Supplementary Information (SI)

Stabilizing bijels using a mixture of fumed silica nanoparticles

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1. Silanization of H30 fumed silica particles

H30 silica particles were chemically modified using hexamethyldisilazane (HDMS) following the procedure described below: 0.5g H30, 0.2g HMDS and 2g ammonia solution were mixed together in 15g ethanol. The mixture was subjected to vortex mixing for 10 seconds, then sonicated in a VWR ultrasonic bath for half an hour. The silanization process continued for 20h at room temperature. The HMDS-modified particles were washed several times using ethanol; the wet particles were then dried at 50^{o}C for 24h before use.

2. Avoiding crystallization

The ethylene carbonate-rich (EC-rich) phase in the bijel should, in principle, crystalize when the temperature is lower than about 30°C. However, crystallization is not immediate. The lower temperature is, the faster EC-rich phase becomes solid. In practice, the bijel remains liquid for several hours at room temperature, which allows us to perform confocal imaging in a straightforward manner.

In the experiments, we chose a low quenching temperature (10°C) for the purpose of producing a fast cooling rate; this helps promote spinodal decomposition. The sample is enclosed in a 1mm path length optical cuvette. The single-phase mixture was quenched in the cold bath (10°C) for about 30 seconds, giving bijels such as that presented in Figure 1. We observed that the EC-rich phase would crystalize when the mixture was placed in the cold bath for about 2 minutes. Crystallization caused clear damage to bijel structures, which is immediately evident in confocal images (data not shown).

3. Particle wettability

Screening the wettability of H30, R972 and R812 fumed silica particles was carried out by simply shaking the mixture with equal volumes of EC-rich and xylene-rich phases. The continuous phase of the resulting emulsion is the liquid which wets the particle surfaces most readily.

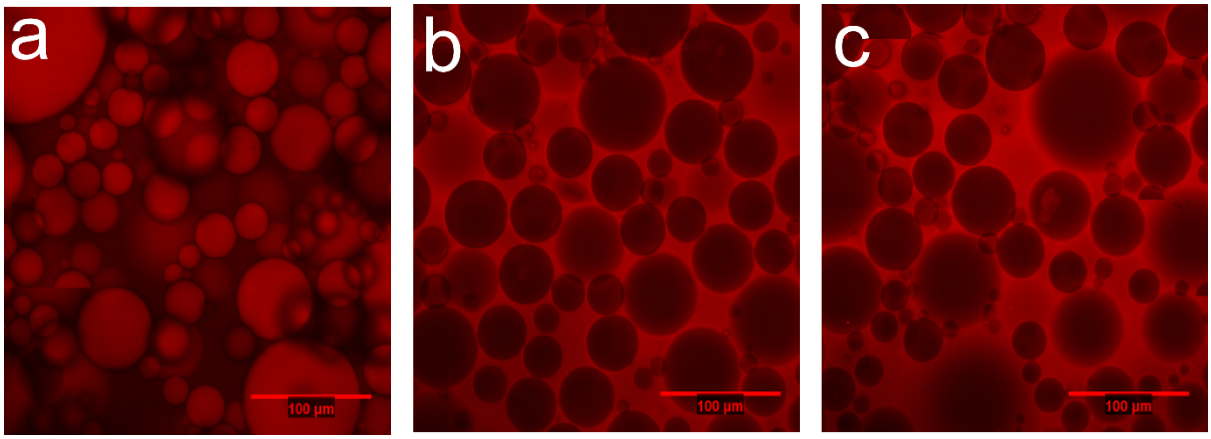

Figure S1 showing confocal images of the emulsions stabilized by 0.4vol% (a) H30, (b) R972 and (c) R812 fumed silica particles. The xylene-rich phase with Nile Red is shown as the red region in the confocal images

4. Formation of EC/xylene bijels

Ethylene carbonate (EC), p-xylene and treated particles (or particle mixtures) were added to a glass vial. The molar ratio of EC and p-xylene was fixed at 45/55 (mol/mol) according to the phase diagram in Figure 2. After heating up to 100^{o}C on a hot plate, the mixture of EC and xylene in the single-fluid phase was quickly sonicated by a tip ultrasound at a power of 5 watts for 10 seconds. Phase separation was avoided due to the heat generated by sonication. Then the mixture was quickly transferred to a glass cuvette preheated at 100^{o}C. Finally, the hot glass cuvette was quenched in a cold water bath (10^{o}C). The imaging was performed by confocal microscopy using a Zeiss Observer.Z1 inverted microscope in conjunction with a Zeiss LSM 700 scan head and a 20× 0.4 NA air objective or a 40× 1.3 oil objective. The fluorescent dye, Nile Red, was added to the xylene-rich phase and excited with a 488 nm laser line. Though we observed partitioning of Nile Red into both EC and xylene-rich phases, careful selection of emission filters allowed separate imaging of the xylene-rich phase (red region in Figure S1). Note: the xylene-rich phase in the bijel was deliberately labelled as grey for ease of visualization.