Supporting Information

How rate, temperature, and solvent exchange affect elastic network rupture?
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Video recordings of samples in extension were all made with *in situ* birefringence measurements, involving sandwich samples with two crossed polarizers and white light source, as shown in Fig. SI.1. retardance plate is used to permit sensitive color progression to be visible for all video recording of stretching under birefringence measurements. The retardance values are indicated in the Michel-Levy chart in Fig. SII.2. In order to improve sensitivity of birefringence observation, we employed retardance plates to displace unstretched state by either 260 or 525 nanometers. From the video recording, we can report both stress level and birefringence as a function of the stretch ratio.

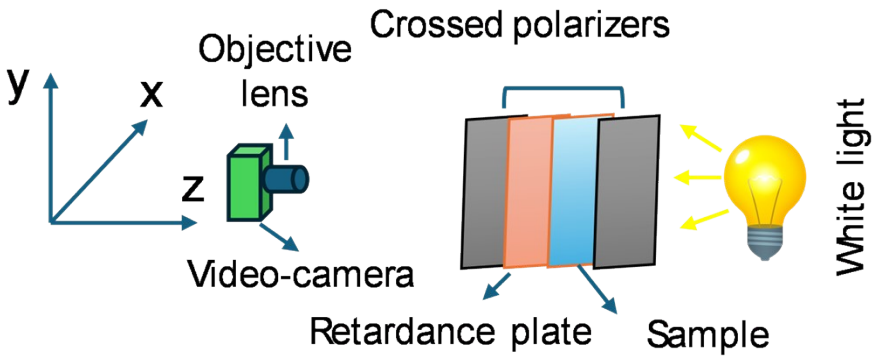
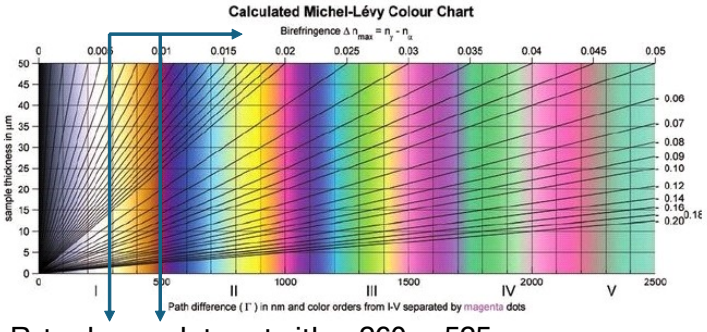


Fig. SI.1



Retardance plates at either 260 or 525 nm are employed for birefringence observations. Color moves to the right-hand side during birefringence buildup

Fig. SI.2

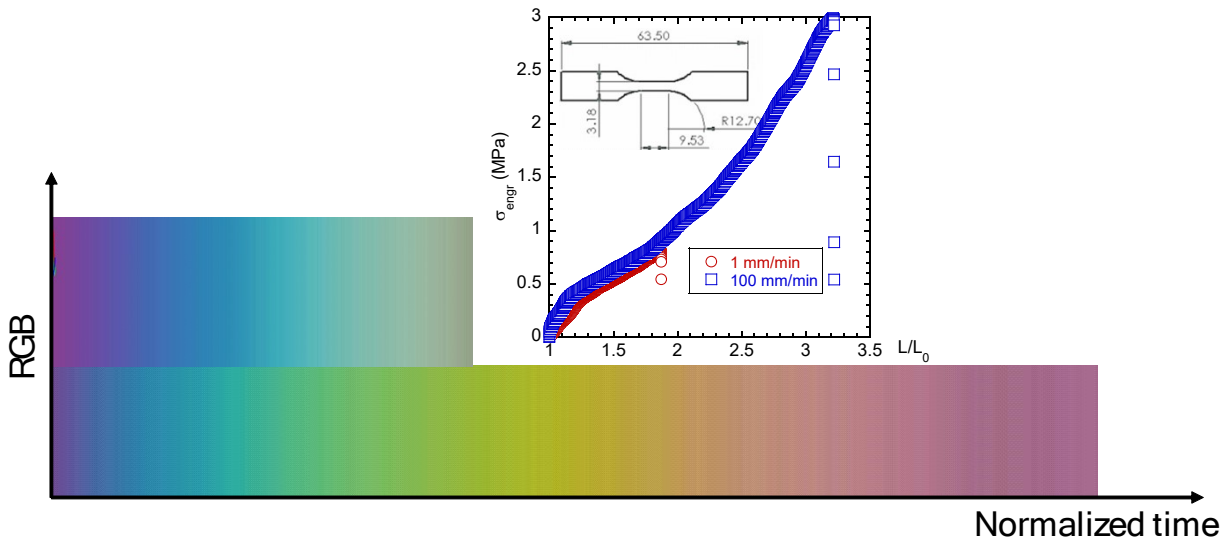


Fig. SI.3

The list of movies

For VHB

Movie-9VHB – Fig. 2(f)

For PMA

Movie-PMA1 and Movie-PMA100 involving crosshead speed V = 1 and 100 mm/min.

For hydrogel

Movie-Compression/W and Movie-Compression/G: Fig. 4(a)

Movie-Cutting/W and Movie-Cutting/G: Fig. 4(b)

Movie-CS/W and Movie-CS/G: Fig. 6(a)

Movie-SR/G4.5 and Movie-SR/G2: Fig. 6(b)