Supporting Information

Multi-stimuli responsive foams combining particles and self-assembling fatty acids

Anne-Laure Fameau,[*a] Stephanie Lam[b] and Orlin D. Velev[*b]

[a,*] Biopolymères Interactions Assemblages, INRA, Rue de la Géraudière, 44316 Nantes, France. Fax: +33240675084; Tel: +33240675083; E-mail: anne-laure.fameau@nantes.inra.fr

[b] Department of Chemical & Biomolecular Engineering, North Carolina State University, Raleigh, North Carolina 27695-7905, USA.

[b,*] Department of Chemical & Biomolecular Engineering, North Carolina State University, Raleigh, North Carolina 27695-7905, USA. Fax: +19195153465; Tel: +19195134318; E-mail: odvelev@ncsu.edu

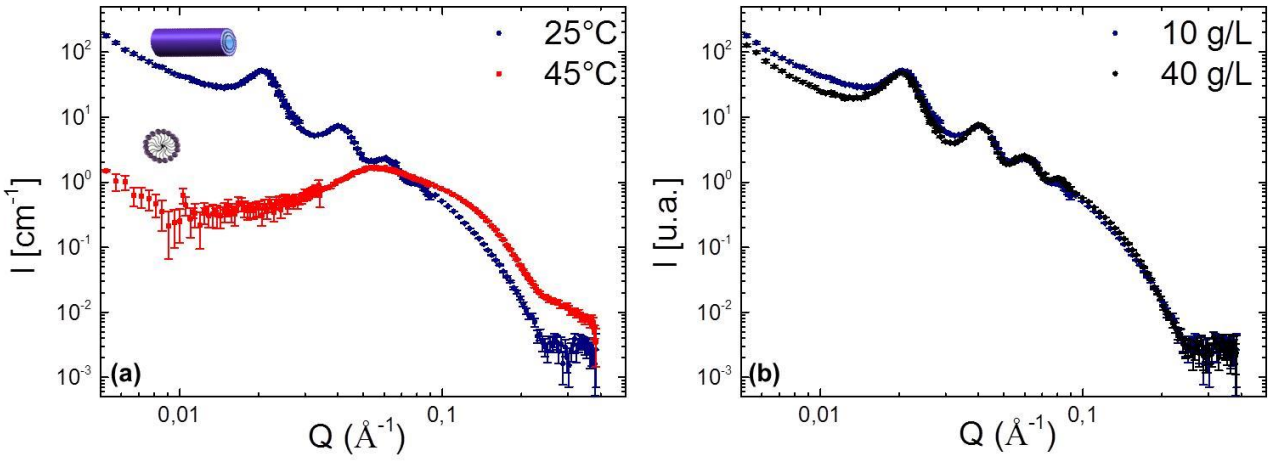

Fig. SI1 (a) SANS data at 25°C *(Blue)* and 45°C *(Red)* for the 12-HSA system at 10 g/L and r = 2 obtained at LLB France on PAXY spectrometer. **(b)** SANS data at 25°C for the 12-HSA system at 10 g/L (*Blue*) and 40 g/L (*Black*) with r = 2. The data have been shifted in intensity for the sake of clarity.

In the SANS curve at 25°C, four peaks are clearly observed and show that tubes are formed by periodically stacked bilayers of 4 nm with an interlayer spacing of 30 nm (Fig SI1 a). This system forms multilamellar micron-size tubes. However, at 45°C the spectrum is completely different and corresponds to the presence of spherical micelles in solution. This result is similar to previous results obtained for 12-HSA tubes with r=1 as a function of temperature.[1, 2] In figure SI1 b, the data have been shifted in intensity to show that Bragg peaks are localized at exactly the same Q-position, demonstrating that fatty acid tube structure at the local scale remains the same regardless the 12-HSA

concentration. This result is in agreement with previous results obtained for 12-HSA tubes with r=1 at various 12-HSA concentrations.[2]

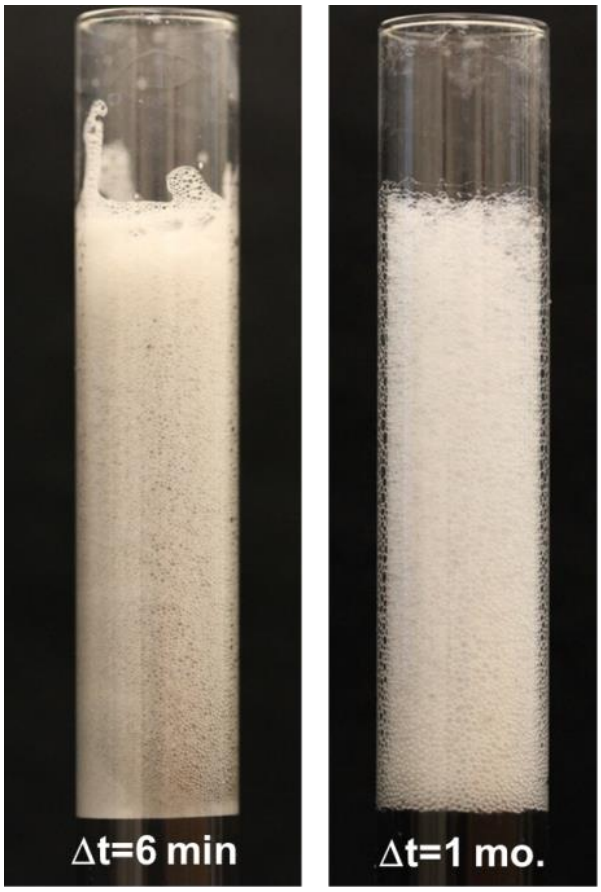

Fig. SI2 Photographs of foams taken **(a)** 6 minutes and **(b)** 1 month after foam formation for a sample containing 10 g/L 12-HSA tubes and 1 g/L Monarch®800.

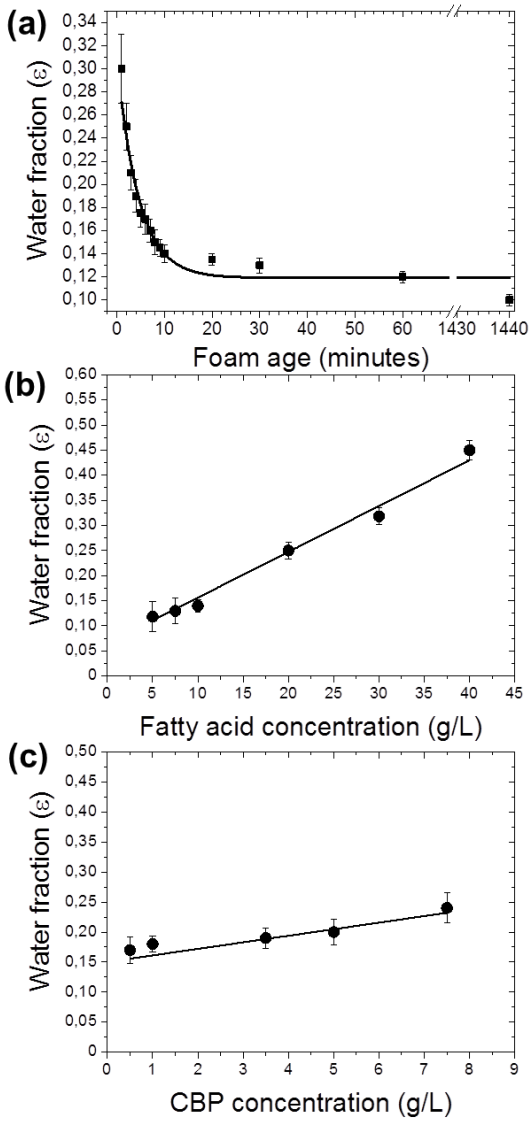

Fig. SI3 (a) Water fraction decay in foam containing 10 g/L 12-HSA and 1 g/L CBP (Monarch®800). **(b)** Water fraction in the foam as a function of 12-HSA concentration with 1 g/L of Monarch®800 10 minutes after the foam formation. **(c)** Water fraction in foam as a function of the Monarch®800 concentration at a constant 12-HSA concentration of 10 g/L. Water fractions for the samples were taken 6 minutes after foam formation.

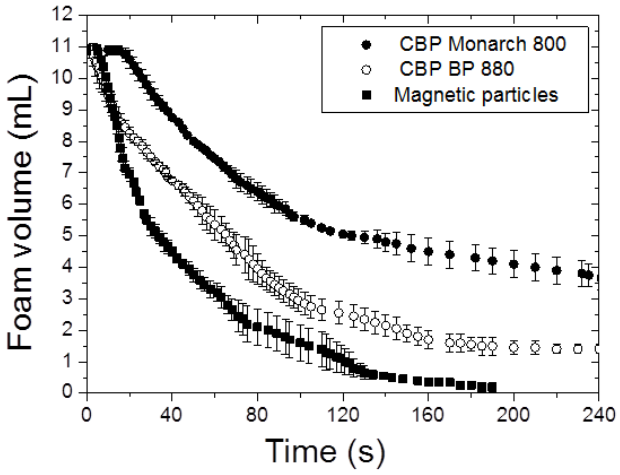

Fig. SI4 Foam volume decay as a function of illumination time for foams having a fixed concentration of 12-HSA (10 g/L) and different types of particles: carbon black particles - Monarch®800 and Black Pearl®880- and carbonyl iron particles 6 minutes after the foam formation.

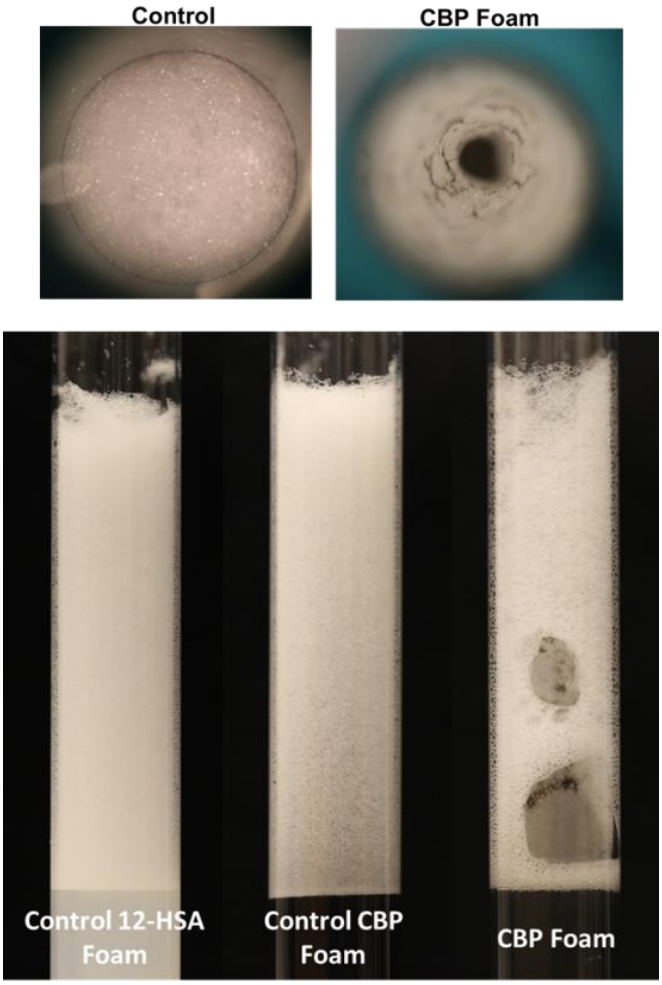

Fig. SI5 Photographs of foams after solar illumination. Control 12-HSA foam samples contain 10 g/L fatty acid, and photoresponsive foam samples contain 10 g/L 12-HSA and 1 g/L Monarch®800. All samples were equilibrated for 24 hours at room temperature prior to testing.

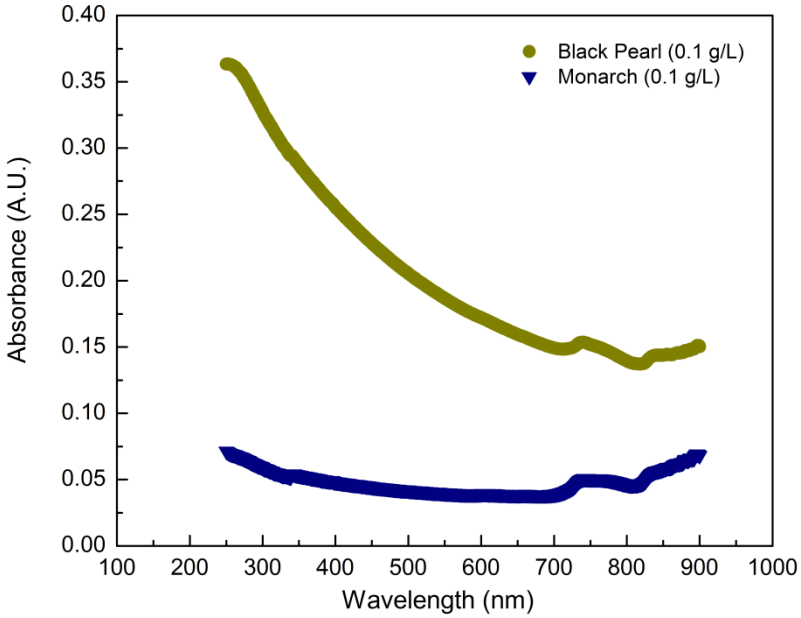

Fig. SI6 UV-Vis absorption spectra of carbon black particles. Plot shows the absorbance of Black Pearl®880 *(yellow)* and Monarch®800 *(blue)* (concentration = 0.1 g/L CBP in 0.04 g/L 12-HSA). Even at one-tenth the concentration of particles used in the foam samples, CBP suspensions show absorbance of light in the whole range of wavelengths tested. It is widely known that carbon black is an intense absorber of light and it has been previously shown that CBPs can absorb radiation in the near infrared range as well.[3] Absorbance for 0.04 g/L 12-HSA solution was measured over the same wavelength spectrum and absorbance of the pure solution between 200-900 nm was found to be ~ 0 A.U.

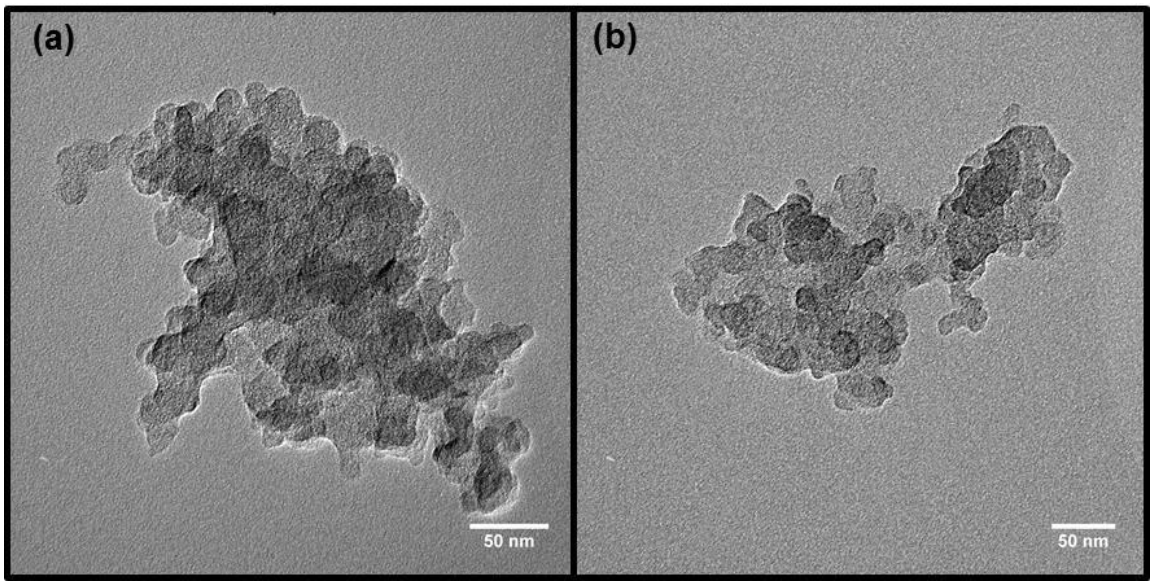

Fig. SI7: Transmission electron micrographs of **(a)** Monarch®800 and **(b)** Black Pearl®880. Most particles in the foam are aggregates of ~20 nm nanoparticles in both samples.

References

1. A.-L. Fameau, F. Cousin, L. Navailles, F. Nallet, F. Boue and J.-P. Douliez, *J. Phys. Chem. B*, 2011, **115**, 9033.
2. A.-L. Fameau, B. Houinsou-Houssou, B. Novales, L. Navailles, F. Nallet and J.-P. Douliez, *J. Colloid Interface Sci.*, 2010, **341**, 38.
3. D. Han, Z. Meng, D. Wu, C. Zhang and H. Zhu, *Nanoscale Res. Lett.*, 2011, **6**, 1.