TECHNISCHE UNIVERSITÄT DRESDEN

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Two phase flow in a mili-/micro-fluidic channel: rare-earth extraction/stripping with/ without magnetic field (student assistant 19 h/week for 3 months + extensions)

Rare earth elements are group of 17 elements in periodic table. They have unique physicochemical properties which make them essential in many high-tech components, e.g. electric mobility, laser, catalyst etc. The separation of rare earths in industry is mainly done by liquid-liquid extraction, a technique of high environmental footprint. The separation is based on the marginal difference in their affinity against the extractant used. Hence, the separation factor, a parameter quantifying the "separability" of these elements, are small. Normally, hundreds of repeating stages has to take place in plants producing multiple single rare earth products.

We are actively researching a potentially more environmentally friendly alternative approach to improve the separation factor in solvent extraction of rare earths. One approach is to modulate their respective extraction kinetics. Rare-earth ions are affected due to their magnetic susceptibility in a stray field of a magnetic source. The Kelvin force that occurs, can selectively influence the extraction kinetics. Once the goal of establishing a functioning microfluidic flow system has been achieved, a magnetic field can be applied. Various experiments are carried out to separate rare earths in this way. This allows conclusions to be drawn about the reaction kinetics and a deeper understanding of the physical chemical processes can be obtained. For promising candidates there is subsequently the opportunity (***Belegarbeit/ Diplomarbeit***)) for further employment.

Major working package:

1. Design and assembly the experimental setup of two two-phase-flow systems, one with a slug-flow and one with a parallel-flow of aqueous and organic solution (Fig 1).
2. Add and adjust pumping system and creation control program
3. UV - Vis Spectroscopy for different rare-earth concentrations
4. Experimental study with/ without applied magnetic field

Requirement:

1. Interest on applied optical experiment
2. Basic chemical and fluid engineering knowledge
3. can handle common lab chemicals
4. Work conscientiously and safely
5. Capable of communication and some basic data analysis skill

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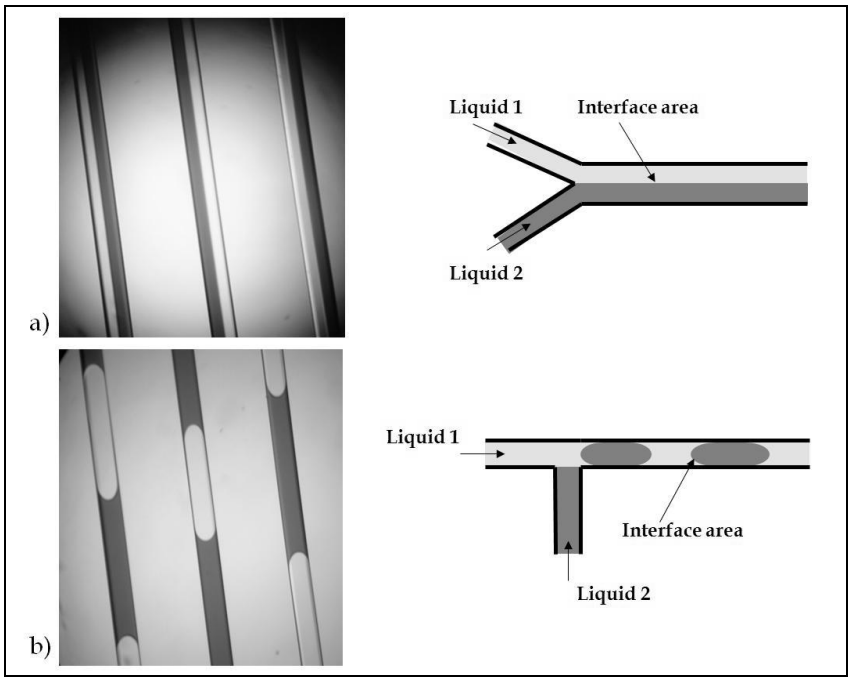

Fig. 1: flow patterns of (a) slug flow and (b) parallel flow