

Electronic Supplementary Information (ESI) for

**Rheological properties and failure of alginate hydrogels with
ionic and covalent crosslinks**

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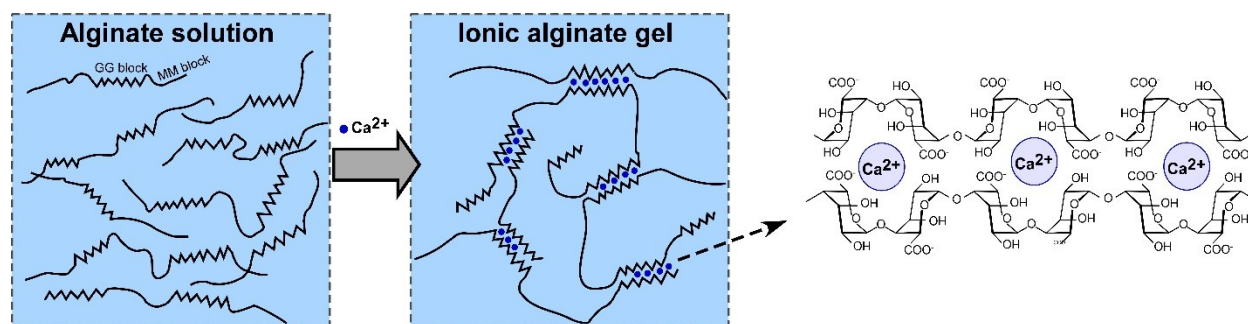


Figure S1 Schematic of gelation mechanism in ionic alginate gel.

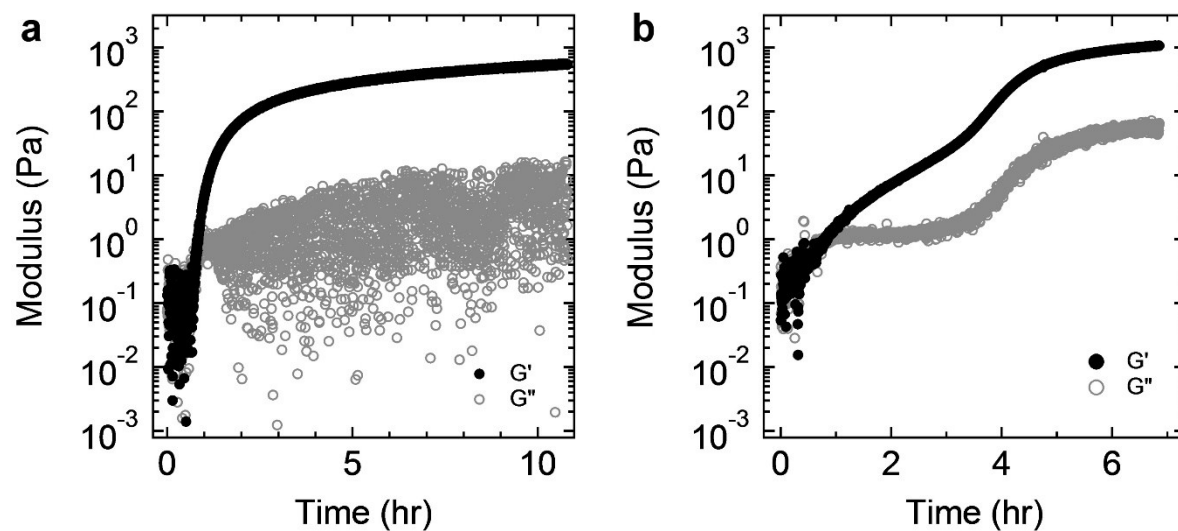


Figure S2 The evolution of shear moduli during alginate gel formation. **a)** chemical alginate with $[AAD] \approx 10$ mM and **b)** ionic alginate with $[Ca^{2+}] \approx 12.5$ mM. The measurements were performed at strain amplitude $\gamma_0 = 0.1\%$ and $\omega = 1$ rad/s. The alginate concentration was 1% wt.

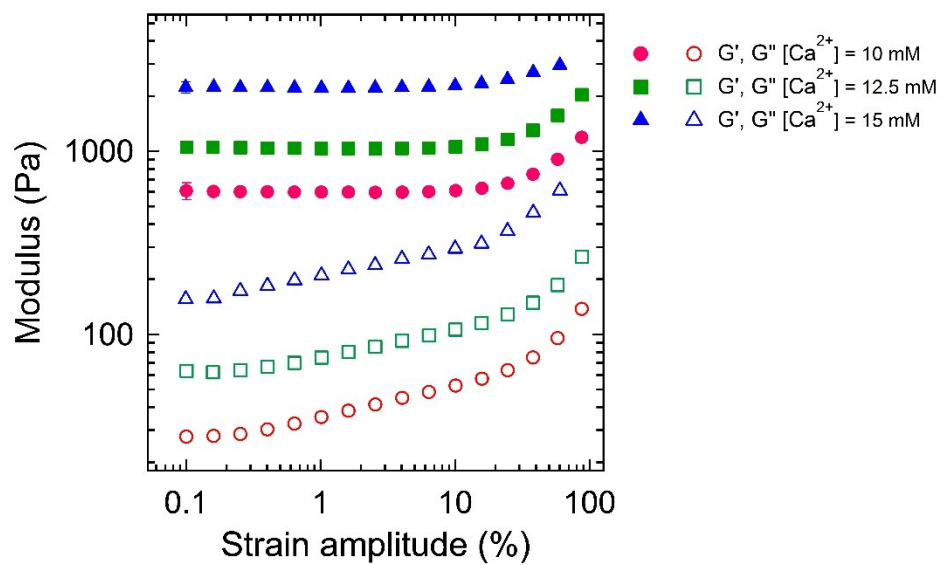


Figure S3 LAOS measurements on ionic alginate gels with different calcium [Ca²⁺] concentration.

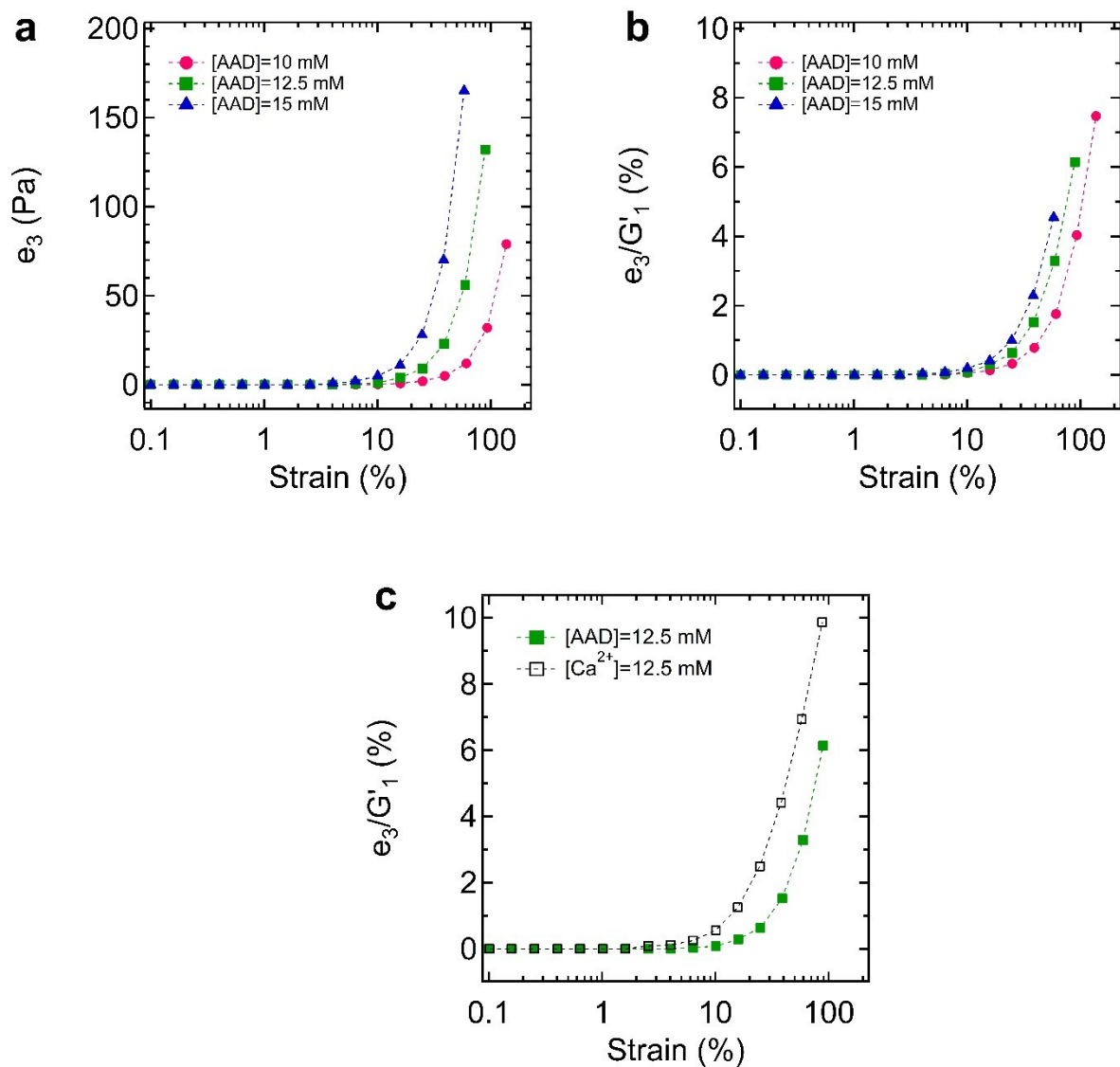


Figure S4 Estimated Chebyshev coefficients (first e_1 , and third, e_3) from stress-strain data during LAOS tests. e_1 is same as G'_1 presented Figure 4a. **a** e_3 and **b** e_3/G'_1 for chemical alginate gels with different AAD concentration. **c** e_3/G'_1 comparing ionic vs chemical alginate gels for crosslinker concentration of 12.5 mM.

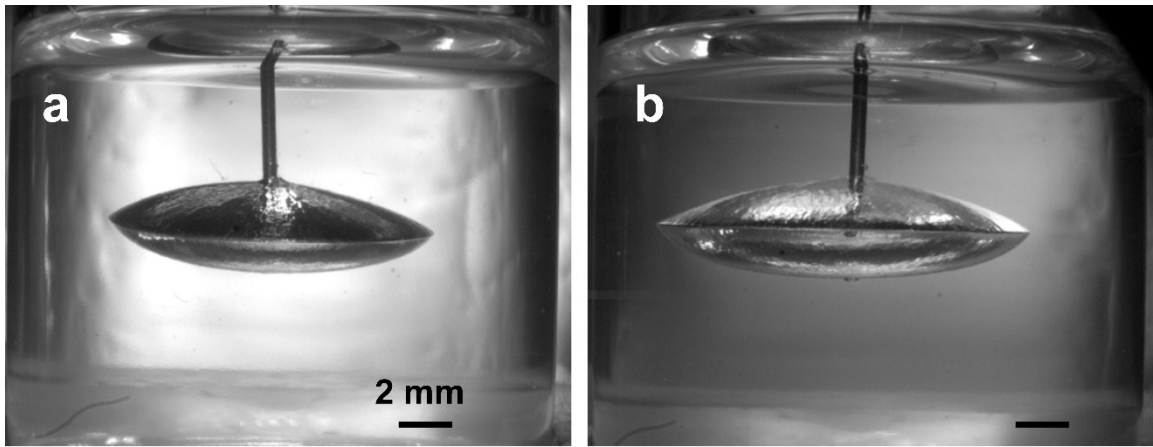


Figure S5 Ellipsoid shape cavities formed during cavitation rheometry in ionic alginate gels with $[\text{Ca}^{2+}]$ of **a** 12.5 mM, and **b** 15 mM.