelic polymers, that form simple Maxwell fluids at high enough droplets and polymer concentrations ([1], [2])

Satndard non linear rheological measurements and time resolved optical observation under extensional flow (pendant drop experiments) have been performed to characterize the fracture of these transient networks. We find evidence of the brittle and reversible nature of the fracture [3] in these materials, and a simple theoretical analysis is proposed for a general understanding of the fracture stress in equilibrium transient networks



(a) **(b)**

Figure
(a) Occurrence of a fracture in a pendant drop experiment of a sample of BME and (b) propagation of this fracture

REFERENCES

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