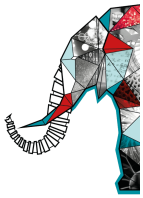
25e Congrès Général de la Société Française de Physique



Contribution ID: **251** Type: **Orale**

USING MECHANOCHEMISTRY TO UNDERSTAND FRACTURE OF SOFT AND TOUGH MATERIALS

Wednesday, 10 July 2019 14:00 (30 minutes)

Fracture of soft materials involves large deformations before macroscopic failure occurs: damage is much less localized at the crack tip than in stiff and brittle inorganic glass. Unlike simple elastic networks of flexible polymers covalently connected that obey classical Lake & Thomas theory, fracture of tough soft materials cannot yet be explained from molecular structure and architecture. We explore how newly developed force sensitive molecules incorporated in networks to give an optical signal (fluorescence, luminescence or absorption change) can quantify and localize bond scission. We infer where energy is dissipated during a macroscopic fracture event. Previous work1,2 showed possible toughening of soft materials by incorporating a minor percolating filler into a stretchable matrix. By using force responsive molecules as crosslinkers in these model interpenetrated networks, we showed that fracture occurs in 2 stages: first softening of the stiff filler network progressively damaged by random bond scission, then a 2nd stage where avalanches of bond breakage occur and load is transferred from the stiff to the stretchable network. Such mechanisms acting at the crack tip are responsible for much higher toughness of these model tough elastomers but should also apply to conventional elastomers reinforced by percolating filler particles.

1 E. Ducrot et al, Science 2014, 344, 186
2 P. Millereau et al, PNAS 2018, 115, 9110

Choix de session parallèle

4.2 Physique des polymères: de la molécule au matériau

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