

RESEARCH ARTICLE

Roughness-engineered 3D-printed microfluidics for continuous glucose and lactate sensing in 3D in vitro tissue models

Supplementary Files

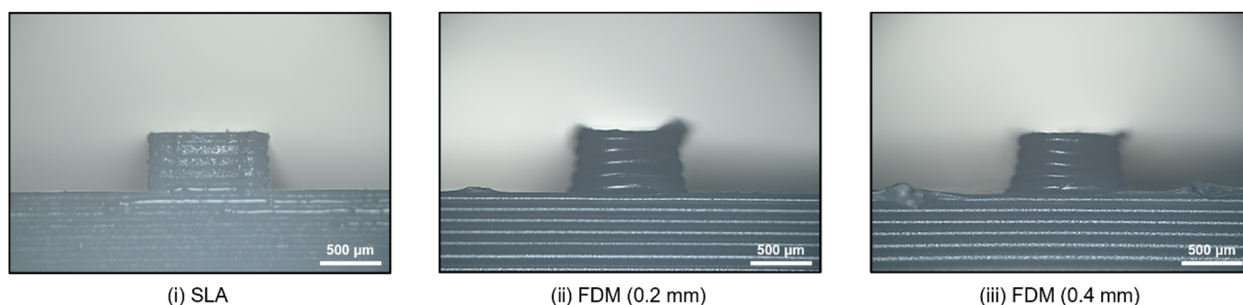


Figure S1. Cross-sectional characterization of the 3D-printed master mold

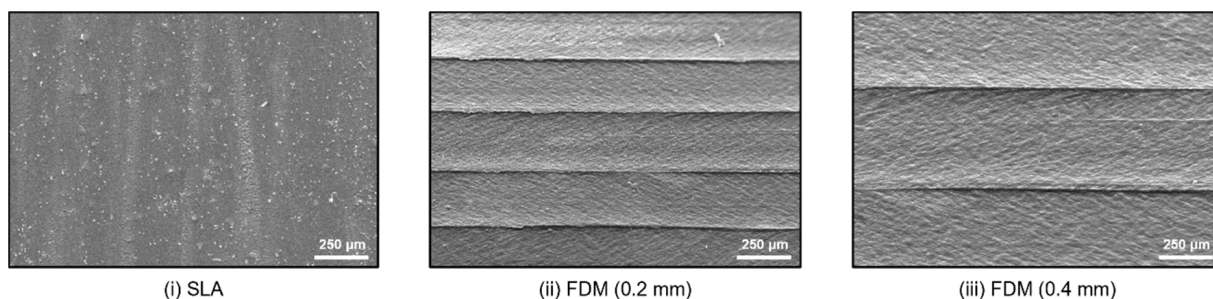


Figure S2. SEM images of the replicated PDMS surface morphology after demolding

Abbreviations: FDM: Fused deposition modeling; PDMS: Polydimethylsiloxane; SEM: Scanning electron microscopy; SLA: Stereolithography.

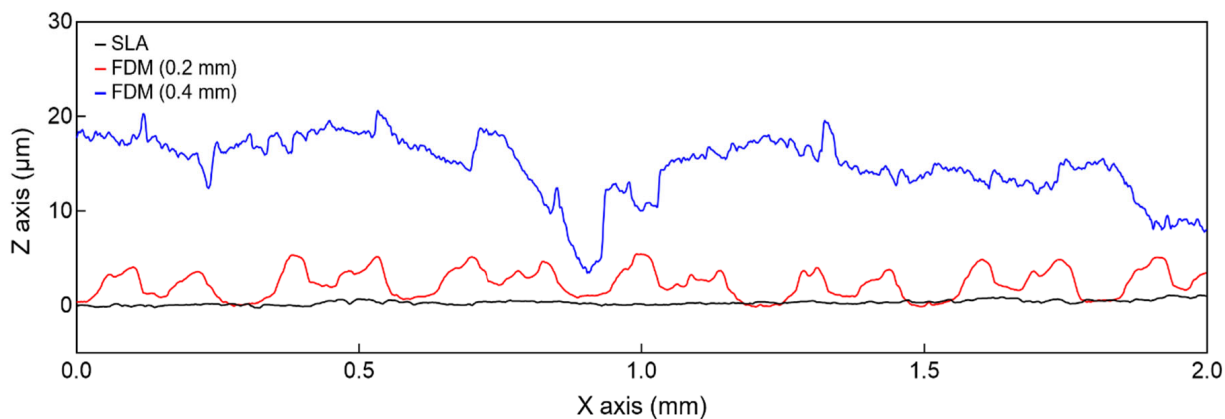


Figure S3. Quantitative surface profile of the replicated PDMS micro-topography

Abbreviations: FDM: Fused deposition modeling; PDMS: Polydimethylsiloxane; SLA: Stereolithography.

Table S1. Quantitative assessment of part-to-model dimensional fidelity

Sample	Master molds Width (μm)	PDMS Thickness (μm)	Sample	Master molds Width (μm)
CAD design	1,000	500	CAD design	1,000
SLA	999.1 \pm 0.887	498.6 \pm 1.135	SLA	999.1 \pm 0.887
FDM (0.2 mm)	987.3 \pm 3.421	496.7 \pm 2.264	FDM (0.2 mm)	987.3 \pm 3.421
FDM (0.4 mm)	990.4 \pm 2.112	495.3 \pm 2.871	FDM (0.4 mm)	990.4 \pm 2.112

Notes: The data are presented as mean \pm standard deviation (SD) with $n = 3$, where n is the number of samples.

Abbreviations: CAD: Computer-aided design; FDM: Fused deposition modeling; PDMS: Polydimethylsiloxane; SLA: Stereolithography.

Table S2. Summary of electrochemical sensing performance parameters for glucose and lactate across different platform configurations

Target	Fabrication method	Sensitivity (nA/mM)	LOD (μM)
Glucose	Non-microfluidic	3.071 \pm 0.0520	44.24 \pm 2.134
	SLA-based (smooth)	5.104 \pm 0.139	31.95 \pm 3.411
	FDM-based (rough)	6.983 \pm 0.0335	15.21 \pm 4.785
Lactate	Non-microfluidic	2.599 \pm 0.0804	16.57 \pm 1.379
	SLA-based (smooth)	3.537 \pm 0.0777	16.26 \pm 1.989
	FDM-based (rough)	5.669 \pm 0.0102	10.85 \pm 1.013

Notes: The data are presented as mean \pm standard deviation (SD) with $n = 3$, where n is the number of samples.

Abbreviations: FDM: Fused deposition modeling; LOD: Limit of detection; SLA: Stereolithography.