Towards molecular separation. Electrified soft interface.

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In electrochemistry liquid – liquid interface is known as **ITIES** (**i**nterface between **t**wo **i**mmiscible **e**lectrolyte **s**olutions). Applications include energy conversion, liquid mirrors, pharmacokinetics or scanning probes and it can also serve as the electrochemical sensor. The sensing mechanism is unique, since it is not restricted to redox reactions, but can simply arise from interfacial ion transfer.

Nowadays the wide range of applications of membrane separation processes from liquid to gas separation are well known. Ceramic membranes show advantageous behaviour compared to polymeric membranes under harsh conditions including high pH, high temperature or the exposure to organic solvents.[1,2] The idea behind this work is to support the ITIES with alumina membranes modified with layer-by-layer (LbL) deposition of polyelectrolytes and to test this system as a potential size and/or charge extruder for the interracially active ions (see Figure 1 for schematics).

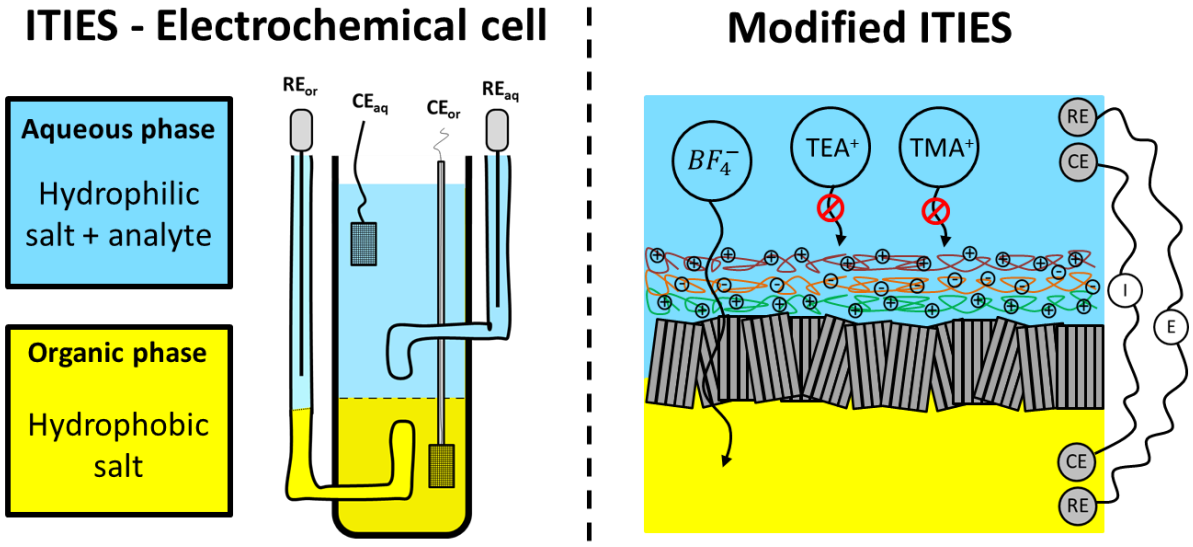

Figure 1. Left: Four-electrode electrochemical cell used to study liquid – liquid interface. The aqueous phase (blue) is a solution of highly hydrophilic salt whereas the organic phase (1,2-dichloroethane, yellow) is a solution of a highly hydrophobic salt. **Right**: Schematics of a liquid – liquid interface modified with a porous membrane and few layers of polyelectrolytes. The charge of the outer layer of polyelectrolyte is considered to be crucial for interfacial ion transfer. Abbreviations stand for: RE – reference electrode, CE – counter electrode, TEA^+ - tetraethylammonium, TMA^+ - tetramethylammonium, BF_4^- - tetrafluoroborate.

Methods:

- Cyclic Voltammetry;
- Infra-red Spectroscopy;
- Transmission Electron Microscopy;

Student tasks:

- Prepare literature background;
- Optimization of number of polyelectrolyte layers (study the dependency between the outer charge and number of monolayers and charge and size of transferring ion);
- Membrane characterization;
- Data treatment and report preparation.

Potential application:

- Electrochemical sensor

Literature:

(1) Amirilargani, M.; Sadrzadeh, M.; Sudholter, E.J.R.; de Smet, L.C.P.M. Surface modification methods of organic solvent nanofiltration membranes. *Chemical Engineering Journal* **2016** (286) 562-582

(2) Platt, M.; Dryfe, R. A. W.; Roberts, E. P. L. Electrodeposition of Palladium Nanoparticles at the Liquid–liquid Interface Using Porous Alumina Templates. *Electochim. Acta* **2003**, *48* (20-22), 3037–3046.