Figures PSE : Renforcement d'une matrice de Kevlar via fluides rhéodurcissants

Kenza Djeghdi, Olivier Chevalier, Thibaut Nouveau

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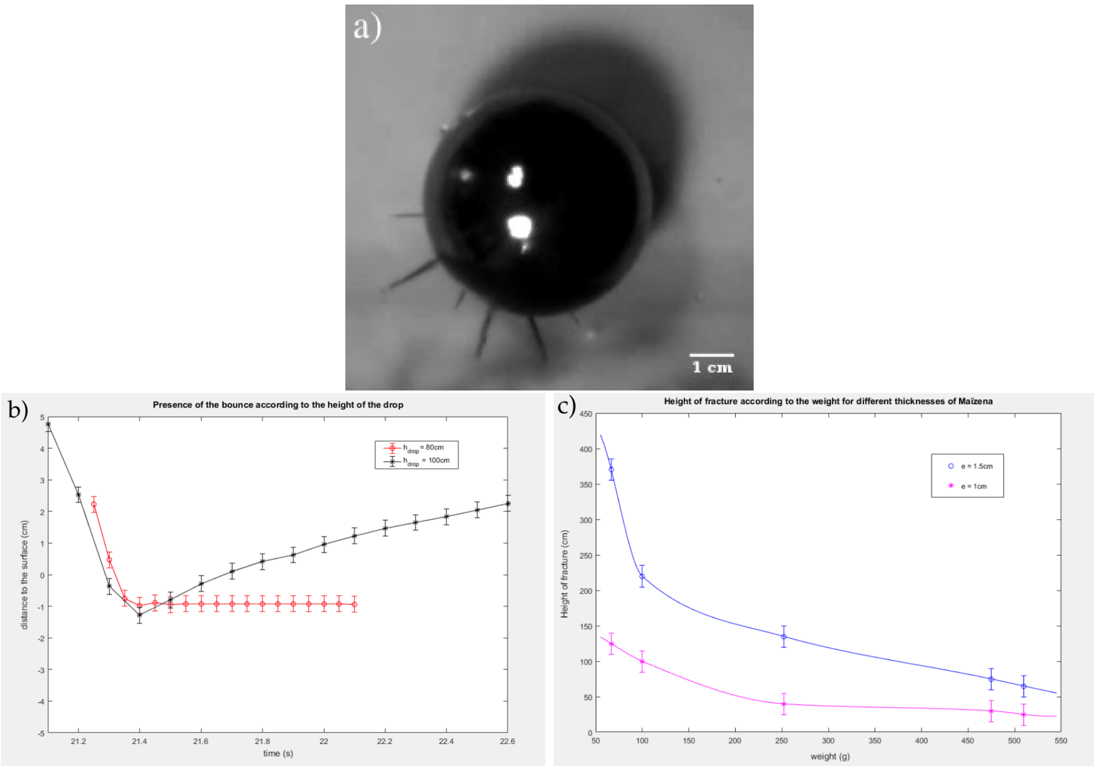
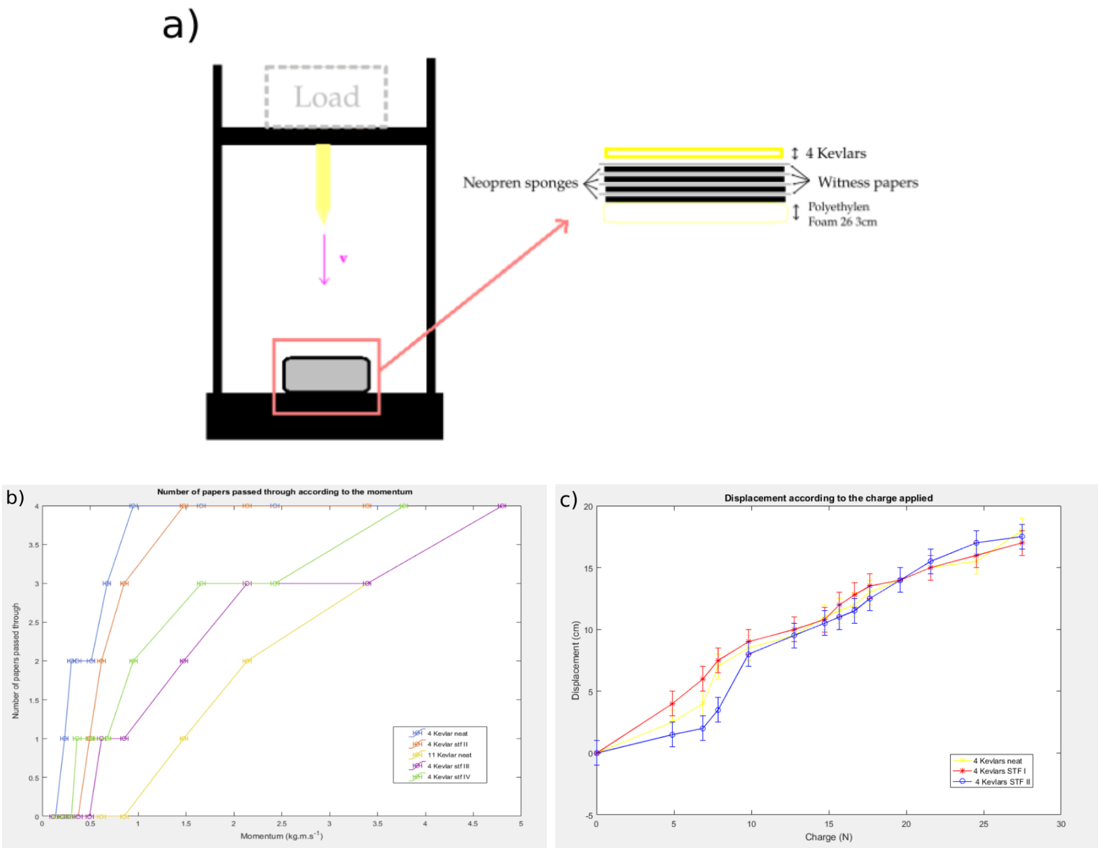


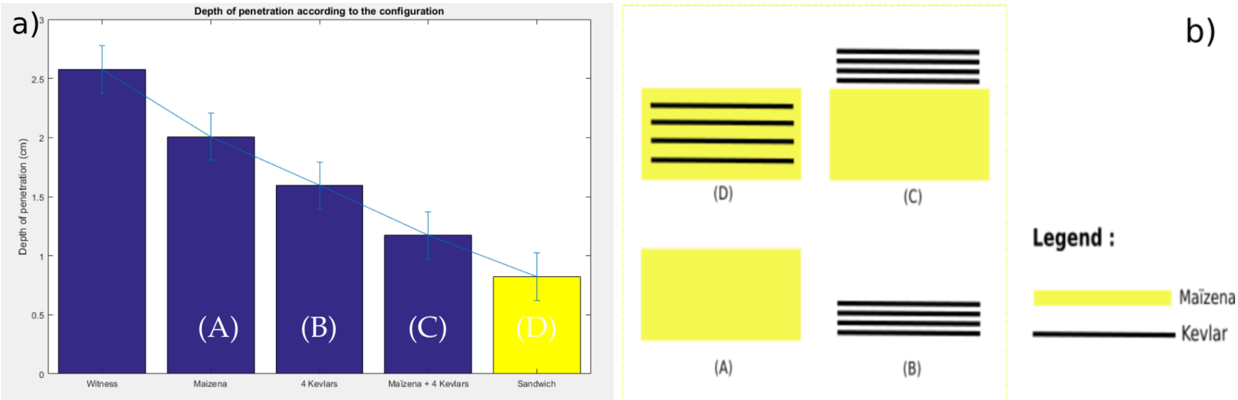
(a) Fracture observation of a 1cm thick layer of cornstarch colloidal suspension after the drop of a 250g ball from a 1m height. In those conditions, the energy is to high for the ball to sink in the suspension or bounce off it. **(b)** Apparition of a bouncing phenomena under particular conditions. For a 250g ball and a 1cm thick suspension : sinking is immediate for a 80cm high drop without the apparition of a fracture. A really slight bounce can already be observed (red curve). The bouncing is more obvious with a 100cm drop (black curve). **(c)** Fracture observation of a 1cm thick layer of cornstarch colloidal suspension after the drop of a 250g ball from a 1m height. In those conditions, the energy is to high for the ball to sink in the suspension or bounce off it.

Figure 1: **Fracture of neat colloidal suspensions**



(a) The sample was placed on a metallic structure under a moving platform on which a brass spike had been placed. The velocity of the platform could be adjusted thanks to calibrated masses put upon it. The sample was made of a succession of layer as told : 4 layers of Kevlar put 45 degrees of the one before, an alternance of witness papers and neopren sponges (4mm thick) and a 3cm foam of polyethylen (FOAM-iT!®26). **(b)** The system aimed at the number of paper pierced according to the momentum of the spike for different samples. For comparison, we chose samples with 4 layers of Kevlar treated as follows : neat, STF II, STF III, STF IV. As a complementary experiment, a sample of 11 neat layers of Kevlar was experimented on. STF III sample has proven the most resistant as shown here, exception made for the 11 layer neat one. The number of papers passed through is linked to the attenuation of the spike's velocity : the energy transmitted to break the papers decreases depending on the Kevlar and STF used. **(c)** A complementary quasi-static study was conducted. Momentum having no real meaning here, the study, the displacement of the spike was measured according to the charge applied. As expected, no decisive difference was perceived between the use of shear-thickening treated sample and neat one. This result coincides with the theoretical expectation as the STF fluids shows no variation of viscosity under a constant and light stress.

Figure 2: **Quasi-static and dynamic stabbing of Impregnated Kevlar layers**



(a) Optimal configuration of layers was determined according to the depth of penetration in identical experimental conditions (platform was dropped carrying a 1kg mass from a height of 50cm, cf Figure 2(a)). **(b)** Configurations taken into account were A- Sample of cornstarch in water massic ratio 2:3, B- layers of neat Kevlar oriented 45 degrees of each other C- 4 layers of neat Kevlar oriented 45 degrees of each other placed on top of a cornstarch colloidal suspension D- 4 layers of neat Kevlar oriented 45 degrees of each other and imbibed in the previous cornstarch suspension, named thereafter 'Sandwich'

Figure 3: **Determination of the optimum configuration STF - Kevlar**