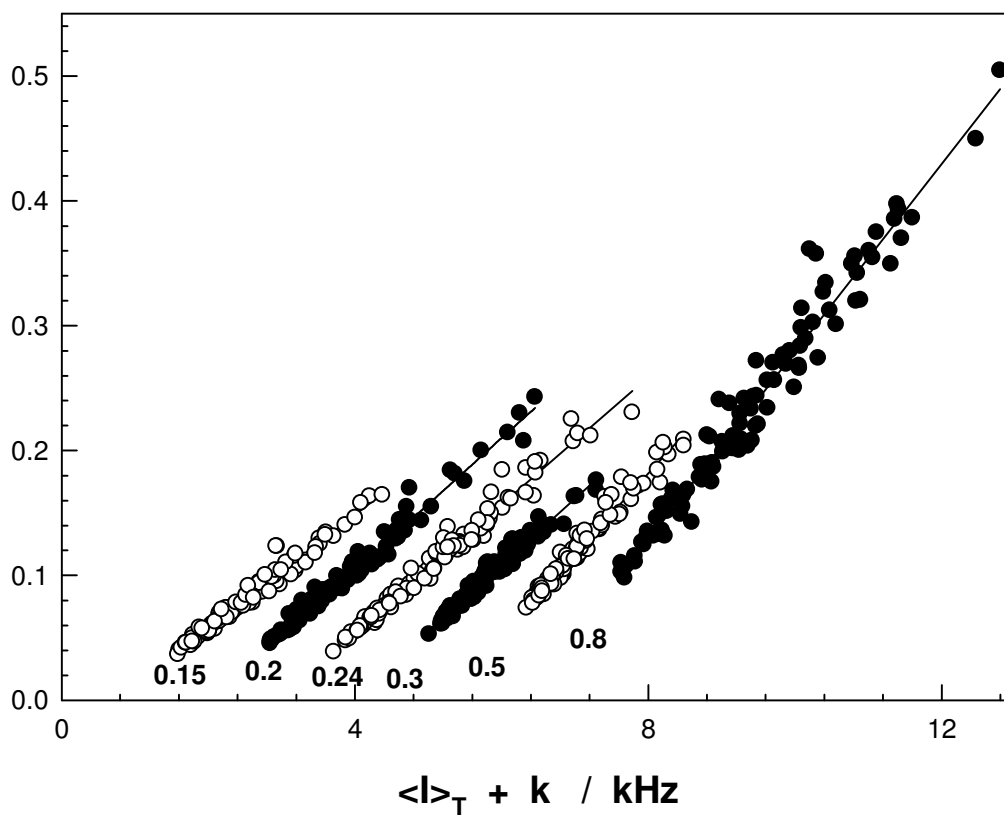**Figure S1.** Decomposition plots according to eq 4 for hydrogels formed using 2 mol % C18 at various salt concentrations C_{salt} indicated (in M). k is the shift factor taken as 0, 1, 2, 3, 4, and 5 for $C_{salt} = 0.15, 0.20, 0.24, 0.30, 0.50, 0.80$ M, respectively.
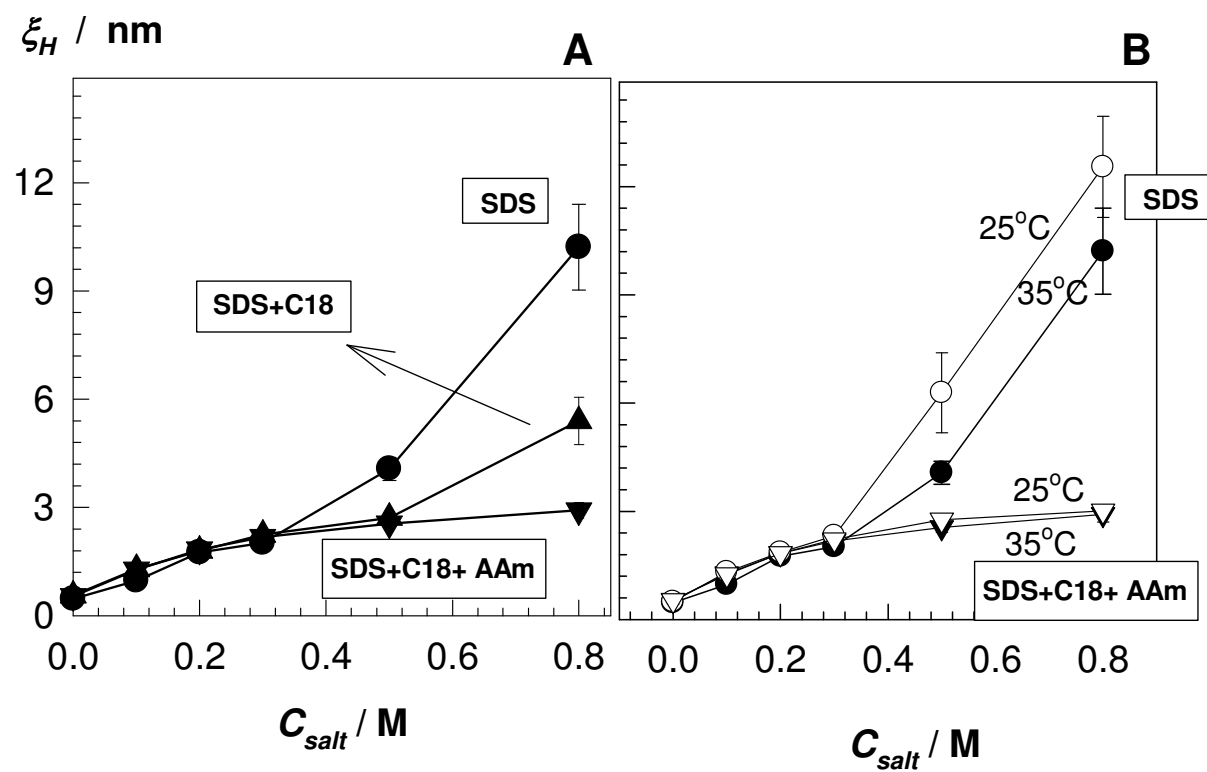
Figure S2. A: Hydrodynamic correlation length ξ_H of 7 w/v % SDS solution without (●) and with C18 (▲) and C18 + AAm (▼) plotted against C_{salt}. Temperature = 35°C. **B:** ξ_H of 7 w/v % SDS solution without (circles) and with the monomers C18 + AAm (triangles down) plotted against C_{salt}. Temperatures are indicated.
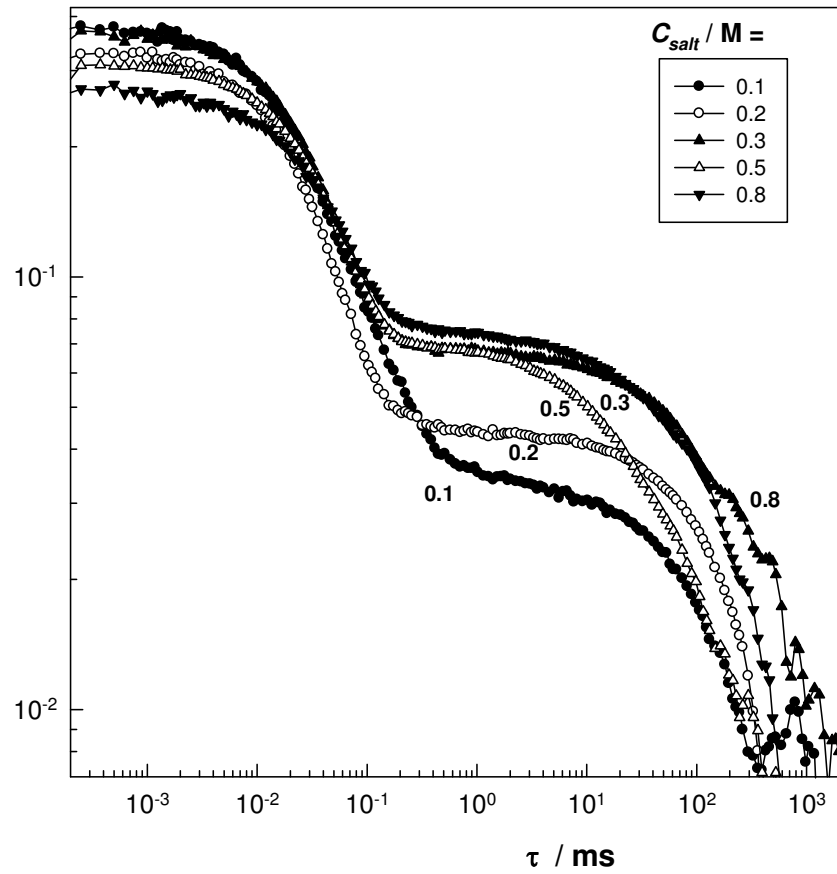
Figure S3. Intensity time-correlation functions, $g_T^{(2)}(\tau) - 1$, of gels (or solutions) at various C_{salt} indicated.
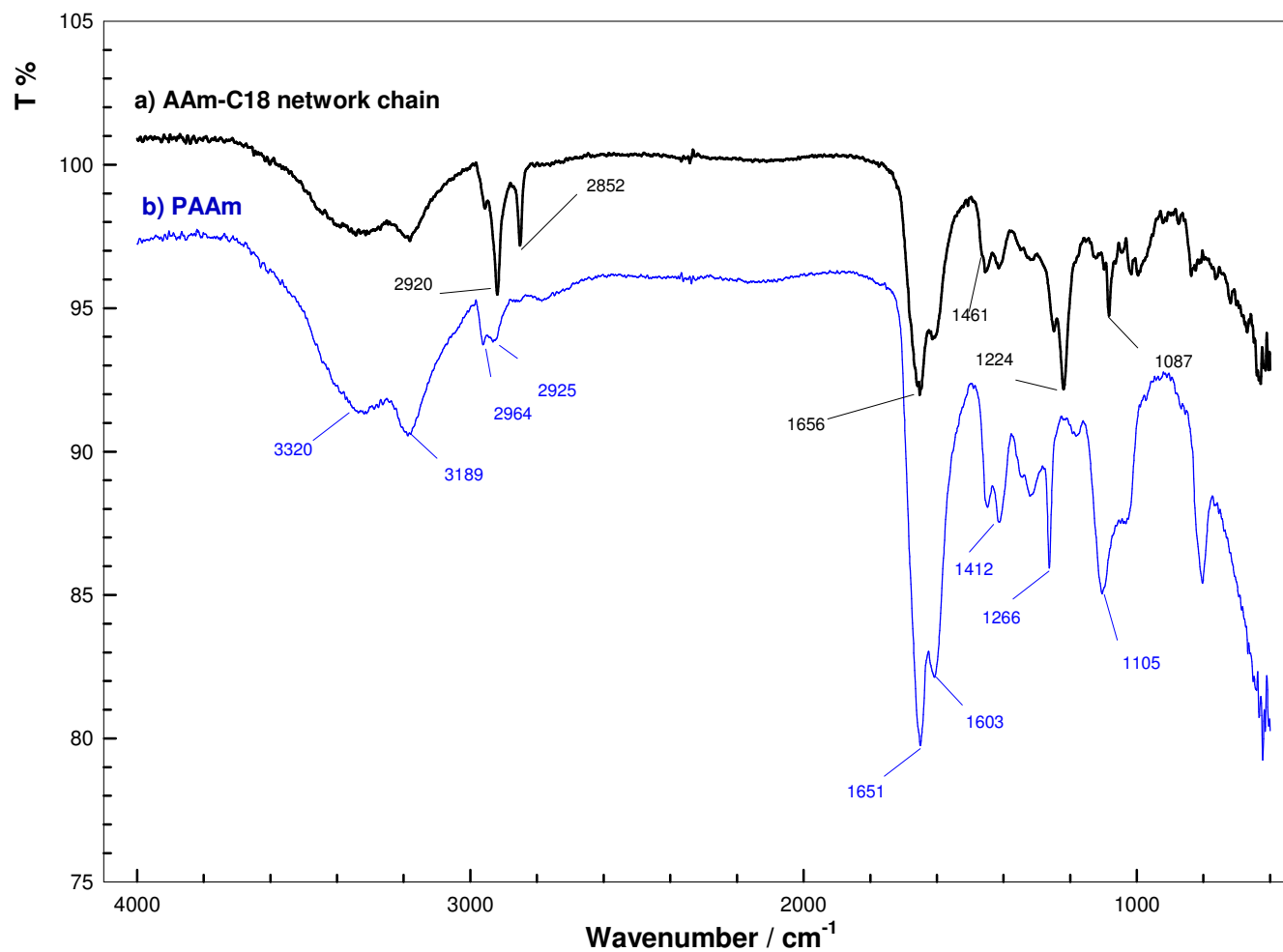
Figure S4. FTIR spectrum of the polymer isolated from the hydrogel network formed at 0.5M NaCl (black) together with the spectrum of pure polyacrylamide as a reference (blue).
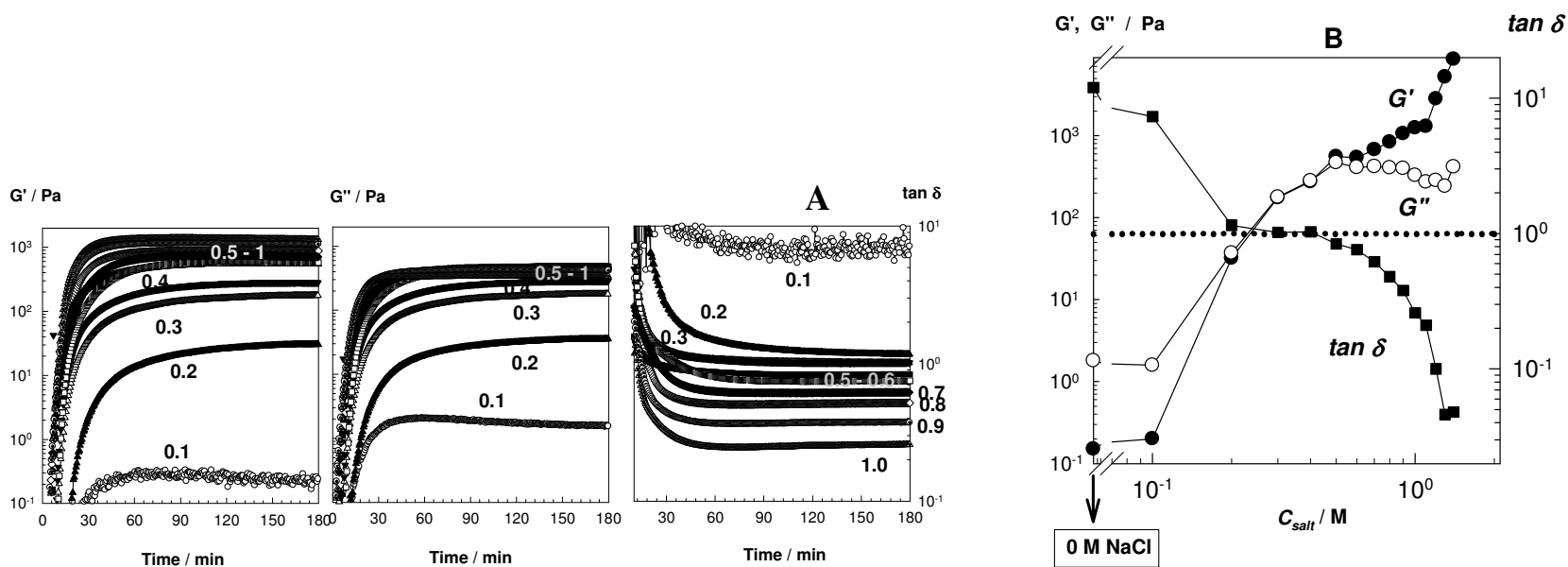
Figure S5. A: Elastic modulus *G'*, viscous modulus *G''*, and the loss factor *tan δ* during the micellar copolymerization of acrylamide and C22 shown as a function of the reaction time. C22 = 2 mol %. SDS = 7 w/v %. NaCl concentrations (C_{salt}) are indicated. ω = 6.3 rad/s, γ_o = 0.01. **B:** The limiting values of *G'* (filled circles), *G''* (open circles), and the loss factor *tan δ* (squares) plotted against C_{salt}. The dotted horizontal line represents *tan δ* =1.
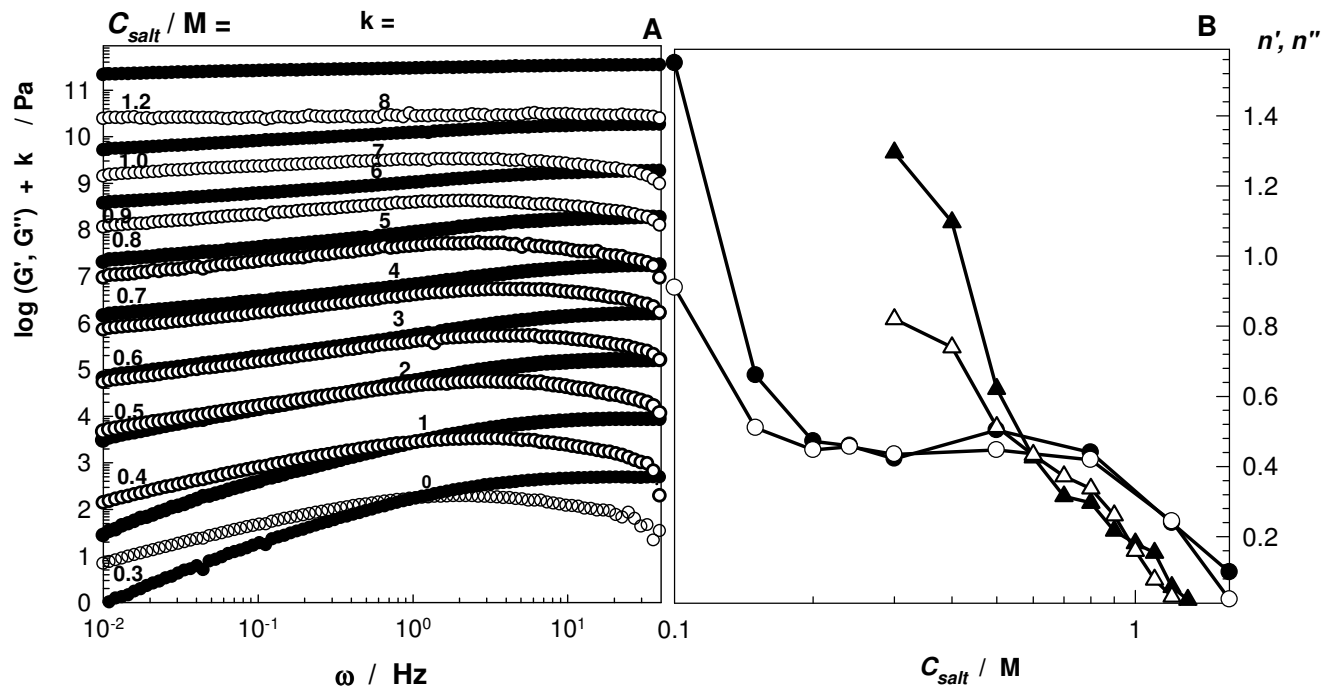
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Figure S6. **(A):** Elastic moduli G' (filled symbols) and viscous moduli G'' (open symbols) of C22 hydrogels shown as a function of the frequency ω measured after 3h of reaction time. k is a shift factor to avoid overlapping. The values of k and C_{salt} at the gel preparation are indicated. C22 = 2 mol %. SDS = 7 w/v %. γ_o = 0.01. **(B):** Exponents n' (filled symbols), n'' (open symbols) of G' and G'' vs frequency plots, respectively, plotted against C_{salt}. Hydrophobe: C18 (circles) and C22 (triangles).
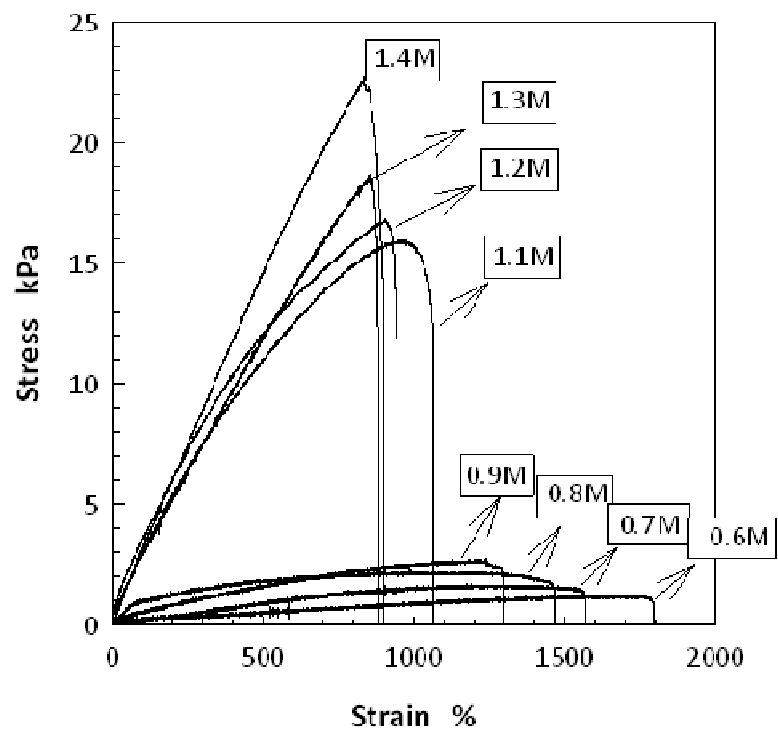
C_{salt} / M	Elongation ratio at break	Tensile strength / kPa
0.6	1660 (113)	1.2 (0.1)
0.7	1590 (118)	2.3 (0.1)
0.8	1450 (96)	2.4 (0.1)
0.9	1310 (97)	2.7 (0.2)
1.1	1040 (84)	15 (3)
1.2	940 (67)	17 (2)
1.3	880 (71)	19 (4)
1.4	850 (62)	23 (2)

Figure S7. Stress- strain curves of C22 hydrogels. C_{salt} indicated. The elongation ratio at break decreases while the strength remarkable increases at $C_{salt} > 1.1$ due to the existence of phase separated domains in the hydrogels (Figure 1B).