Supporting Information

Sandwich-format 3D printed microfluidic mixers: a flexible platform for multi-probe analysis

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I. COMSOL simulations

Numerical simulations were carried out to assess the linear velocity profile of each mixer's geometry that was tested. A 2D finite element model was computed on COMSOL Multiphysics Version 4.3a software (Comsol Inc., Stockholm, Sweden) using the parameters listed below (Table S1) and an extra-fine mesh. The models (Figure S1) were built in COMSOL using the dimensions and angles of the mixer, determined from images taken with the Olympus microscope. The simulations were performed by solving the incompressible Navier-Stokes equation and calculating the velocity vector at each element. The calculations used the physics package "Laminar Flow" to model the fluid dynamics.

Table S1: Parameters used for COMSOL numerical simulations

Mixer	Flow Velocities (m/s)
Cross-shaped	D_2O: 0.0057 (for 3 μL min^{-1})
	H_2O: 0.095 (for 50 μL min^{-1})
Droplet forming	Fluorescein: 0.0002 (for 0.25 μL min^{-1})
	KI: 0.0002 (for 0.25 μL min^{-1})
	Hexanes: 0.0133 (for 14 μL min^{-1})
Serpentine	Methyl Yellow: 0.012 (for 20 μL min^{-1})
	Ethanol: 0.012(for 20 μL min^{-1})

Table S2: 3D printing parameters

Parameter	Value
Nozzle diameter	0.35 mm
Print speed	10 mm/s
Nozzle Temperature	220 C

Bed Temperature	70 C
Nozzle Fan	100%
Layer height	0.2 mm
Fill Pattern	Rectilinear
Extrusion width	0.26 mm
Infill density	0.4

Table S3: Printed mixer channel diameter measurements

Annealed status	**Channel pixel width (pix)***	**Channel diameter (μm)**
pre-	727	400
pre-	665	366
pre-	731	402
pre-	856	471
pre-	715	393
post-	358	197
post-	207	114
post-	291	160
post-	196	108
post-	309	170
post-	245	135
post-	255	140
post-	309	170
post-	304	167

*Microscope resolution is 0.55 μm/pix

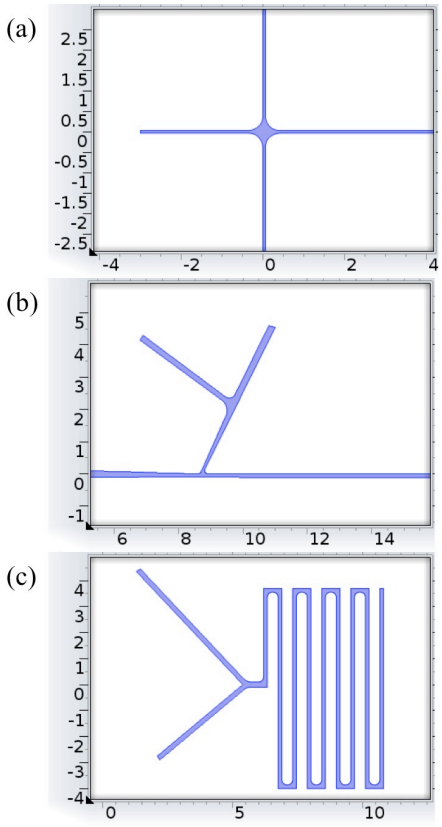

Figure S1: Geometries of the three mixers tested (a) cross-shaped mixer (b) droplet mixer (c) serpentine mixer

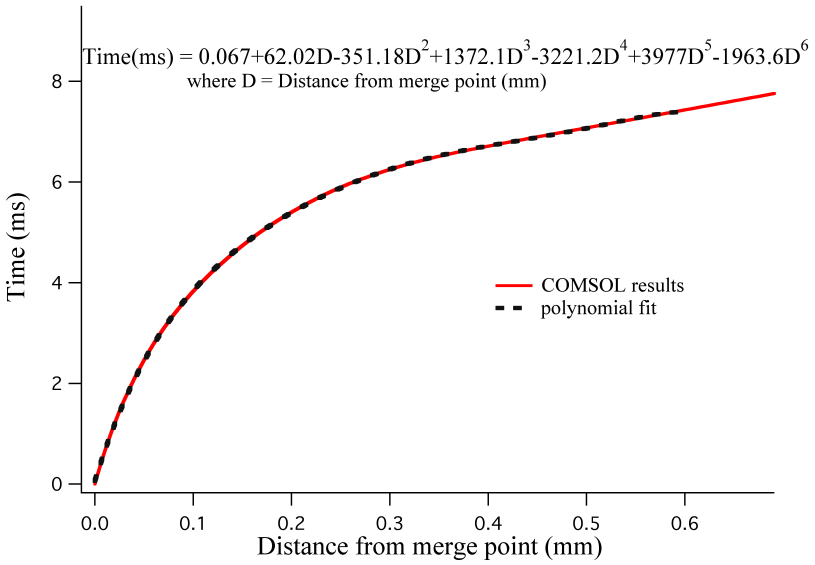

Figure S2: Time vs. distance plot showing the results from COMSOL simulations (solid line) and the polynomial fit (dashed line) used to convert from distance from the merge point in the mixer to time for the cross-shaped mixer

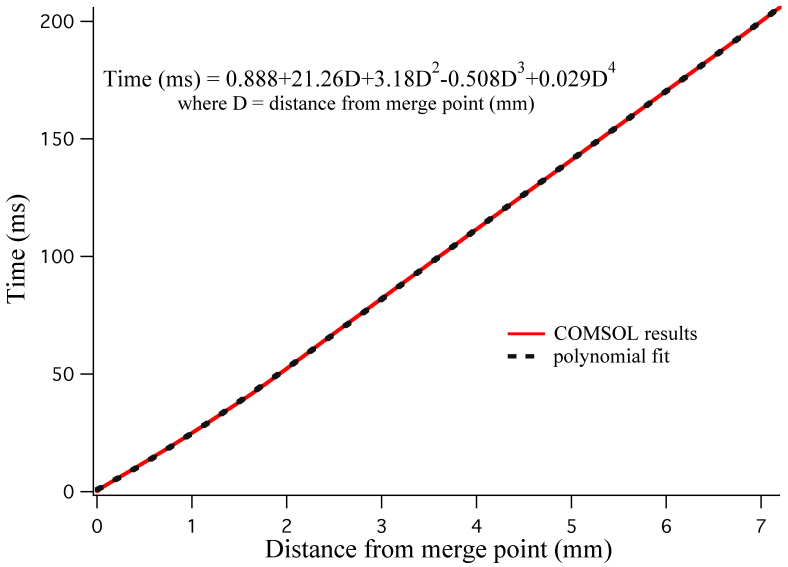

Figure S3: Time vs. distance plot showing the results from COMSOL simulations (solid line) and the polynomial fit (dashed line) used to convert from distance from the merge point in the mixer to time for the droplet mixer

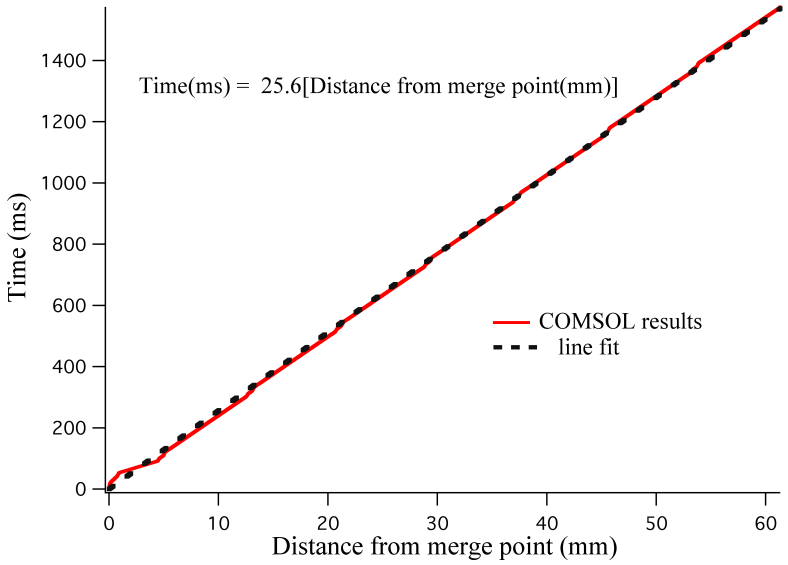

Figure S4: Time vs. distance plot showing the results from COMSOL simulations (solid line) and the linear fit (dashed line) used to convert from distance from the merge point in the mixer to time for the serpentine mixer