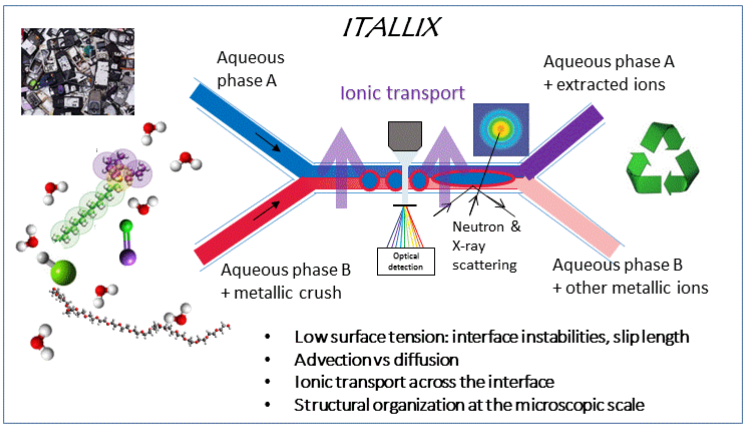
M2 intership offer

in the Laboratoire Interdisciplinaire de Physique, Grenoble :

Ionic transfer through a liquid-liquid interface of an aqueous biphasic solutions

Recycling without polluting is one of the biggest challenges that chemistry faces today. Regarding metals, recycling involves highly polluting liquid-liquid extraction processes, thus requiring innovative systems in this field. The recent development of acidic aqueous two-phase systems for extraction during phase separation induced by temperature variation has opened up new perspectives in this direction.
The system that we are currently investigating is a mixture of ionic liquid, water and strong acid, with a phase separation temperature higher than room temperature by a few tens of degree. It has a *Lower Solution Critical Temperature*, meaning that it is monophasic at room temperature and phase separates upon heating. Metallic ions can be dissolved thanks to the solution acidity, and migrate in the biphasic mixture to their preferred phase according to their own complexation properties. For a further exploitation of this family of mixtures, we therefore need to understand the nucleation process driving the phase separation as well as the diffusion processes of metallic ions through the interface. Moreover, to address specific questions related to an optimized industrial use, the diffusion has to be characterized under flow.
The first step of this internship will be to design a microfluidic device and perform the first tests to find the right geometry for a flat interface and optimal ionic transfer. Channel dimensions, solution composition (influencing the viscosity and surface tension), temperature as well as flow velocity are parameters to be adjusted.
In a second time, the device will be mounted on an optical platform enabling to do UV/Vis spectroscopy of the metallic ions along the channel and characterize the diffusion process along the flow.



The subject can be continued for a PhD, funded by the ANR ITALLIX.

Students with a background in physics, chemical physics or chemical engineering, with possible knowledge of basics of microfluidics, are welcome.

References :

1. Matthieu Gras, Nicolas Papaiconomou, Nicolas Schaeffer, Eric Chainet, Farouk Tedjar, Joao Coutinho and Isabelle Billard, *Ionic-Liquid-Based Acidic Aqueous Biphasic Systems for Simultaneous Leaching and Extraction of Metallic Ions.* Angew. Chem. Int. Ed., 57 (2018) 1563. https://hal.archives-ouvertes.fr/hal-01898075

2. Gautier Meyer, Ralf Schweins, Tristan Youngs, Jean-François Dufrêche, Isabelle Billard and Marie Plazanet, *How temperature rise can induce phase separation in aqueous biphasic solutions*. J. Phys. Chem. Let., 13 (2022) 2731–2736.
https ://hal.archives-ouvertes.fr/hal-03632709

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