Electronic Supplementary Material (ESI) for Molecular Systems Design & Engineering.

Supplementary information

Microfluidics of binary liquid mixtures with temperature-dependent miscibility

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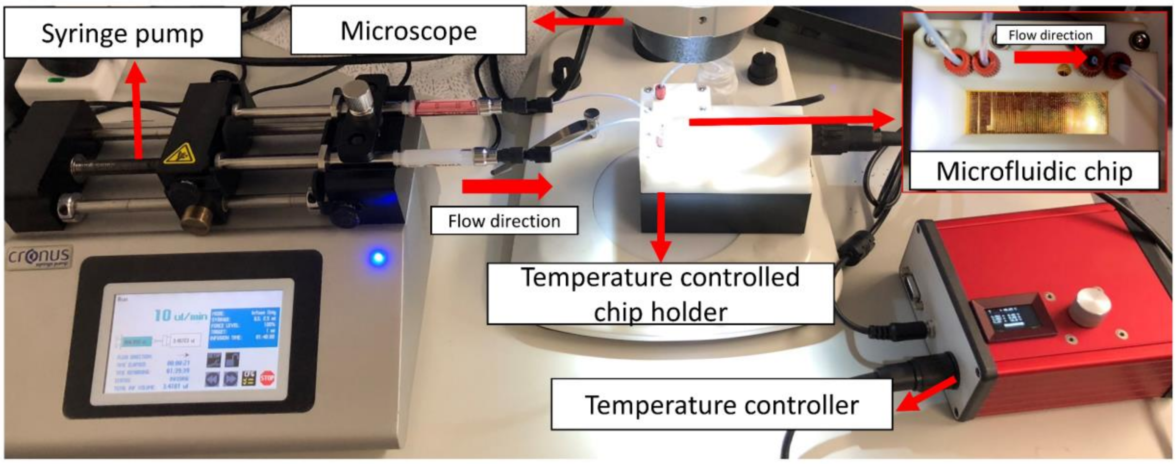

Figure S1 Microfluidics setup used to study mixing behaviour.

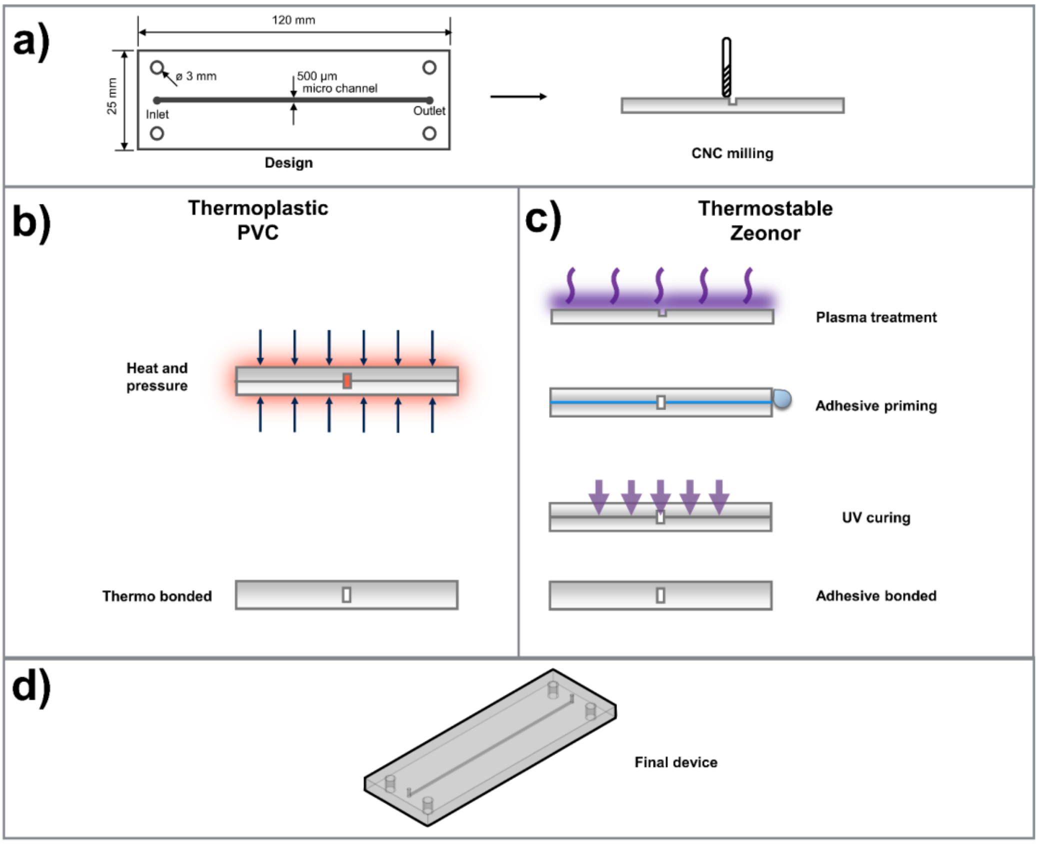

Figure S2 Schematic of the two fabrication processes used for the assembly of the microfluidic devices. A) First, chips were designed using a CAD software and machined with a CNC mill. B) For thermoplastic chips, heat and pressure was applied over two parts to induce thermobonding. C) For thermostable Zeonor chips, a UV-curable adhesive was used to bond upper and lower part. D) Final device.

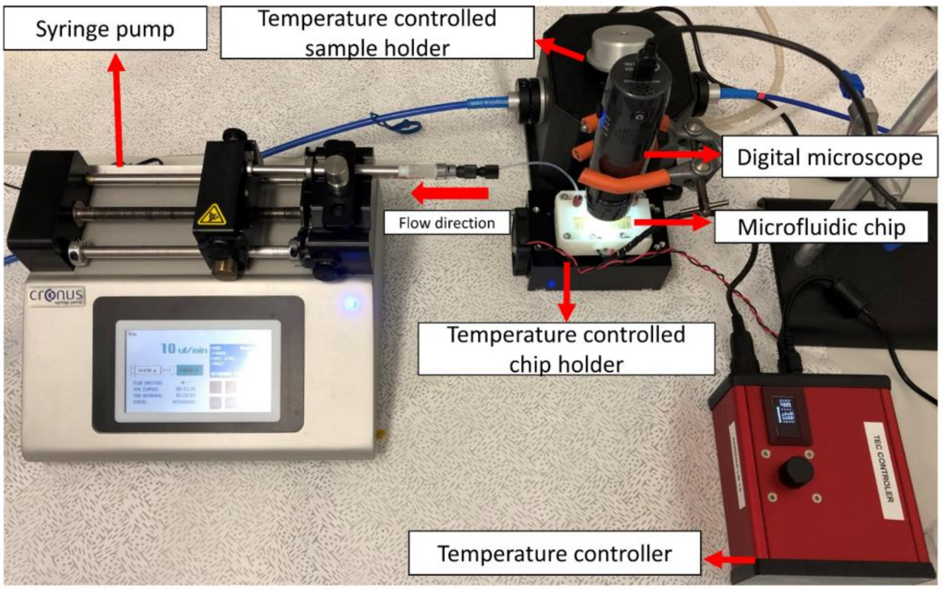

Figure S3 Microfluidics setup used to study phase separation.

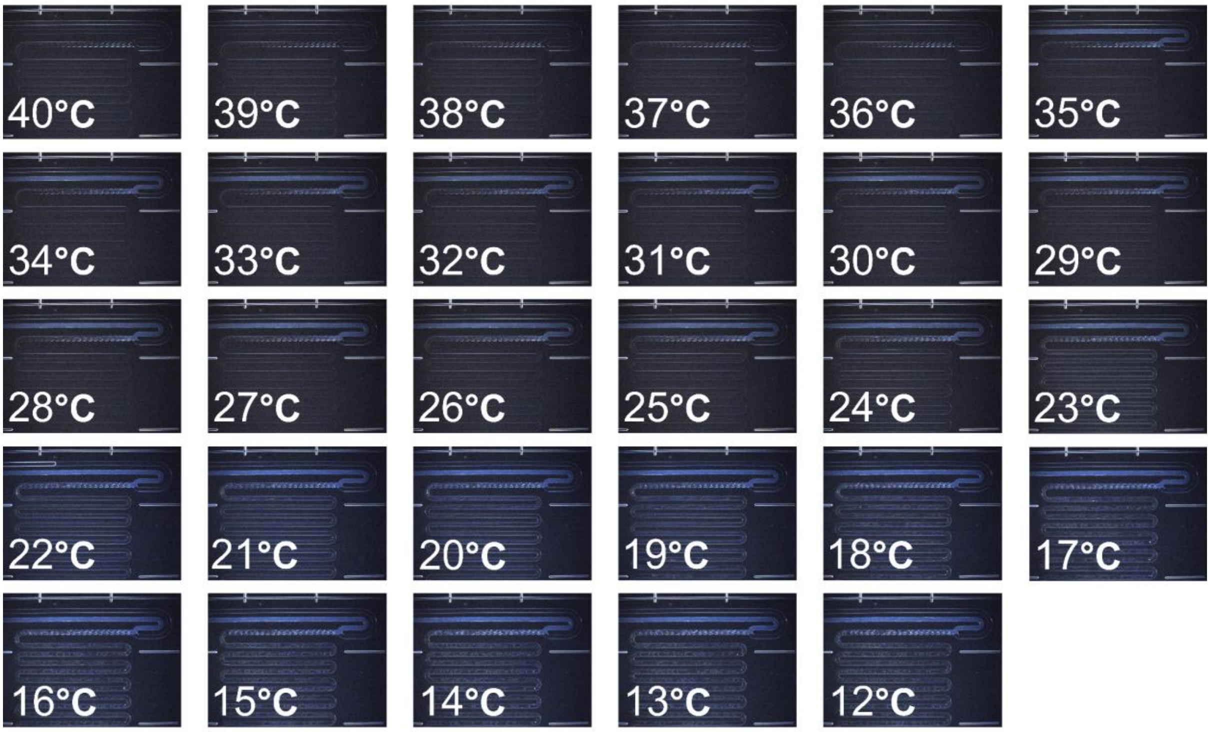

Figure S4 Mixing behaviour of 5CB and MeOH infusions, imaged at chip temperatures ranging from 40°C to 12°C. See Figure 1 in main manuscript for set-up details.

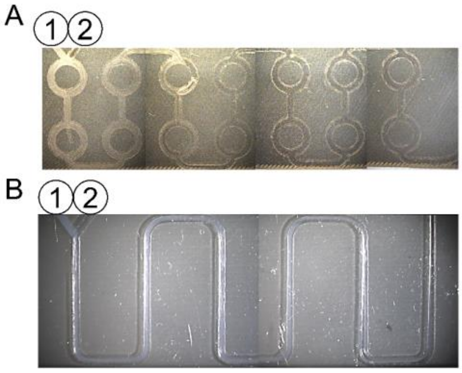

Figure S5 Alternative microfluidics passive mixers used to study mixing of 5CB and MeOH at 30 °C. A) split-ring micromixer and B) serpentine arrangement. Insets 1 and 2, indicate the 5CB and MeOH inlets, respectively.

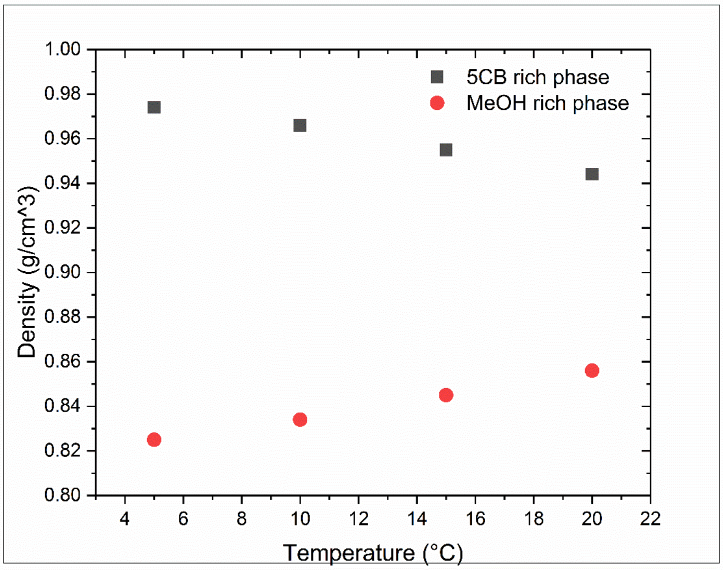

Figure S6 Density of 5CB-rich and MeOH-rich phases after phase separation. Values are based on a Lever-rule compositional analysis of the binary liquid mixture at different temperatures and linear interpolation of the phase pure density value for MeOH (0.791 g/cm3) and 5CB (1.008 g/cm3). We refer to L.A. Serrano et al., Soft Matter, 14, 4615–4620 (2018) (https://doi.org/10.1039/c8sm00327k) for the corresponding phase diagram.

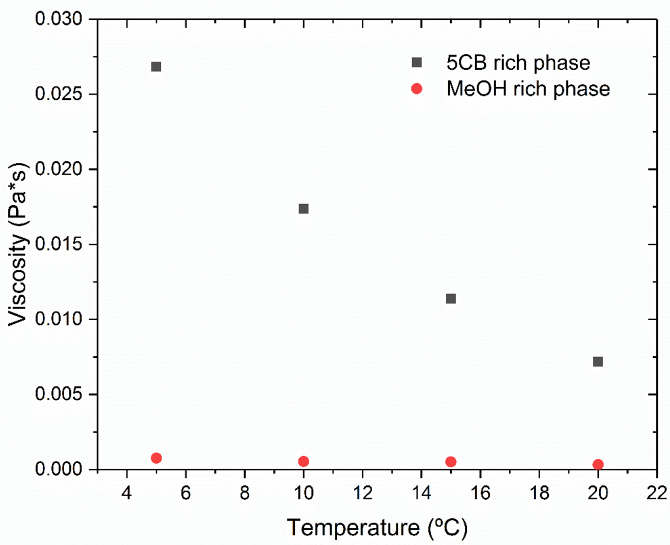

Figure S7 Dynamic viscosity at different temperatures. Samples were obtained from cooling the single-phase mixture from 40°C to the respective temperature. Sample aliquots were then extracted from the MeOH-rich and 5CB-rich phase, respectively.

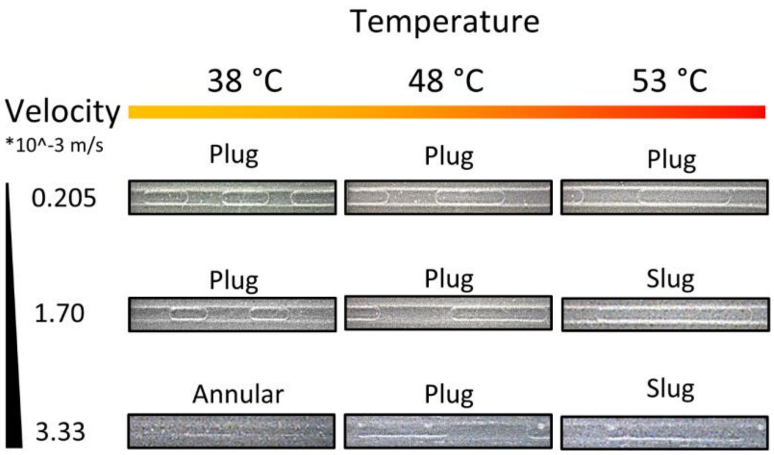

Figure S8 Flow patterns of the binary liquid mixture 2,6-lutidine/water at different velocity and temperature. This mixture phase separates upon heating (LCST).

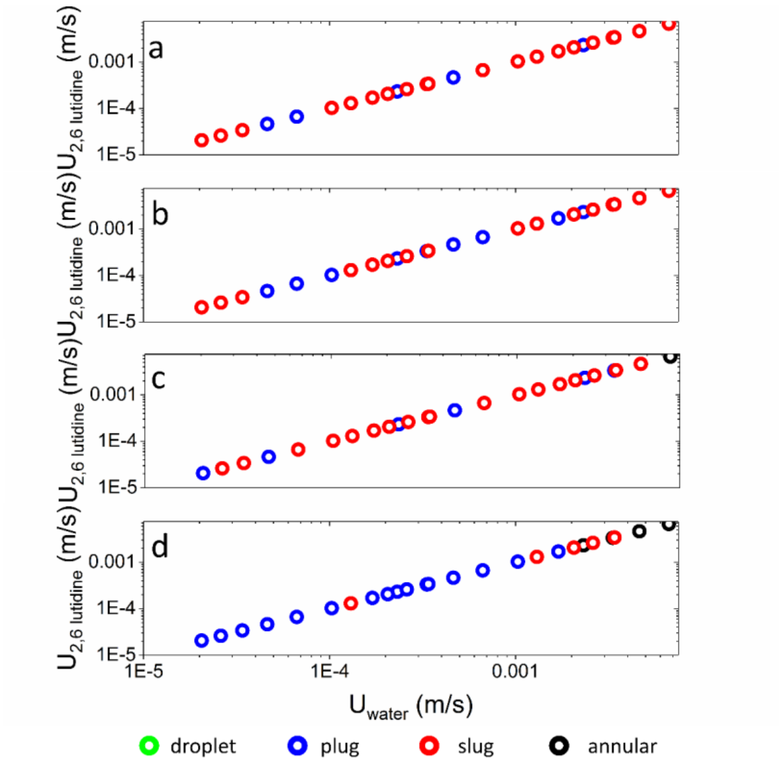

Figure S9 Estimated velocity of each phase after phase separation of a mixture 30/70 v/v mixture of 2,6-lutidine/water and corresponding two-phase regime observed. Three different regimes were observed, namely plug, slug and annular flow. a) 53 °C, b) 48 °C, c) 43 °C and d) 38°C. Note that annular flow regime appears at the coolest temperature, i.e. inverse to the mixture 5CB-MeOH, where annular flow developed at the highest temperature.