Minicolloque n° MMM13 ☒ **Oral** ☐ **Poster**

Phase separation of a confined ionic-liquid – water mixture assisted by a temperature gradient

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Ionic liquids have remarkable properties and are commonly harnessed for green chemistry, lubrication and energy applications. In this paper, we study a thermoresponsive Water - Ionic Liquid (IL) binary mixture which has the property of phase separating above a critical temperature (LCST system). Thermoresponsive Water - IL mixtures have been proposed for various applications such as selective synthesis and extraction of chemical products or desalination [1]. We are interested in the separation process of both phases (in order to recover the phase of interest). For this purpose, we generate a temperature gradient in a microfluidic cavity where the confinement strengthens wetting effects and enhances the demixing.

Upon separation an emulsion forms in the cavity and the two phases rapidly segregate under the effect of the temperature gradient. The temperature dependence of the mixture composition and interfacial tension induce Marangoni strains at interfaces, which are responsible for 3D flows in the cavity. Thermocapillary forces impose the droplets direction of migration while the drainage of wetting films gives rise to shear flows oriented toward the warmer side. Altogether those mechanisms lead to the accumulation of the wetting phase near the heating source [2, 3]. We believe this work will find applications in the recycling of ionic liquids.

[1] C.-H. Hsu, et. al., ACS Omega, vol 4, 4296–4303 (2019)
[2] M. Pascual, A. Poquet, A. Vilquin, M-C. Jullien, Phys. Rev. Fluids, vol 00, 4000 1-15 (2021)
[3] M. Pascual, A. Amon, M-C. Jullien, submitted (2021)

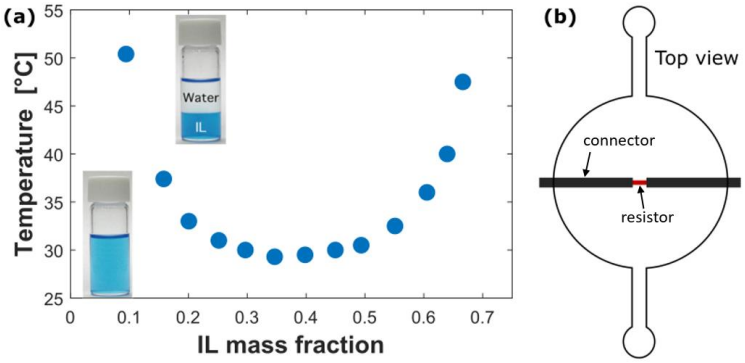

Figure 1 : (a) Phase diagram of the LCST (Lower Critical Solution Temperature) IL-water system. The solution is colored with a blue dye. Critical point is at 35 wt% in IL, and 29.2°C. (b) Top view of the microfluidic chip. Diameter is 1 cm.