Internally Self-Assembled Submicronic Droplets stabilized by Colloids: Isotropic versus anisotropic morphology.

F. Muller¹*, A. Salonen², J. Jestin¹, A. Brület¹, O. Glatter³

¹ Laboratoire Léon Brillouin, CEA-Saclay, 91191 Gif sur Yvette Cedex, France.
² Laboratoire de Physique des Solides, CNRS UMR 8502 Université Paris Sud, France.
³ Department of Physical Chemistry, University of Graz, Austria.
*e-mail: francois.muller@cea.fr

Dispersions of liquid crystalline phases have been studied in detail over the past years, due to their potential as delivery vehicles for active molecules. The dispersions had until recently always been stabilized using polymeric stabilizers, which renders the interface porous and decreases their effective use for controlled release. Recently we showed the possibility of stabilizing these systems using colloidal particles to create stable, white emulsions with an average size of 200 nm and with a variety of internal structures (bicontinuous cubic, hexagonal, micellar cubic or micro-emulsion). We used two different colloidal stabilizers: disk-like clay with a diameter of around 25 nm and sphere-like silica also with a radius of around 25 nm.

The internal structure has been studied using small angle x-ray scattering (SAXS), whilst the size of the droplets has been measured using dynamic light scattering [1-4]. It is shown that the internal structure is not affect by either of the stabilizers whatever the form or the stabilizer concentration, but the size of the droplets depends on both parameters. Using SAXS measurements two stabilizer concentration regimes have been identified with or without nanoparticles in the continuous water phase. Small-angle neutron scattering has been additionally used in order to give new insights into the colloidal organization and stabilization mechanisms involved. Using the contrast variation method, we have studied all the different contributions separately. Remarkably, we have been able to demonstrate, for the first time, that depending on the morphology of the stabilizer (disc-like or spherical) the interfacial organization is very different [5]. We show that the spherical colloids do not form an armor around the particles, and the surface concentration is very low. In contrast when Laponite is used as the stabilizer an armor of stacked colloids seems to form at the interface. Finally, the behavior of the stabilized particles (and the stabilizers themselves) with added salt have been investigated using x-ray, neutron, and light scattering. The results lead to new insights into the stabilization mechanisms as a function of the colloidal morphology and concentration.