Molecular origin of the extensibility of fibrin

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We report on the design and construction of a novel shear cell for performing in-situ 2DIR spectroscopy on protein gels under mechanical shear. The shear cell will be used to study the molecular origin of the extensibility of fibrin.

Blood clots are remarkable biological materials that consist of more than 95% water. Nevertheless, they are highly extensible and display strain-stiffening behavior. These special properties are due to the protein fibrin, which forms a three-dimensional network of elastic

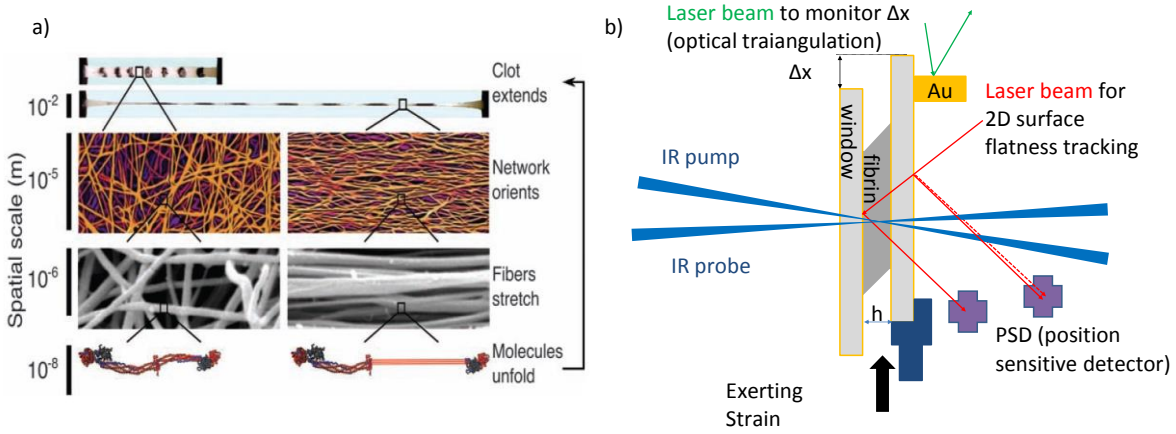

Fig.1 (a) Illustration of the hierarchical organization of a fibrin gel and of the different types of deformations that give rise to its elasticity. Adapted from ref.1. (b) Schematic of the sample cell which can shear strain (Δx/h) the sample reproducibly.

fibers (Fig.1a). To date very little is known about the molecular mechanism that underlies the remarkable extensibility of these fibrin fibers. Here we propose to use a unique combination of linear and nonlinear spectroscopic techniques to study the molecular and mesoscopic deformations that occur as a fibrin gel is stretched. To this end we have constructed a spectroscoic shear cell which allows one to reproducibly apply a shear strain to a sample. We discuss the design considerations and present the first proof-of-principle experiments.

[1] Brown et al., Science 325, 741 (2009).