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Four modes of electrical conductivity extending over four orders of magnitude observed in extractant based microemulsions

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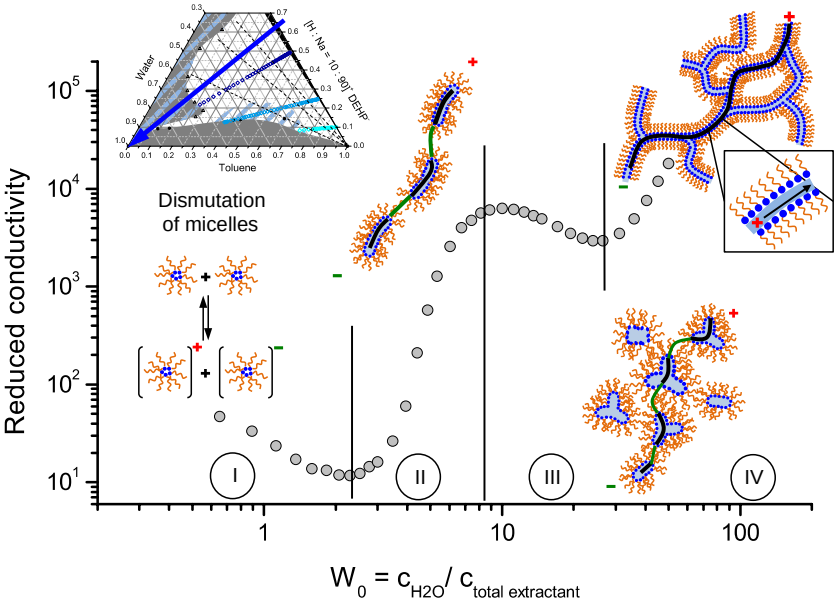
Abstract:

Reverse micelles and microemulsions are the core of all liquid-liquid extraction and recycling processes. Liquid-liquid extraction is currently the only known method to recycle magnets that are present in wind-mills. All known liquid-liquid extraction use the so-called Winsor II regime later renamed emulsification failure when a reverse micelle equilibrium is in equilibrium with excess water that contains the metallic cations that need to be selectively extracted and stripped back.

We use as model system the HDEHP an electrolytic but oil-soluble surfactant that is called "extractant" in the context of chemical engineering, for which the quaternary phase prism is available. The HDEHP/water/isooctane belongs to the class of flexible microemulsions, since the two hydrophobic chains are branched[1].



We experimentally determine the conductivity behavior along water dilution lines while keeping all parameters constants, varying only the proton to sodium ratio, i.e. the spontaneous curvature[2]. Confronting conductivity behavior observed along these different liens allows to identify and understand the condition of appearance of four completely different regimes of conductivity (I to IV) on the figure[3]. We will discuss and quantify the molar conductivity values in the four regimes.

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[1] *Dufrêche, J-François and Zemb, T. "**Bending: from thin interfaces to molecular films in microemulsions**". (2020) COCIS n°49 Pp133-147*

[2] *Lopian T., Dourdain S., Kunz W., Zemb T.; "**A formulator's cut of the phase prism for optimizing selective metal extraction",** Colloids and Surfaces A, (2018), 557, pp. 2-8*