–SUPPLEMENTARY INFORMATION–
Temperature-induced liquid crystal microdroplet formation in a partially miscible liquid mixture

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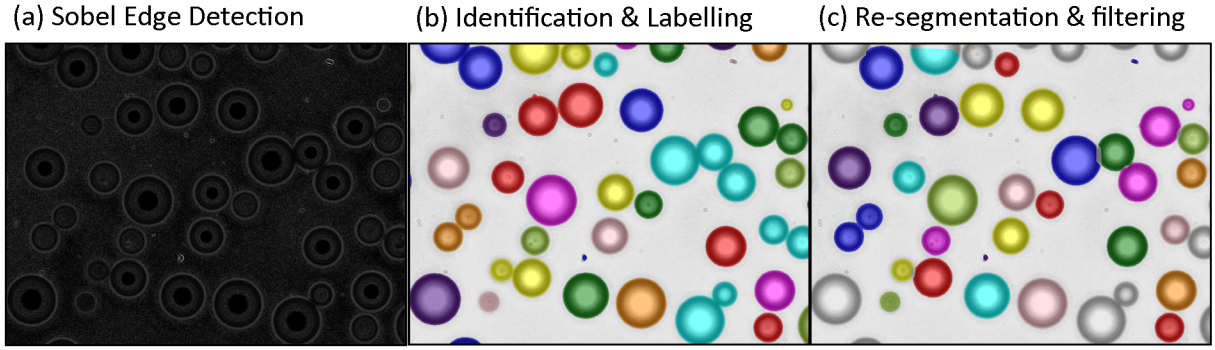
Automated Computational Analysis for Droplet Characterisation

Droplet images were recorded on an optical microscope (Zeiss, Axio Scope A1) connected to a digital camera at 50 frames per second for short term analysis (using Photron Fastcam MC1) and 1 frame per second for long term analysis (using Lumenera Infinity 3-3UR). The diameter and the number of droplets were measured from the recorded images using a routine developed on Python 3.5[1], along with *NumPy*[2], *SciPy*[3], *Matplotlib*[4], and *scikit-image*[5] modules. The script operated as follows. All images in a corresponding folder were opened and converted to a gray-scale format. The droplets in the images were subsequently separated from the background using a watershed algorithm, where a Sobel filter was used to identify the edges of the droplets (Figure 1a). The Sobel transform detects the edges of features based on the pixel gradients in the image, thereby preserving the size of the droplets. This resulted in a binary image. A *binary fill hole* step was then performed to ensure that all the pixels inside the droplets were also considered. A connected component labelling (CCL) step was subsequently carried out to distinguish between the droplets in an image, where each droplet was assigned a unique label (Figure 1b). The first watershed step did not separate droplets in contact with one another, and hence were identified as a single droplet. To address this issue, a second round of watershed algorithm was implemented, where a conditional filter chose features with $< 95\%$ circularity and a pixel area $>$ around $\frac{2}{3}$ of the average area of all droplets in a given image. The watershed algorithm was performed on one feature at a time in the binarised format, and the newly re-segmented droplets were issued unique labels (Figure 2). The new labels were over-written on the initially labelled image. Droplets touching the borders of the images were then removed to avoid analysing droplets that were only partially included in the field of view of the camera, as shown in Figure 1c. The equivalent circular diameter and the number of droplets in each frame were then calculated, stored in an array and later exported in the CSV file format. Pixel areas were converted to actual μm^2 based on the magnification used in the optical microscopy. Particle Size Distributions (PSDs) of the droplets in each frame were also calculated.



Supplementary Figure 1 | A representation of the steps taken by the computational script. (a) Edge detection performed by a Sobel transform that returns the gradient of an image. (b) Droplets identified after separation from the background through a watershed transform. (c) Processed image after re-segmentation of adjoining droplets, and filtering of partial droplets touching the edges of an image.

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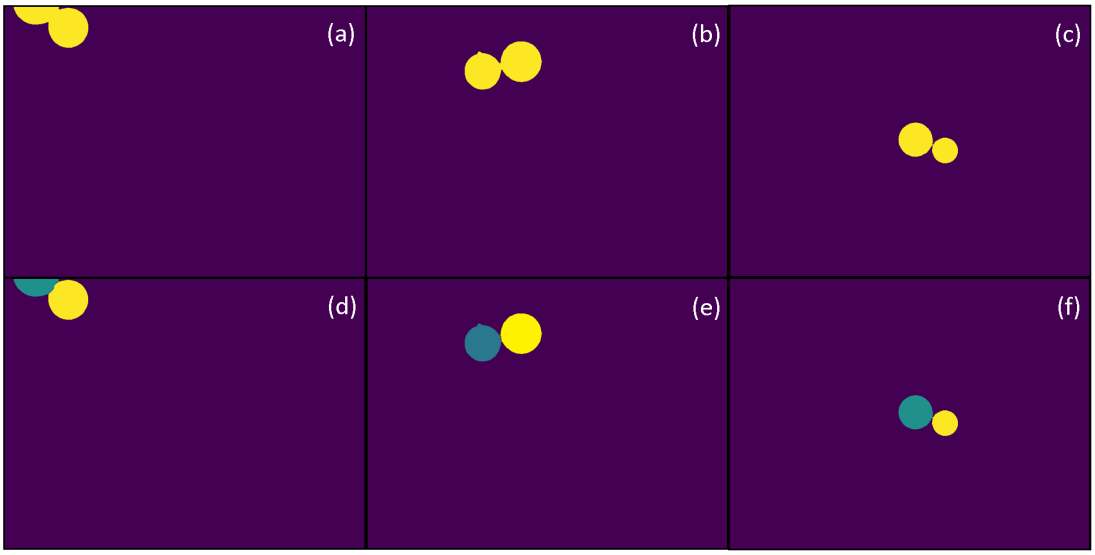
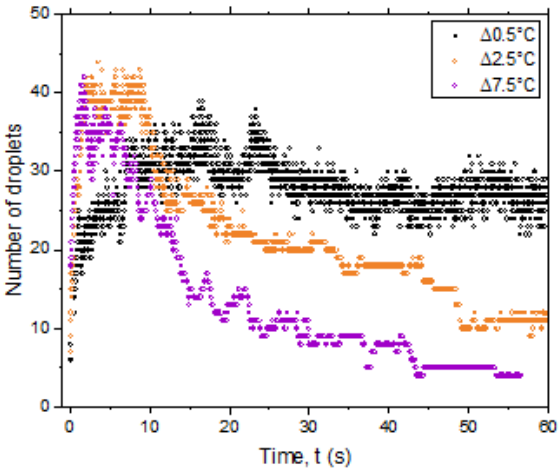
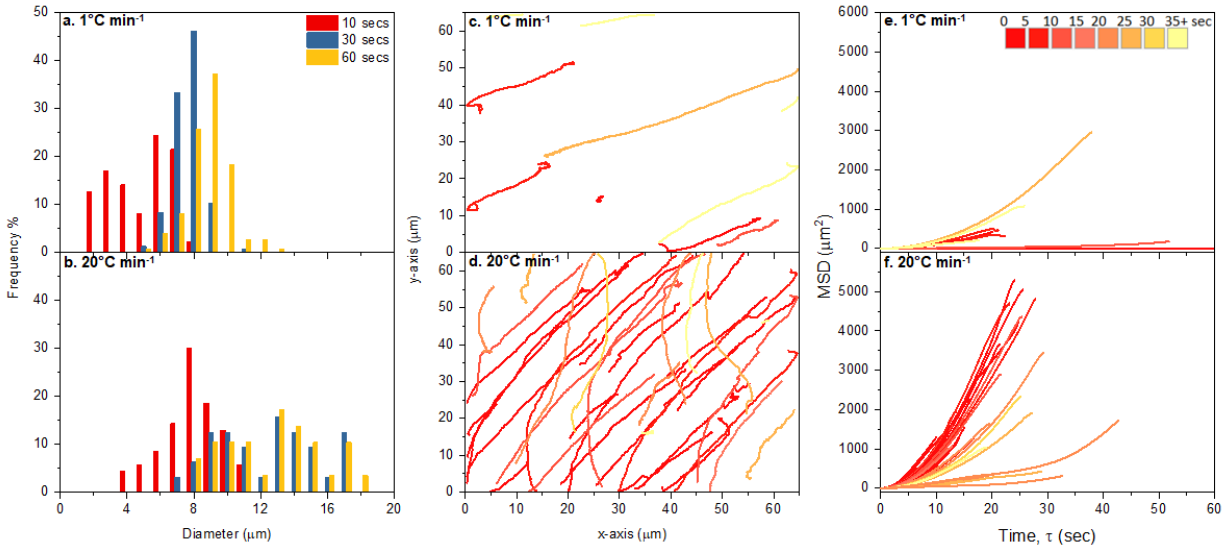


Supplementary Figure 2 | Sample images of the second watershed treatment to segment droplets in contact with one another. (a,b,c) Droplets identified as a single feature (yellow) distinguished from the background (purple) after the initial watershed segmentation and CCL step. (d,e,f) Droplets re-segmented from one another after a watershed treatment. A new label was assigned (green) to the segmented droplets to distinguish them from the initial droplet label (yellow) and the background (purple).

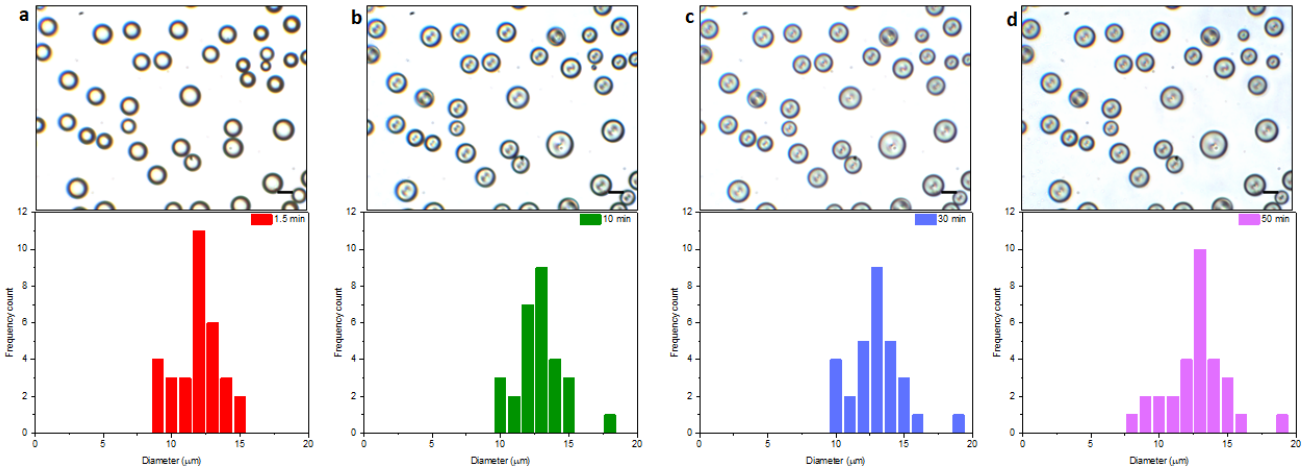
Further Experimental Results



Supplementary Figure 3 | **Effect of quench depth on number of isotropic droplets.** (a) The number of droplets over time is presented for a quench depth of $\Delta 7.5\,^{\circ}\mathrm{C}$, $\Delta 2.5\,^{\circ}\mathrm{C}$ and $\Delta 0.5\,^{\circ}\mathrm{C}$, respectively, at a cooling rate of $20\,^{\circ}\mathrm{C\,min^{-1}}$.



Supplementary Figure 4 | Dispersity and Trajectory of isotropic droplets (a-b) Polydispersity of 5CB droplets over time with cooling rates of (a)1 °C min^{-1}, (b)20 °C min^{-1}. (c-d) Trajectory of droplets along the x and y axis over the course of 60 seconds at cooling rates of (c)1 °C min^{-1}, (d)20 °C min^{-1}. (e-f) Mean Square Displacement of droplets at cooling rates of (e)1 °C min^{-1}, (f)20 °C min^{-1} over time. Quench depth: Δ7.5 °C



Supplementary Figure 5 | Polydispersity of nematic droplets over time. Image (top) and corresponding histogram (bottom) of 5CB droplets in MeOH, and their size when cooled at 20 °C min^{-1} after (a) 1.5 minutes, (b) 10 minutes, (c) 30 minutes and (d) 50 minutes, with a quench depth of Δ27.5 °C. (scale bar: 10 µm)

References

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