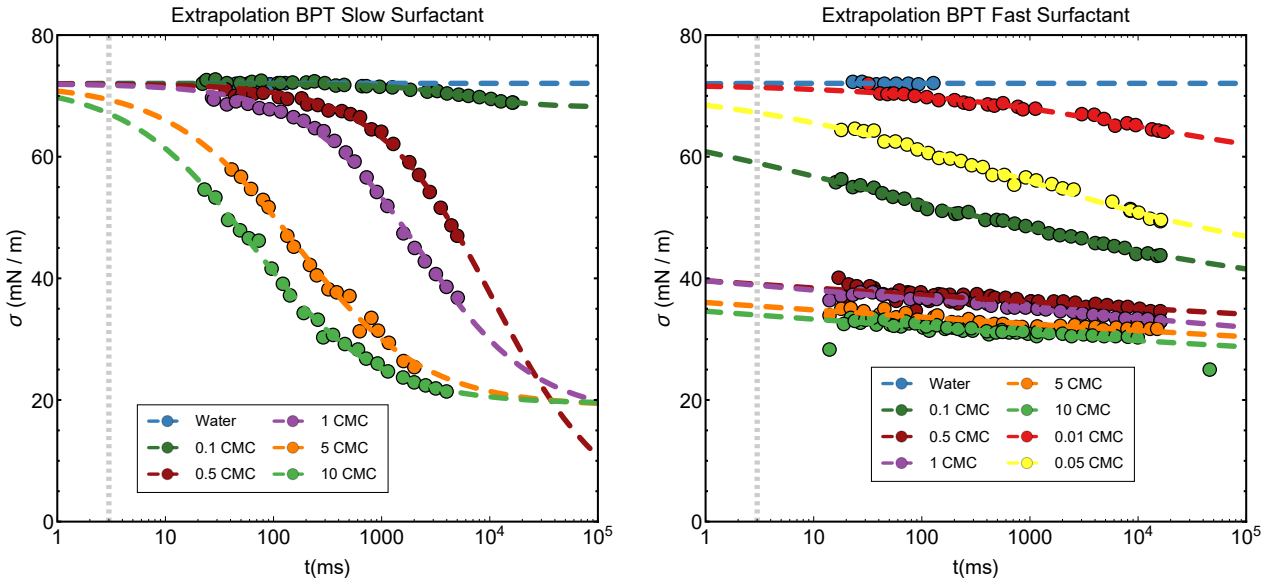
Supplementary Information

Silanization procedure of glass slides

1. Mix Toluene + Trichlorooctylsilane (Volume conc. 1%), stir until it's a clear solution
2. Pour solution into a large petri dish (glass) and cover with2 a large glass lid
3. Blow of dust (air gun)
4. Plasma treatment for 30 sec (cleaning process)
5. Place the glass slides into solution, cover with a lid and leave it for 15min
6. Then rinse the glass slides with isopropanol (generous amount)
7. Store slides away from dust and any other impurities
8. Use the solution only once per batch

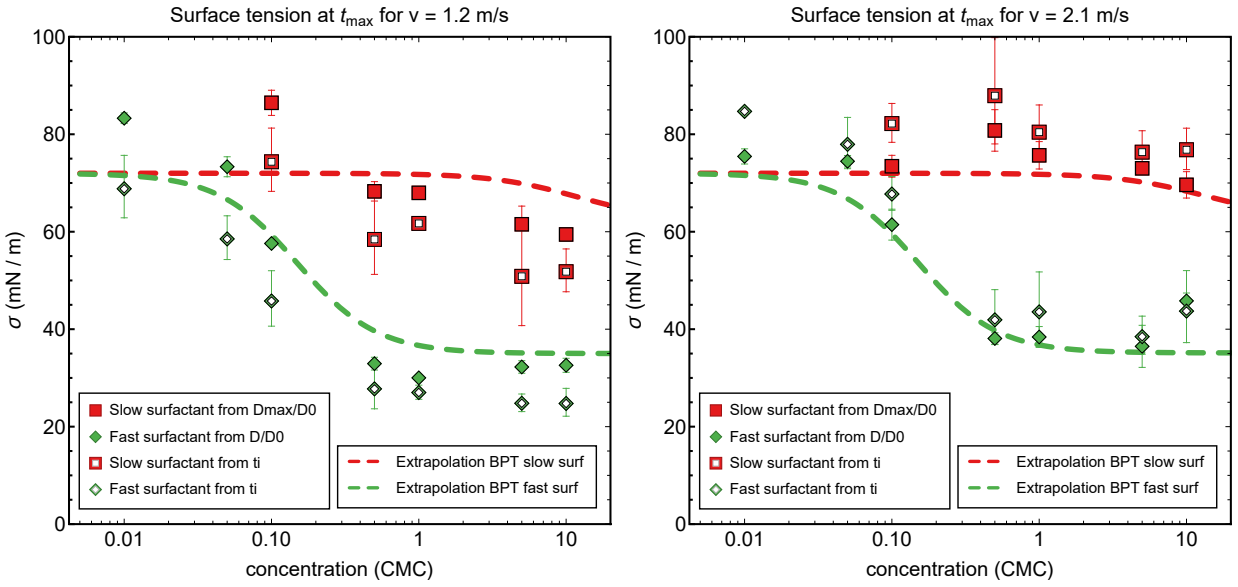
Bubble pressure tensiometer fits



(a) (b)

Figure 1: Bubble pressure tensiometer data and fits to Eq.3 for concentrations **a** slow surfactant **b** fast surfactant compared to water (blue circles, constant at $72mN/m$). The dashed lines are the best fits of Eq.3 to the experimental data. These fits are used to extrapolate the dynamic surface tension of the liquids to the typical time of spreading of a droplet, which is 3 ms (grey dotted line). Fit parameters $\sigma_0(mN/m), \sigma_\infty(mN/m), \tau(s), n$: $\sigma_0 = 72$ for all fits,**a** $\sigma_\infty = 68.1, \tau = 5.56 * 10^3, n = 1.21$ (0.1 CMC), $\sigma_\infty = 1.00, \tau = 1.01 * 10^4, n = 8.22 * 10^{-1}$ (0.5 CMC), $\sigma_\infty = 17.5, \tau = 2.22 * 10^3, n = 8.12{}^*10^{-1}$ (1 CMC), $\sigma_\infty = 19.0, \tau = 1.63 * 10^2, n = 7.38 * 10^{-1}$ (5 CMC), $\sigma_\infty = 19.4, \tau = 62.1, n = 7.51 * 10^{-1}$ (10 CMC). **b** $\sigma_\infty = 57.7, \tau = 1.14 * 10^4, n = 3.7{}^*10^{-1}$. (0.01 CMC), $\sigma_\infty = 41.5, \tau = 7.01 * 10^2, n = 3.10 * 10^{-1}$ (0.05 CMC), $\sigma_\infty = 35.2, \tau = 2.53, n = 0.2$ (0.1 CMC), $\sigma_\infty = 22.5, \tau = 1.4 * 10^{-6}, n = 4.74 * 10^{-2}$ (0.5 CMC), $\sigma_\infty = 1.00, \tau = 1.04 * 10^2, n = 3.76 * 10^{-2}$ (1 CMC), $\sigma_\infty = 17.4, \tau = 3.12 * 10^{-7}, n = 4.39 * 10^{-2}$ (5 CMC), $\sigma_\infty = 18.3, \tau = 9.83 * 10^{-8}, n = 5.13 * 10^{-2}$ (10 CMC).

Effective dynamic surface tension for other velocities



(a) (b)

Figure 2: Effective dynamic surface tension at maximum spreading. Dynamic surface tension σ calculated using the two methods described in the main text as a function of fast (green diamonds) and slow (red squares) surfactant concentration for **a** low impact velocity $v = 1.2$ m/s and **b** high impact velocity $v = 2.1$ m/s. The dotted lines are extrapolations based on BPT measurements (see Suppl. Inform.) and Eq.3.