ESRF	**Experiment title:** Dynamics in ferrofluids as a function of size, surfactant length, particle concentration and magnetic field	**Experiment number**: SC-1864
Beamline: ID10A	**Date of experiment**: from:30-November-2005 to: 6-December-2005	**Date of report**: 23-January-2007
Shifts: 18	**Local contact(s)**: Aymeric Roberts	*Received at ESRF:*

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Report:

Ferrofluids are dispersions of magnetical nanoparticles typically suspended in a liquid solvent. In general ferrofluids behave like isotropic liquids possessing high magnetic susceptibility. This fact makes ferrofluids to be of great potential for several industrial applications. The stability of the magnetic particles against coagulation is achieved either by electrostatic repulsion or by coating with low molecular weight surfactants. Stable ferrofluids can also be formed by using high molecular weight polymers. In this case, a new type of nanocomposites are possible enable variation of the physical properties by external stimuli. In general, the application of an external magnetic field provoke the formation of elongated aggregates with the long axis parallel to the magnetic filed. X-ray scattering techniques have been extensively used to characterize conventional as well as ionic ferrofluids. However not much attention has been devoted to polymer-magnetic particles ferrofluids. In this experiment we have attempted to investigate the dynamics of the aggregation of the magnetic particles in a liquid and in a polymeric matrix. The SAXS from the polymer-magnetite ferrofluid under the influence of an external magnetic field and its comparison with a conventional ferrofluid allow us to preliminarily state that in spite of the higher viscosity of the polymeric medium, the polymer-magnetite ferrofluid behaves similarly to the conventional one.

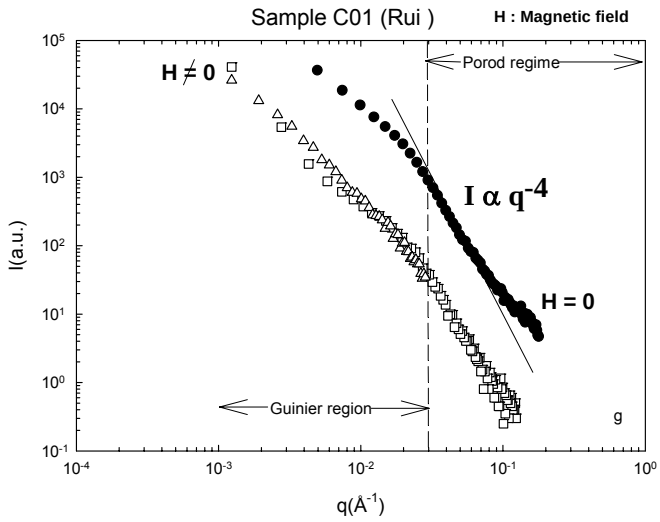

Fig. 1: Small angle X ray scattering from the polymer-ferroparticle sample under the influence of a magnetic field, and comparison with the scattering in the absence of field

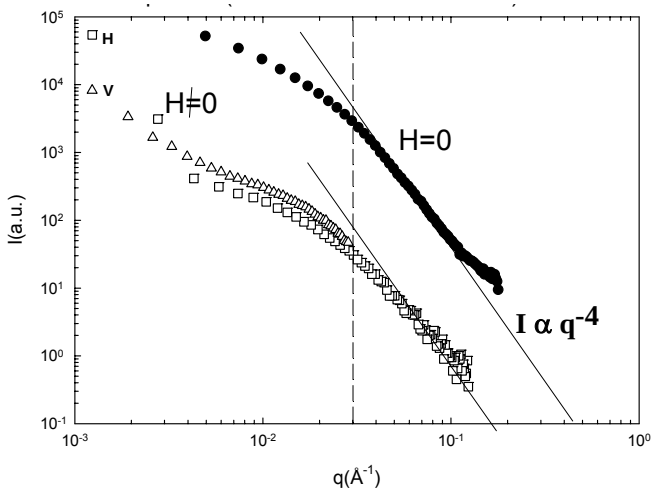

Fig. 2: Small angle X ray scattering from the ciclohexane-ferroparticle sample under the influence of a magnetic field, and comparison with the scattering in the absence of field.

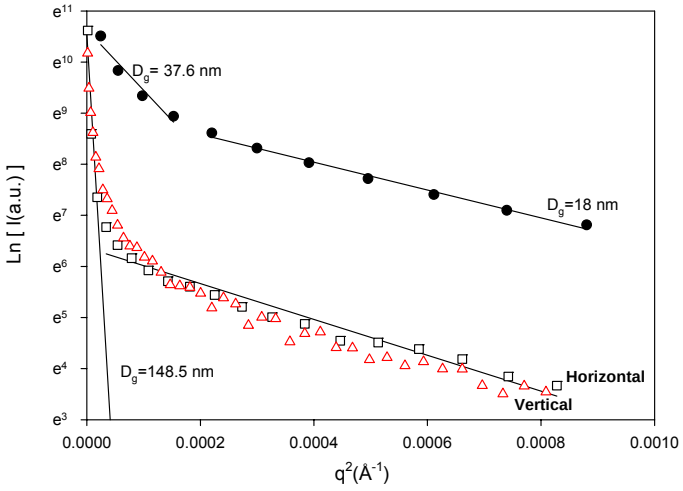

Fig. 3: Guinier representation of the obtained data in the case of polymer-ferroparticle system

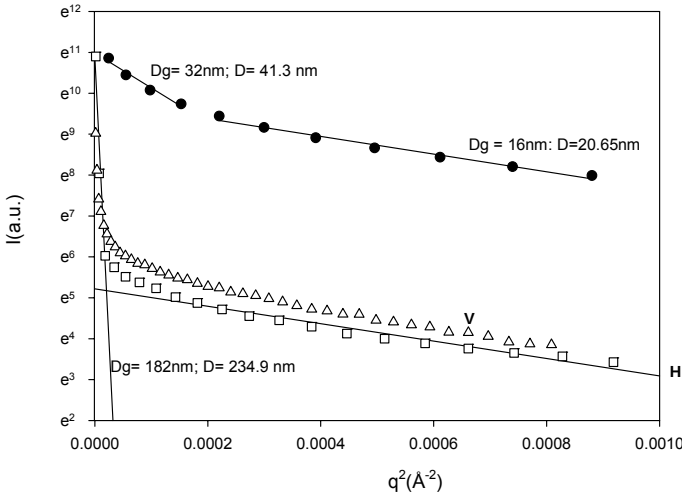

Fig. 4: Guinier representation of the obtained data in the case of cyclohexane-ferroparticle system

With H=0. The linear region at high q's can be interpreted as due to scattering of particles with diameter around 23 nm ($D= D_g(5/3)^{1/2}$). At lower q-values higher diameters (around 48.5 nm). Probably single particles of about 23 nm coexist with aggregates of about two particles. Also a distribution of particles with $48<D<23$ is possible.With $H \neq 0$. The slope at lower q-values increases. It seems that the magnetic field induces de formation of aggregates of about 148.5/18 ≈8 particles. No significant anisotropy is observed (Intensity vertical is similar to intensity horizontal)

From the experiments of XPCS performed on both the polymer-ferroparticle and the cyclohexano-ferroparticle systems we conclude that the aggregates contained in the samples diffuse with characteristic times $\tau < 10^{-3}$ s which are too fast to be observed by XPCS under the present experimental conditions. A new set of samples, where the viscosity of the polymer matrix can be tuned, have been prepared and a preliminar test is undergoing in ID10.