Supplementary Information

Rheology of cellulose nanofibrils in the presence of surfactants†

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Surfactant	MW (g/mol)	CMC (mM)	CMC (wt.%)	c_c (wt.%)
DTAB	308	14.6-16 [1]	0.45-0.49	0.08
SDS	288	8.2 [1]	0.236	1.6
SLES-3*	420	0.80 [2,3]	0.034	16
F68†	8800	12 [4–6]	10	-
TX100	647	0.24-0.27 [1,7]	0.016-0.018	-

Table 1 List of CMC values of surfactants used in this study. MW: Molecular weight in g/mol. c_c: Critical concentration at and above which 0.6% CNF suspensions destabilize.

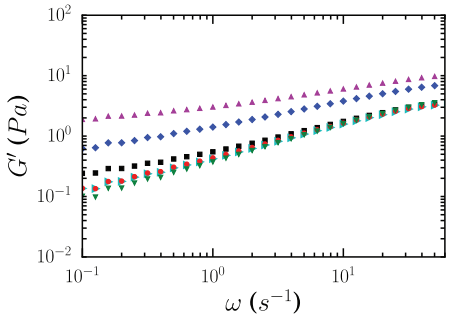

Fig. 1 Storage G' of CNF suspensions at 0.6% in presence of different concentrations of non-ionic surfactant, Pluronic F68 (0.1 % :▶, 0.5 % :■,1 % :●, 2 % :▼, 4 % : ♦,8% :▲)

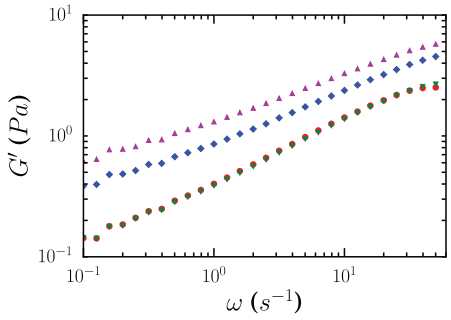

Fig. 2 Storage G' of CNF suspensions at 0.6% in presence of different concentrations of non-ionic surfactant, TX100 (1 % :●, 2 % :▼, 4 % : ♦,8% :▲)

∗ Commercial SLES is typically SLES-3. MW is $288 + 44n \approx 420$, for $n = 3$. CMC is relatively independent of ethoxylation [2,3].

† There is considerable discrepancy in the cmc values reported for Pluronics F68 depending on the method used (tensiometry, fluorescent probe) and temperature. Early work noted the apparent absence of micelles at room temperature in water [4–6,8], and the pronounced temperature sensitivity of the cmc, which decreases on increasing temperature due to dehydration of the EO units. However the cmc is also reported to be in the range of 0.04 mM by some sources [9?,10].

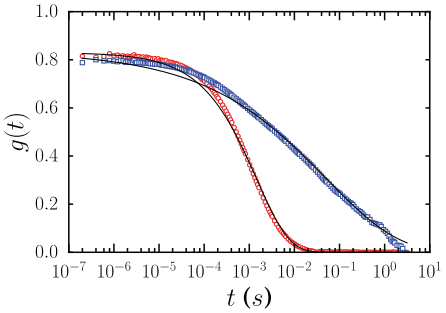

Fig. 3 Correlation function $g(t)$ as function of time for 0.01 (○) and 0.6 % (□) of CNF. The solid line fits indicate stretched exponentials, $g(t) = exp(-(t/\tau)^{\beta})$, where $\tau = 1.45$ and 50, and $\beta = 0.6$ and 0.27, each respectively, for 0.01 and 0.6 % of CNF. While the CNF suspension as 0.01 % is also well described by a single peak in the relaxation-time distribution, as in Figure 4, the 0.6 % suspension is not.

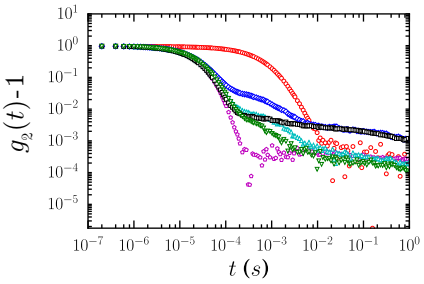

Fig. 4 Correlation function $g(t)$ as function of time of 0.01% of CNF in presence of different concentration of TX100.(0:○, 0.5:◇, 1:△,2:□, 5%:▽ and neat solution of TX100 at 5%:⬠)

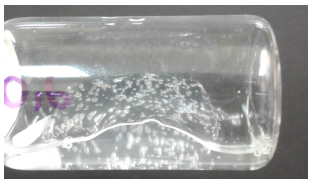

Fig. 5 Observation of reversed vials of 0.6 % of CNF in presence of SLES (8 %)

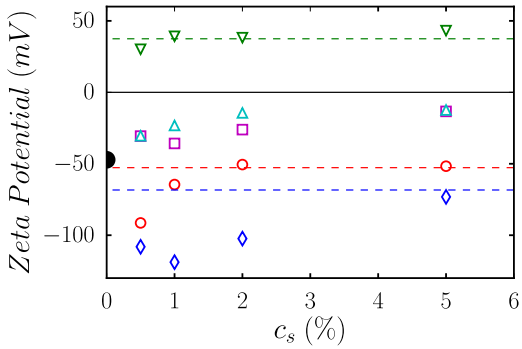

Fig. 6 Zeta potential of CNF suspension at 0.01 % in presence of different concentration surfactant: SDS:○, SLES:◇, TX100:△,PF68:□, DTAB%:▽. ● correspond to the neat suspension of CNF at at 0.01 % and the dashed lines correspond to the zeta potential of the neat solutions of the ionic surfactants at 5 %

References

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