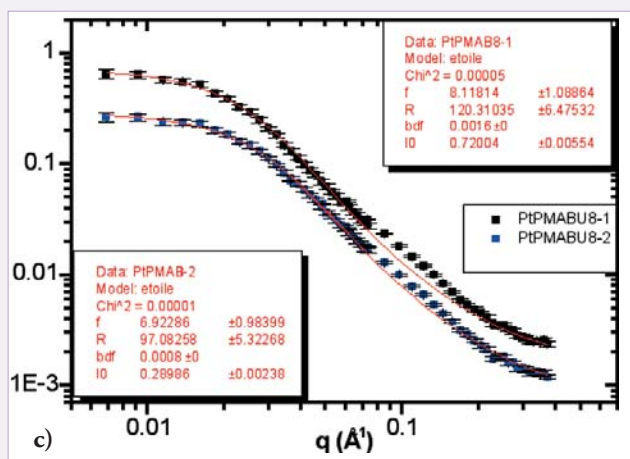
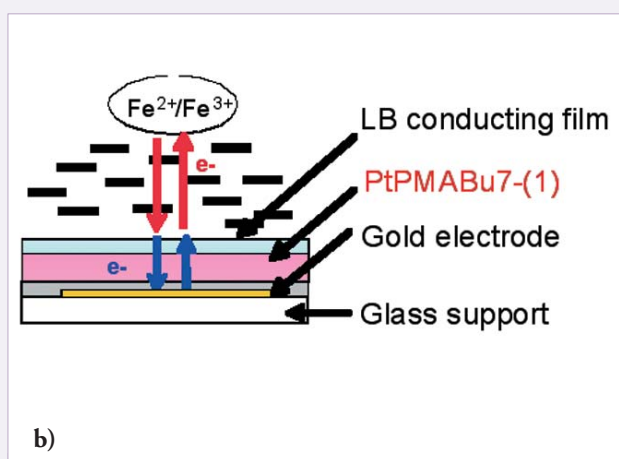
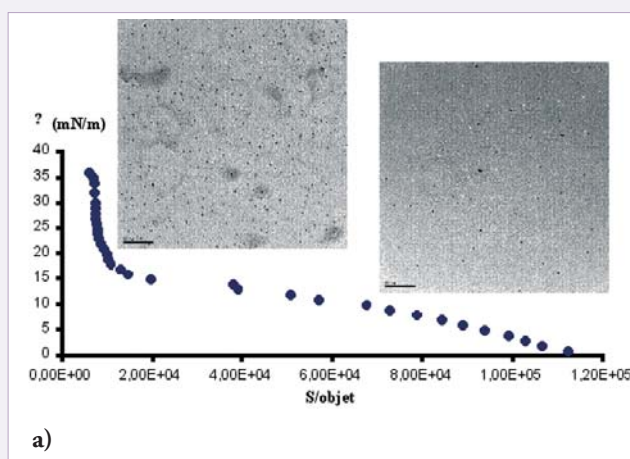


[C1. G. Carrot] Self-assembling via Langmuir-Blodgett films and SANS characterisation of polymer-grafted platinum nanoparticles : a possible application in fuel cells.

We synthesized platinum nanoparticles possessing electrocatalytic properties which are used as catalyst in the reduction of oxygen in fuel cells. The study of their electrical and electrochemical properties is performed after deposition on gold electrodes via Langmuir-Blodgett (LB) films. To improve the dispersion of the particles in the LB film as well as the deposition step, we grafted polymer chains onto the platinum



nanoparticles. Well-dispersed LB films can be obtained directly from the polymer-grafted-particles solution and the distance between particles may be adjusted depending on the degree of compression (Figure 1a). We are currently conducting electrical and electrochemical measurements onto these materials and the transfer onto gold electrodes can be done without the presence of fatty acid (Figure 1b). SANS spectra of two polymer-grafted nanoparticles with different molecular weights but the same grafting density are shown in Figure 1c (particle matching). First they show a plateau at small q which attests that the objects are individual and well-dispersed. We used a model of polymer star (chains connected together to a very small core) to fit the form factor. This model permitted us to determine both the number of chains (between 5 and 8, depending on the polymerisation batch), the radius of gyration of the polymer corona and the chain molecular weight.

[Collaboration : G. Carrot, LLB, H. Perez, SPAM, CEA-Saclay]

Figure 1: (a) Compression isotherm from polymer-grafted platinum nanoparticles and corresponding TEM images at different degrees of compression (surface pressure, $P=2$ mN/m (left image); $P=26$ mN/m (right image)) (b) Configuration scheme for electrochemical measurements (c) Neutron scattering spectra obtained from the grafted polymer chains at two different polymerisation time (particle matching): fit with a polymer star mode (particle matching).

[C2. K. Lagréné] Dynamics of a polymer confined in macroscopically monodisperse oriented pores.

Thanks to numerous theoretical developments spanned over few decades, it is now possible to draw a close relationship between polymer rheology in the bulk and polymer dynamics at the molecular level. Nevertheless, numerous technical applications are a step forward of the theoretical developments and already take advantage of the peculiar properties of polymers in interfacial situations or deep confinement. In the scope of my thesis work, we focus on the influence of confinement on hydrogenated polyethylene oxide (^hPEO) with high molecular mass 100 000 g/mol (the critical entanglement mass ($M_C = 3600$)). As confining material, we use Anodic Aluminium Oxide (AAO) membranes. AAO are a class of materials showing an extremely well defined and anisotropic porous structure made of macroscopically aligned micrometers long cylinders with nanometre size diameter (Fig. 1). The isotropic "average out" of the dynamical information occurring in non-oriented systems can then be overcome by proper orientation of the AAO pores axe relative to the beam. The topology is described by the pore

diameter, D_p , the inter-pores distance, D_{int} , and channels length, L_c . We have shown that the topology can be tailored so as to obtain fairly mono-disperse pores with diameter in the range 11 to 45 nm. The Small Angle Neutron Scattering (SANS) contrast matching technique is used to evidence that PEO can be fully and uniformly confined within the AAO porous network. We probe the properties of the confined polymer by differential scanning calorimetry and incoherent quasi-elastic neutron scattering. The ratio R_G / D_p sharply drives the properties of the confined polymer. Upon confinement, for $D_p / R_G > 2$, a strong depression of the melting point temperature is observed but above the bulk melting point the PEO dynamics is not affected. For $D_p / R_G < 2$ no melting transition is detected and the PEO protons mean-square displacement is significantly reduced compared to the bulk behaviour.

[K. Lagrené and J.-M. Zanotti, *Proceedings of the QENS 2006 conference, MRS Symp. Proc.*, accepted.]

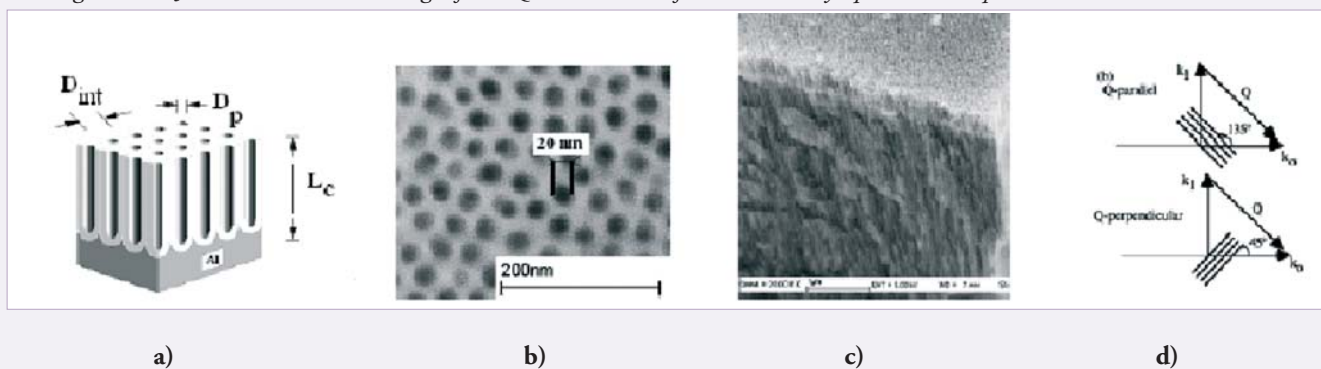


Figure 1. a) Schematic drawing of a porous alumina membrane. b) Scanning Electron Microscope (SEM) image of a LLB made AAO membrane. Here, the pore diameter is 20 nm. c) 3D SEM view of an actual LLB made AAO membrane showing the macroscopic alignment of the cylindrical pores in the bulk of the membrane (scale is 1 μm). d) Schematic illustration of how relative orientation of AAO samples to the incident beam (k_0) and measurement of the intensity scattered in a detector at $2\theta = 90^\circ$ (i.e. along k_1), can provide information (sensed along Q) on confined PEO dynamics parallel (top) and perpendicular (bottom) to the AAO cylinders axes.

[C3. N. Malikova] Dynamics of water and ions in clays: a concurrent TOF, NSE and MD study

The potential application of clays as components of barriers around underground storage sites of radio-active waste has recently intensified the study of mobility of water and ions (both natural, e.g. Na^+ , and potential radionuclides, e.g. Cs^+) in these systems. At a more fundamental level, these investigations shed light onto dynamics of liquids in confined charged media and phenomena at a solid/liquid interface. The dynamics of water in a montmorillonite clay has been investigated here on the picosecond timescale by quasi-elastic neutron scattering (time-of-flight (TOF) and neutron spin echo (NSE) techniques) and classical molecular dynamics (MD) simulations.

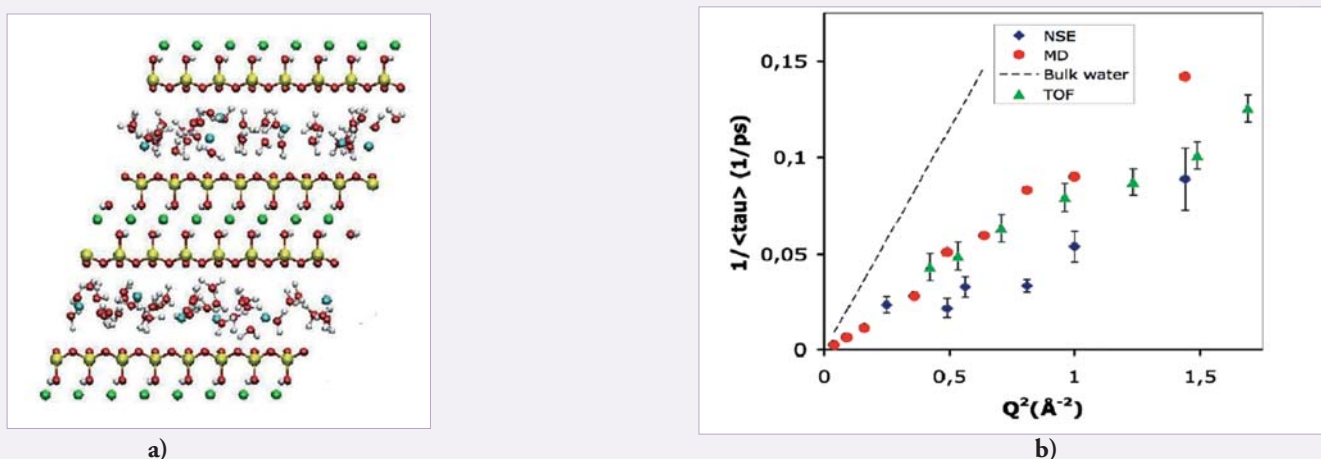


Figure 1. a) Atomic structure of a hydrated clay used in MD. Mobile species: water molecules (white and red), $\text{Na}^+ / \text{Cs}^+$ ions (blue). b) Inverse relaxation times versus the wave-vector for two-layer hydrate of Na-montmorillonite.