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Droplet formation and lateral migration via solvent shifting in a microfluidic setup RAMIN HAJIAN, STEFFEN HARDT, Center of Smart Interfaces, TU Darmstadt — When a non-solvent is added to a solvent/solute mixture and if the solvent and the non-solvent are miscible, a part of the solute transforms to tiny (i.e. micron-/submicron-sized) droplets when the solvent concentration reduces. This phenomenon, resulting from supersaturation, is termed solvent shifting or Ouzo effect. Here we investigate this process in a co-flow microfluidic device. Thanks to the laminar nature of the flow, the mass transfer is mainly diffusive and can be analyzed employing (semi)analytical models. Using the resulting concentration profiles along with the ternary phase diagram (TPD) we analyze droplet formation and their lateral migration in the channel. The ternary system consists of a binary mixture (0.5wt% divinyle benzene (DVB) + 95.5wt% ethanol) and deionized water (non-solvent). Plotting concentration trajectories in the TPD we show that they hit the binodal curve in a region in which droplets of DVB form via nucleation, as opposed to spinodal decomposition. The lateral migration of droplets is partially attributed to the Marangoni effect induced by concentration gradients. However, the main effect governing droplet migration appears to be the phase-separation front (separating the one-phase and two-phase regions) moving toward the center of the channel.

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