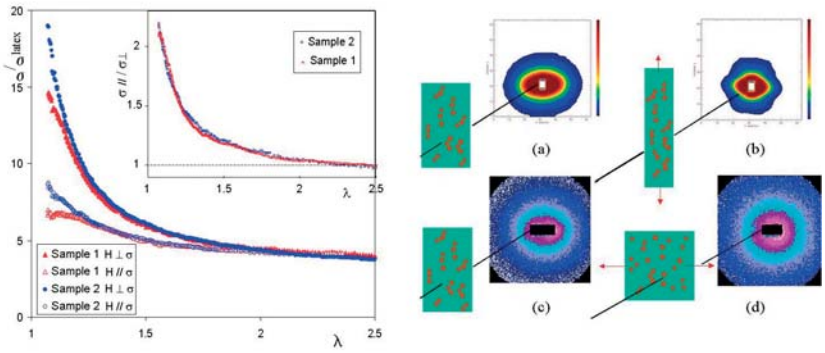
[C4. F. Cousin] **Anisotropic reinforcement of latex films by magnetic nanoparticles**

The mechanical properties of polymeric films can be strongly enhanced by the addition of mineral charges within the polymeric matrix. Recent work from LLB made on films obtained by mixing aqueous solutions of nanoparticles have shown that the mechanical reinforcement is controlled by the size and morphology of aggregates of silica nanoparticles after drying. The morphology of aggregates can be precisely tuned by the pH as is controls the surface charge of nanoparticles and thus electrostatic interactions between nanoparticles during drying. In order to get an additional degree of control on the morphology of the aggregates, we have replaced here the silica nanoparticles by magnetic nanoparticles (γ-Fe2O3) of the same diameter (~ 10 nm). The maghemite nanoparticles have firstly be coated by a thin silica layer to get exactly the same surface properties as the silica nanoparticles. We have then obtained homogeneous films latex reinforced by maghemite nanoparticles. When the film is dried without external magnetic film, dipolar magnetic interactions are negligible and the properties of the film are very similar to the one made with silica nanoparticles. When the films are dried under a magnetic film, nanoparticles form chainlike aggregates in the direction of the films. This has a dramatic effect on the mechanical properties of the film : the reinforcement is much higher in the direction parallel to the film than in the direction perpendicular to the film. The reinforcement anisotropy can reach a value of 2 at small deformation ! This is linked to the local structure of chainlike aggregates within the films determined by SANS. When the deformation is parallel to the applied field, aggregates organized themselves though they are broken when the deformation is perpendicular to the film.

[Collaboration : C. Ménager,V. Cabuil, LI2C, Université Paris VI, I. Dubois, J. Jestin, F. Boué, F. Cousin, LLB]



Left: reinforcement as a function of deformation (insert anisotropy of deformation)

Right: SANS experiments : (a) and (c) spectra before deformation, (b) deformation parallel to the field (d) deformation perpendicular to the field

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[C5. J. Vinas] **Stimuli-sensitive hybrid nano-objects: polymerisation from silica nanoparticles synthesized in aqueous medium.**

We are developing new methods in the synthesis of hybrid nano-objects polymer/inorganic particles in aqueous media. We are synthesizing monodispersed nanometric silica particles which are then functionalized through reaction with alkoxysilanes containing an initiator moetie. This new method allowed us to gain in the control of the colloidal stability and to improve the polymerization conditions through a higher amount of initiating sites. Moreover, the polymerisation of thermo- or pH-sensitive monomers will give us an additional degree of liberty in the control of the shape of our objects. These model objects may lead to potential applications as bio-markers, drug delivery systems or diagnostic tools. We use SANS to characterise in details the synthesized particles and the evolution in size of the particles with the change of some reaction parameters and by checking the colloidal stability through the different reaction steps (functionnalization, polymerization). Also, by using contrast matching, we can follow the evolution of the polymer layer with polymerization time. The next experiences will also focus on the characterization of the solution properties of our objects by varying the pH or the temperature.

[Collaboration : J. Vinas, D. Gigmes, D. Bertin CROPS, Université de Marseille I,G. Carrot, F. Boué, LLB]

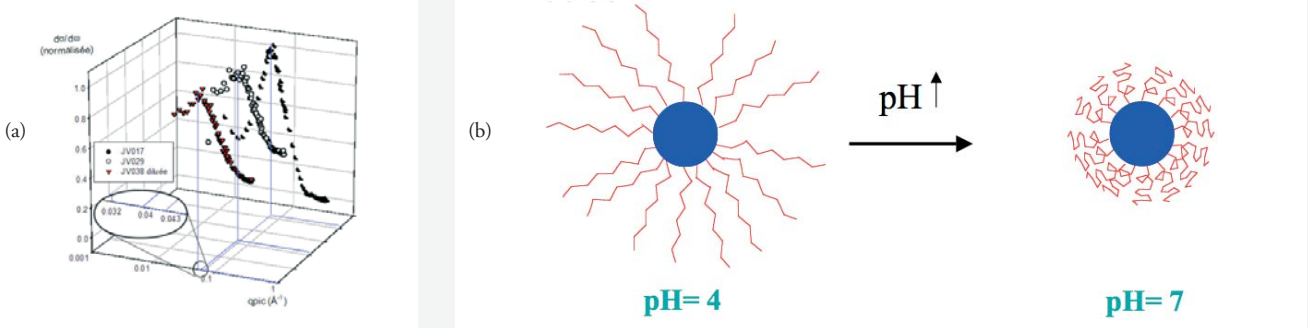

Figure 1. (a) SANS measurements of different particle sols. (b) Reversible changes in chains conformation depending on pH (stimuli-responsive polymers)