Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Information

SI 1: Example data recorded during compression-relaxation and SAOS steps.

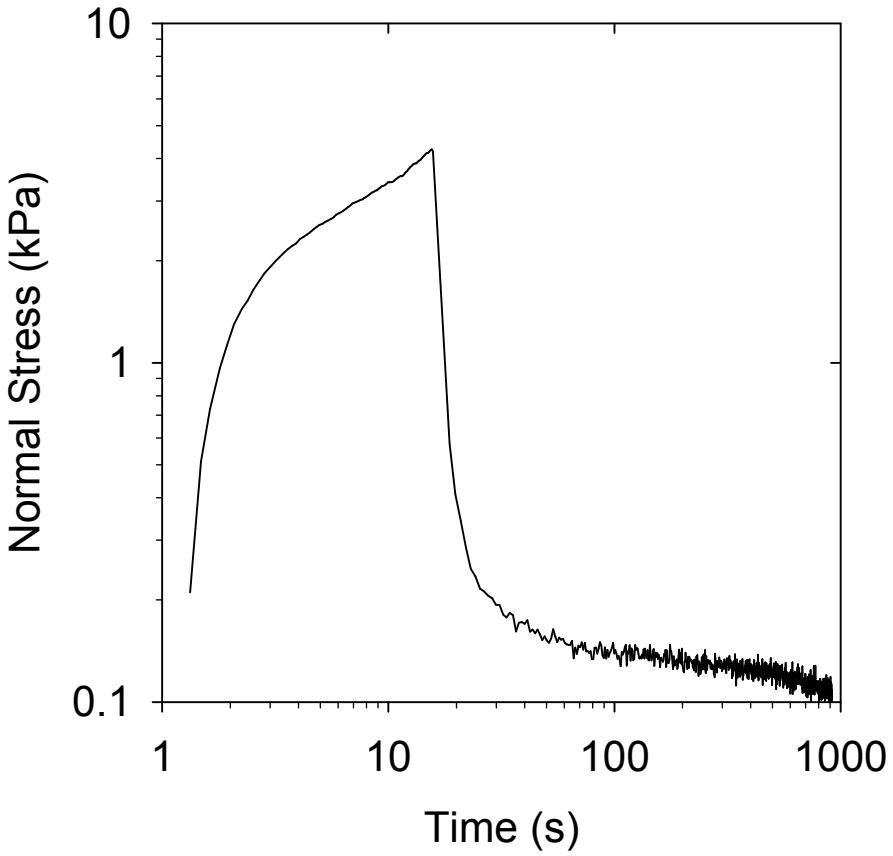


Figure SI1.1. Normal stress recorded over time during compression-relaxation of cellulose hydrogel pair compressed to a CR value of 0.7

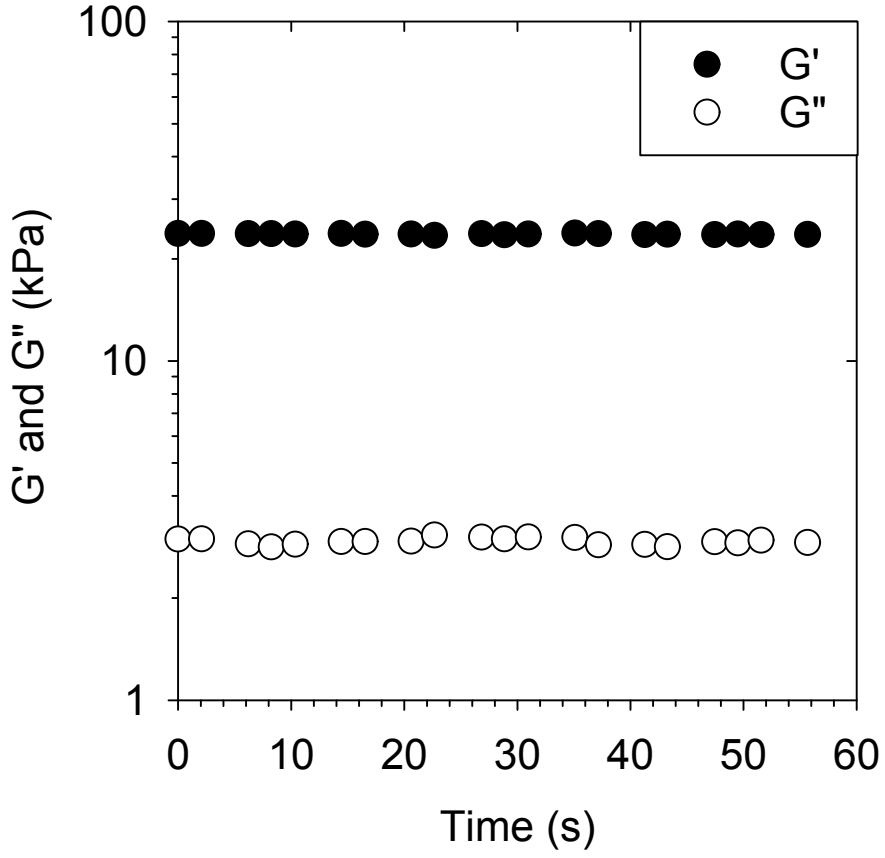
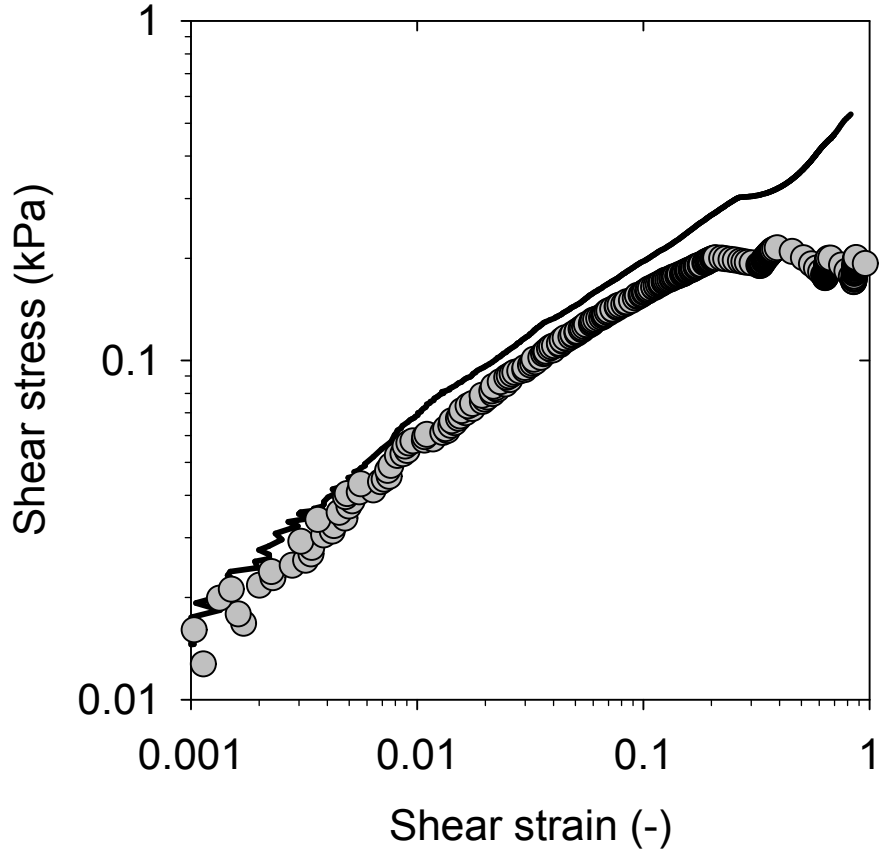


Figure SI1.2. SAOS data for CAX hydrogels compressed to CR = 0.5

SI 2: Stress-strain curve of single CAX hydrogel attached to both rheometer plates (line) and pair of CAX hydrogels with each gel attached to single rheometer plate (symbols). Samples are compression to a compression ratio of 0.5.



SI 3: Friction curves for Cellulose, CAX and CXG at all CR values in water.

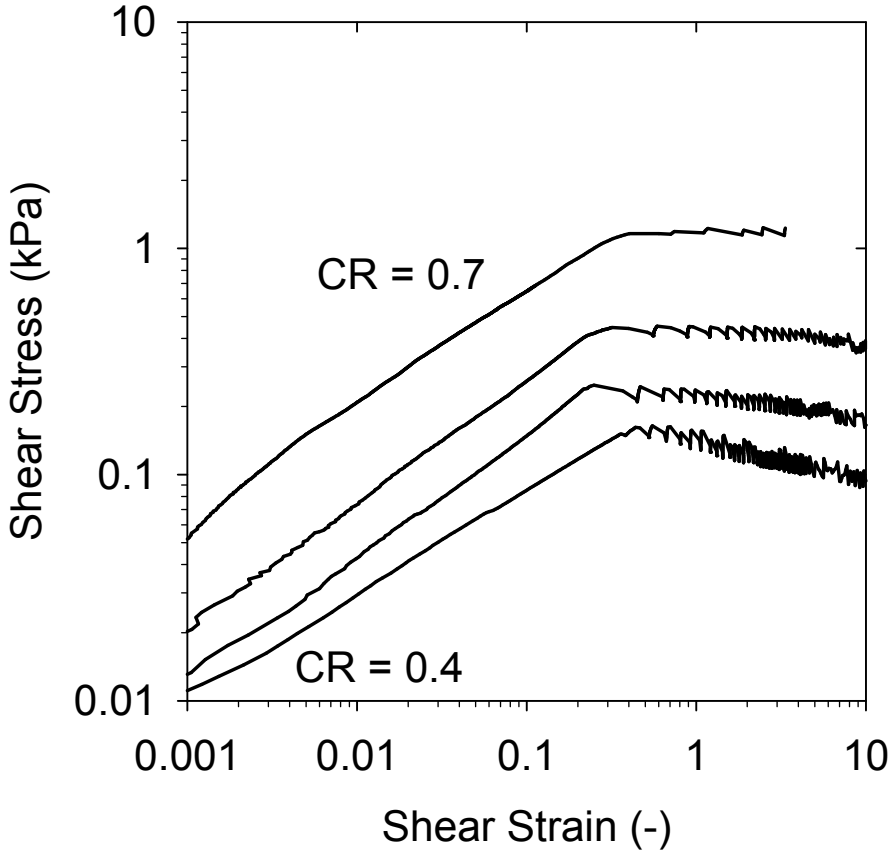


Figure SI3.1. Friction curves for Cellulose hydrogel pairs in water at all compression ratios.

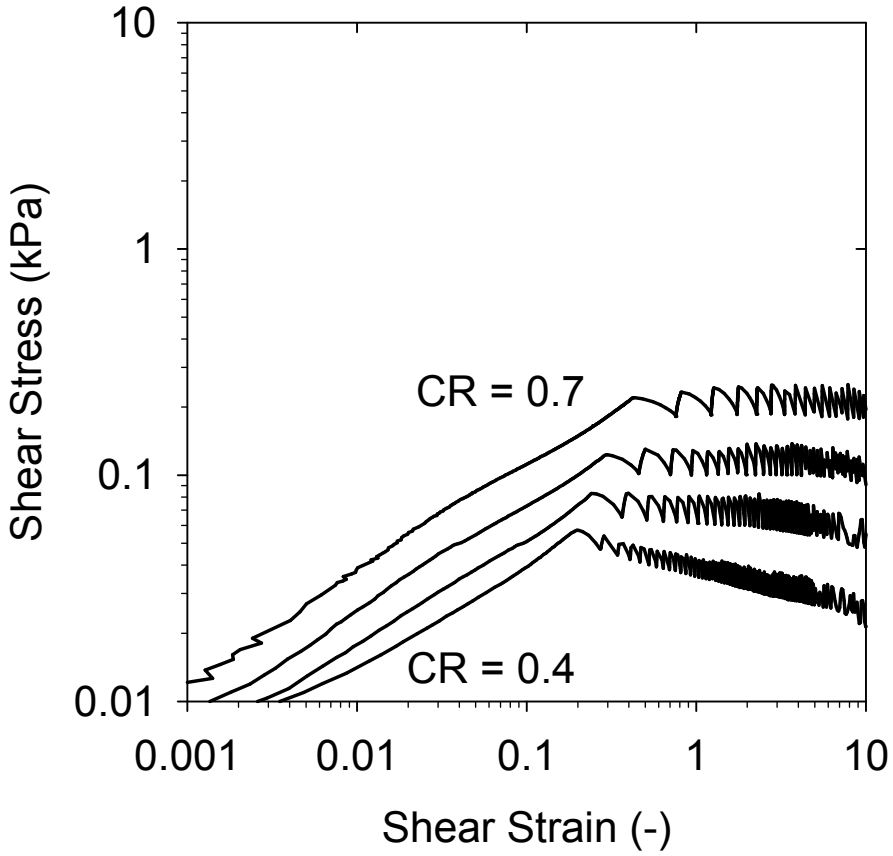


Figure SI3.2. Friction curves for CAX hydrogel pairs in water at all compression ratios.

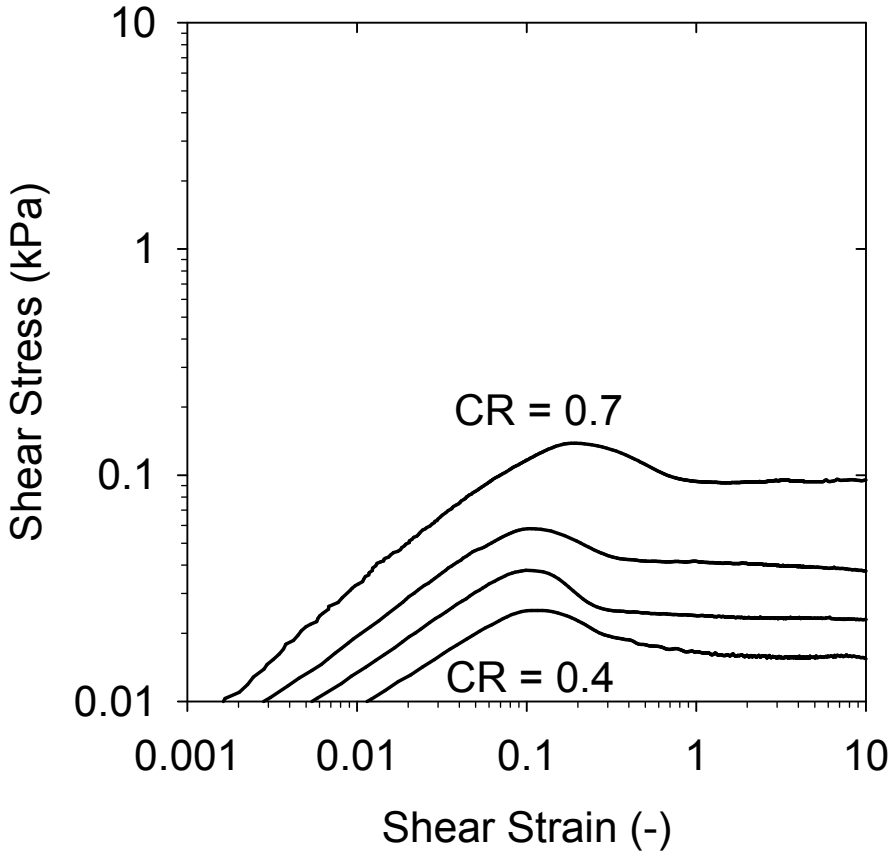
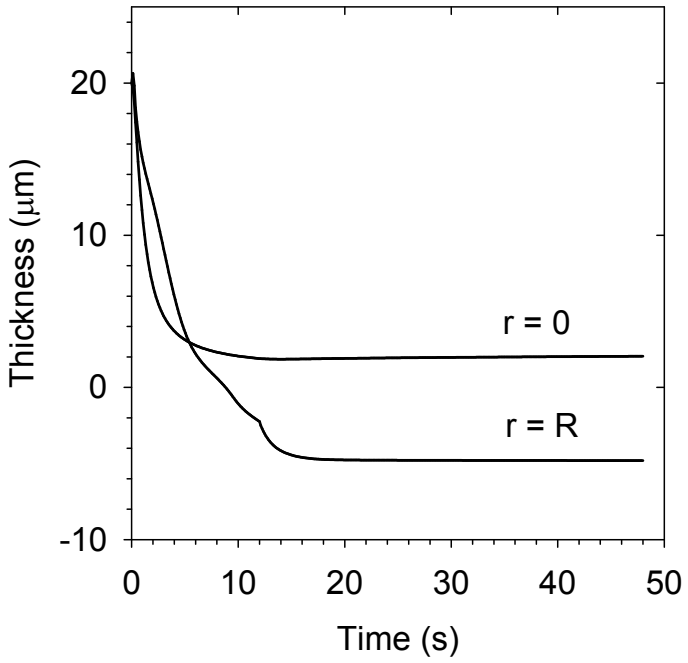
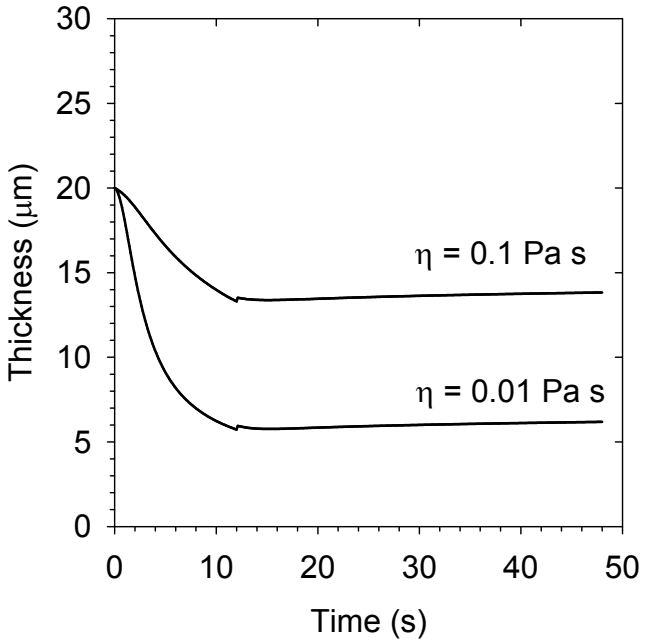


Figure SI3.3. Friction curves for CXG hydrogel pairs in water at all compression ratios.

SI 4: Film thickness at the centre and edge of the interface predicted by the Comsol™ Multiphysics model during compression-relaxation steps.



SI 4.1. Simulated film thickness at the centre, i.e. r = 0, and edge, i.e. r = R, of the interface against time. The hydrogels (axial modulus, E_z = 5kPa) are compressed in water (viscosity 0.001 Pa.s) at a constant rate (33 μm/s) from 0 – 12 s followed by relaxation at a constant CR.



SI4.2. Simulated film thickness at the centre, i.e. r = 0, of the interface against time. The hydrogels (axial modulus, E_z = 5kPa) are compressed at a constant rate (33μm/s) from 0 – 12 s followed by relaxation at a constant CR. The solvent viscosity (η) is labelled for each curve.

SI 5: Friction curves for Cellulose hydrogel in all pectin solutions at all CR values.

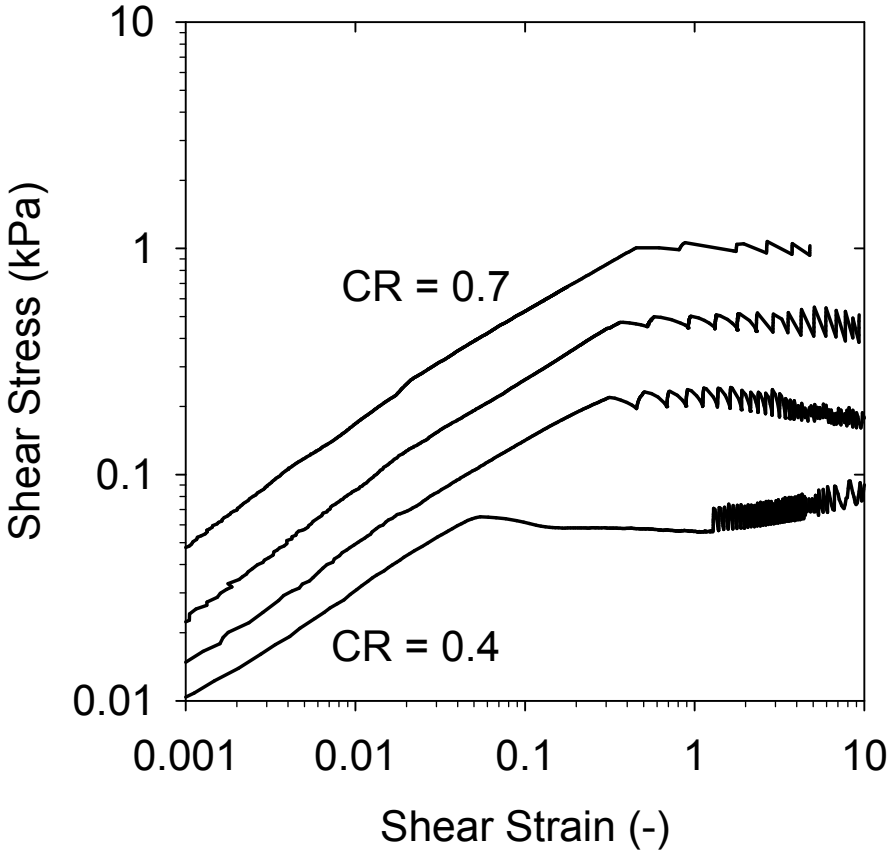


Figure SI5.1. Friction curves for a pair of cellulose hydrogels in 0.5 wt% pectin solution at all values of CR.

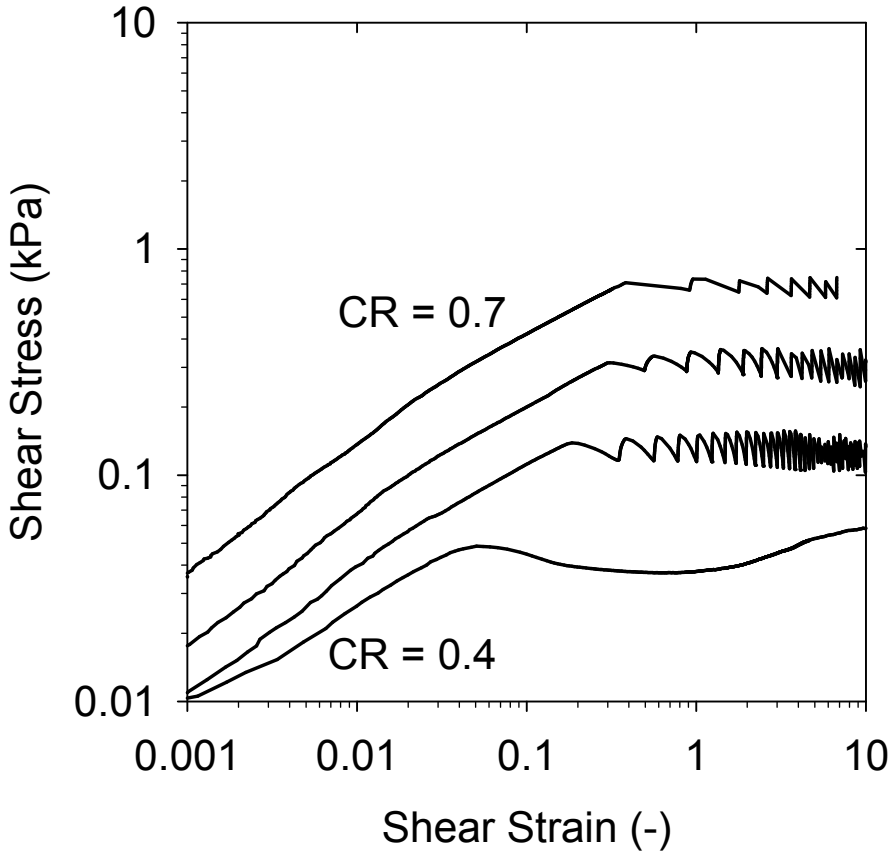


Figure SI5.2. Friction curves for a pair of cellulose hydrogels in 1 wt% pectin solution at all values of CR.

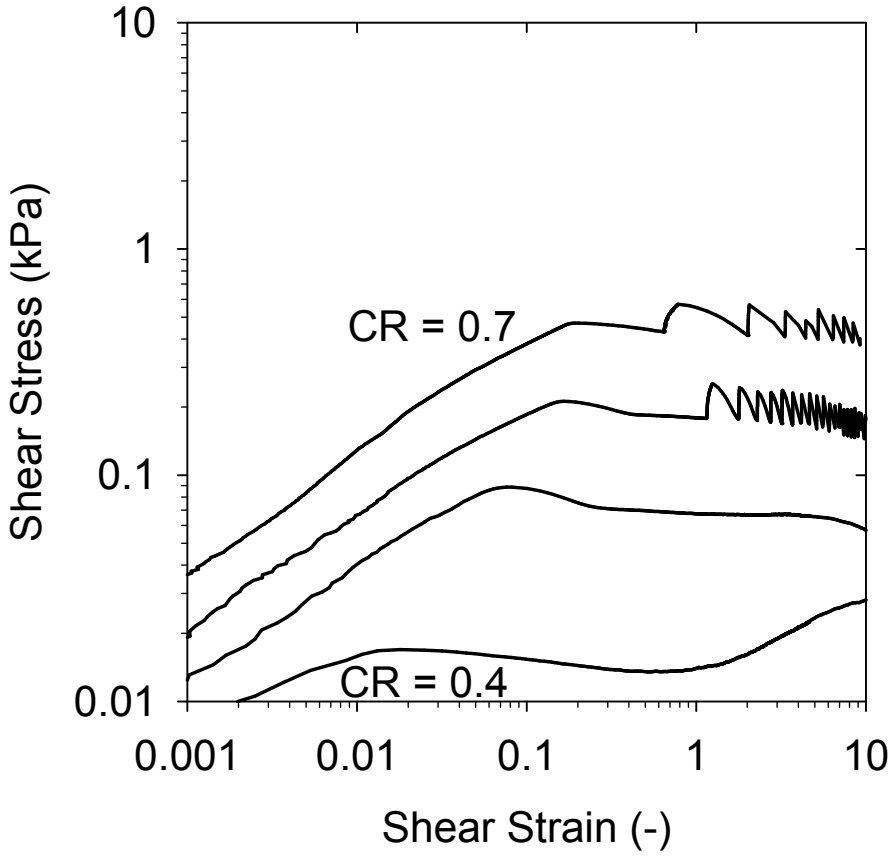


Figure SI5.3. Friction curves for a pair of cellulose hydrogels in 2 wt% pectin solution at all values of CR.

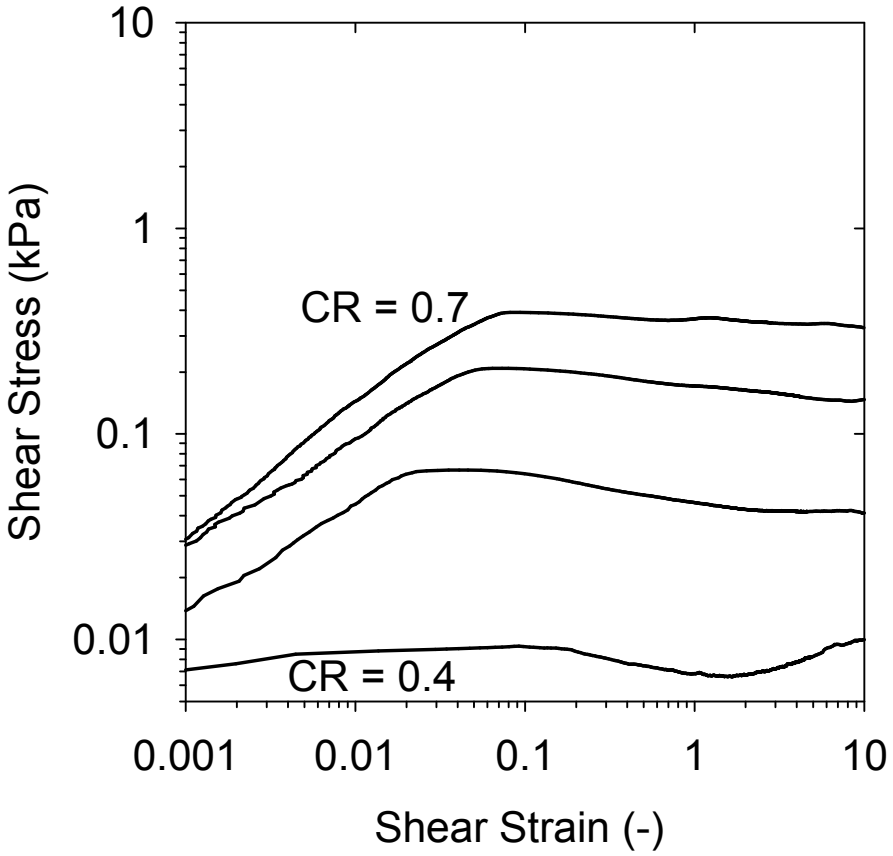


Figure SI5.4. Friction curves for a pair of cellulose hydrogels in 4 wt% pectin solution at all values of CR.

SI 6: Cellulose concentration based on the G' of the hydrogel for cellulose, CAX, and CXG systems.

Cellulose		**CAX**		**CXG**	
G'	*Cellulose concentration*	*G'*	*Cellulose concentration*	*G'*	*Cellulose concentration*
Pa	*%*	*Pa*	*%*	*Pa*	*%*
101.9	0.71221	159	0.68698	112.7016	1.24404
159	0.73679	387	0.72277	203.6787	1.3418
237	0.7634	723	0.7625	335.9278	1.45624
331.4	0.79171	1160	0.80686	485.7625	1.59203
435.5	0.82221	1580	0.85669	716.3231	1.75574
607	0.85514	2010	0.91309	882.8999	1.95697
761.8	0.89083	2530	0.97743	999.65	2.21031
974.8	0.92962	3120	1.05153	1260.495	2.53899
1098	0.97195	3770	1.13778	1713.081	2.98251
1246	1.01831	4410	1.23945	2645.768	3.61376
1455	1.06932	5100	1.36107	5130.178	4.58396
1787	1.12512	6050	1.50916		
2244	1.18772	7500	1.6934		
2669	1.2577	9680	1.92889		
2960	1.33643	14800	2.24045		
3600	1.42569				
4409	1.52772				
5246	1.64675				
5905	1.7844				
6733	1.94894				
8173	2.14475				
10370	2.3843				
13150	2.68409				
19030	3.06571				
24860	3.57981				
31250	4.30108				
33720	5.38633				
30450	7.20408				

SI 7: *Recovery of the weight of a single bacterial nano-fibrillar cellulose hydrogel over time after compression. The dotted line shows the original weight of an uncompressed hydrogel. The three data sets are for cellulose hydrogels compressed to the different thicknesses that are labelled (initial thickness ~ 2500μm).*