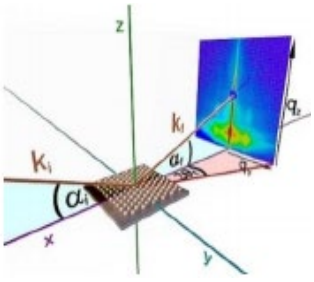
INTERNSHIP PROPOSAL

Laboratory name: **Laboratoire Léon Brillouin, CEA-CNRS**
CNRS identification code: **UMR 12**
Internship director'surname: **Alexis Chennevière / Frédéric Restagno**
e-mail: alexis.chenneviere@cea.fr / frederic.restagno@u-psud.fr
Phone number: +33667677870
Web page: http://www-llb.cea.fr/
Internship location: **CEA Saclay**
Thesis possibility after internship: **YES**
Funding: **YES** If YES, which type of funding: **ANR**

Enhanced Poly(Ionic Liquid) Lubricants: multiscale structure and interfacial properties

This internship is part of an ANR project for which a PhD funding is already secured and should start in October 2020.

Poly(Ionic Liquid) refer to a special type of polyelectrolyte in which each monomer unit is composed of ionic liquid (IL). They have recently drawn significant attention since they present a unique combination of the properties of ILs (e.g.high thermal, chemical, electrochemical stabilities, interfacial adsorption and enhanced ionic conductivity…) with those of polymer materials (e.g. processability, viscoelasticity, adhesion, film-forming properties, and broad macromolecular design...).
On a polymer physicist point of view, the main difference between an ideal polymer melt and PILs stems from the presence of counter-ions and local interactions between IL monomer units due to their amphiphilic nature. Preliminary experiments involving small angle neutron scattering have highlighted the influence of these local interactions on the conformation of PILs chains leading to a deviation from ideal polymer chains conformation. Such a deviation has a strong influence on the bulk viscoelastic properties of PILs which may lead to enhanced lubrication properties.
The aim the this internship is to probe and understand the molecular conformation of PILs chains close to an interface which plays an important role in lubrication. For this purpose, X-ray reflectivity (XR) and Grazing Incidence Wide Angle X-ray scattering (GIWAXS) will be used in order to probe the influence of the surface chemistry and the molecular parameters involved (i.e chains length , chemical composition).



(left) : Small angle neutron scattering spectra of PILs melt showing the deviation from the Gaussian chain at large Q.
(right) : Scheme of GIWAXS experiment. The incident X-ray beam (ki) is reflected by the sample. The off specular scattering is collected on a

During the thesis, additionally to structural characterization, the PhD student will study the lubrication properties of PILs using advanced velocimetry technique based on photobleaching. The PhD will benefit from the unique collaborative environment of the PhD project.