Supporting Information

In an effort to describe activation of spiropyran according to a statistical model, the cumulative Weibull distribution function was employed to determine activation parameters. As such, the probability of spiropyran activation as a function of shear strain is assumed to be described by Weibull statistics. The cumulative Weibull distribution function, $\mathrm{F}(\gamma)$, is then

$$F(\gamma) = 1 - \exp\left[-\left(\frac{\gamma}{\lambda}\right)^{k}\right] \qquad \text{(SI (1))}$$

where γ is the shear strain, λ is the scale factor and k is the shape factor or Weibull modulus, in this case a measure of the distribution of activation shear strains. Calibration of FFF intensity values was achieved by irradiating with UV light for the first three hours of polymerization to convert spiropyran to the photo-stationary merocyanine state. The sample was kept in the dark until polymerization was complete to prevent conversion of merocyanine back to spiropyran. The UV polymerized sample was then tested in torsion following the same procedure as active samples and the final FFF intensity was measured (I_{max}). The sample was then irradiated with visible light to revert the open merocyanine back to the closed spiropyran form, and the intensity was measured again (I_{min}).

FFF intensity data was then analyzed by normalizing with respect to the maximum (photo-stationary merocyanine form) and minimum (photo-stationary spiropyran form) intensities. The normalization factor is defined as

$$\bar{I} = \frac{I(\gamma) - I(\gamma = 0)}{I_{max} - I_{min}} = F(\gamma) \qquad \text{(SI (2))}$$

where $I(\gamma)$ is the intensity of an active sample at a given shear strain, $I(\gamma=0)$ is the intensity of an active sample at zero shear strain and I_{max} and I_{min} are the maximum and minimum intensities of a UV polymerized sample as described above.