Supplementary Information for "Stress relaxation in F-actin solutions by severing"

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Timescales in the case of unstable fragments ($\gamma \to \infty$)

By rewriting Eq. (14) in terms of the two length scales, i.e., the entanglement length L_e and the initial average length $\langle L \rangle$, we obtain

$$\begin{aligned} \sigma(t) = {} & L_e \, \exp\big(-R^2 - t/\tau_1\big) \\ & + \langle L \rangle \, \mathrm{erfc}\big(R + t/\tau_2\big) \, \exp\big((t/\tau_2)^2\big) \end{aligned} \tag{1}$$

where $R = \frac{\sqrt{\pi}}{2}\frac{L_e}{\langle L \rangle}$, $\tau_1 = \frac{1}{\alpha L_e}$, and $\tau_2 = \frac{\sqrt{\pi}}{\alpha \langle L \rangle}$. This expression gives two different timescales τ_1 and τ_2 indicating that in the regime where $L_e < \langle L \rangle < L_d$, stress initially decays as $\frac{1}{\langle L \rangle}$ (see inset of Fig. 4 in the main text) and then relaxes as $\frac{1}{L_e}$.

Length-independent stress relaxation for finite γ

Figure S1 shows the stress relaxation for two different initial average length $\langle L \rangle$ in the regime where $L_e < L_d < \langle L \rangle$ (regime II in Fig. 2a and b in the main text). As expected, the stress relaxation is length-independent in this regime. The deviation of the curve corresponding to the smaller length is due to numerical errors. Likewise, by plotting stress relaxation curves for two different $\langle L \rangle$ in the regime where $L_d < L_e < \langle L \rangle$ (regime III in Fig. 2a and b in the main text), which is shown in Fig. S2, we clearly see a length-independent relaxation.

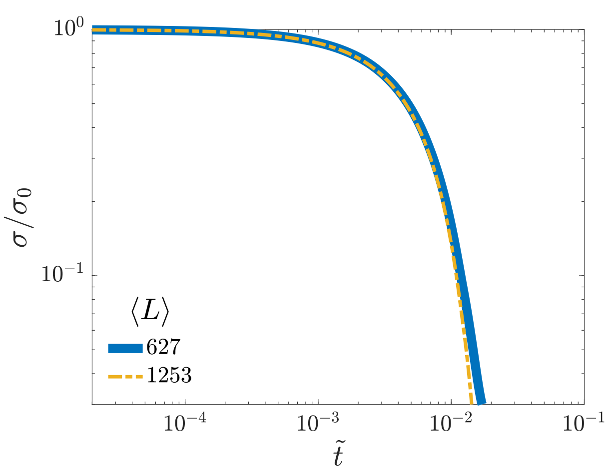

FIG. S1. Stress relaxation for two different $\langle L \rangle$ as shown in the legend in the regime where $L_e < L_d < \langle L \rangle$ for $L_e = 20$ and $L_d = 150$.

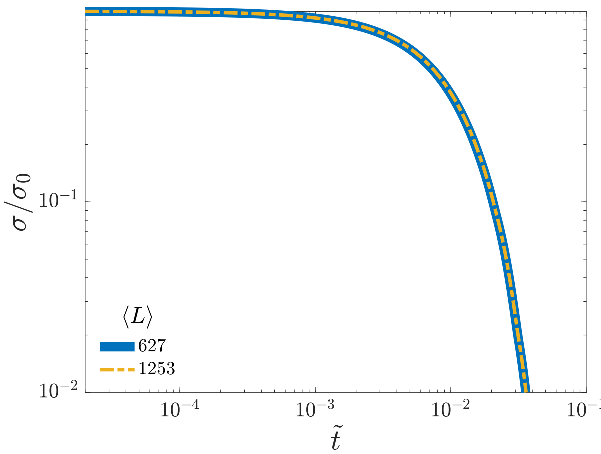

FIG. S2. Stress relaxation for two different $\langle L \rangle$ as shown in the legend in the regime where $L_d < L_e < \langle L \rangle$ for $L_e = 150$ and $L_d = 20$.