ACCSCIENCE PUBLISHING

International Journal of Bioprinting

RESEARCH ARTICLE

Stereolithography 3D printing of microgroove master moulds for topography-induced nerve guidance conduits

Supplementary File

Table S1. Dimensions of the 3D-printed master moulds and microgroove films based on 3D LSCM

	Average width (μm)		Average spacing (μm)		Average depth (μm)	
	Master mould	**Casted film**	**Master mould**	**Casted film**	**Master mould**	**Casted film**
PCL-10	10.32 ± 0.45	11.55 ± 0.49	9.87 ± 0.88	9.03 ± 0.56	13.12 ± 0.84	14.47 ± 1.03
PCL-20	20.34 ± 0.94	21.38 ± 0.76	18.79 ± 0.70	17.17 ± 0.67	14.51 ± 0.98	16.67 ± 1.17
PCL-25	27.14 ± 0.68	28.28 ± 0.83	25.38 ± 0.97	24.91 ± 0.88	15.23 ± 1.02	18.91 ± 1.32
PCL-30	29.54 ± 0.81	31.74 ± 1.12	28.89 ± 1.05	27.79 ± 0.34	15.78 ± 0.97	18.87 ± 1.28
PCL/PLA-10	/	11.36 ± 0.57	/	9.25 ± 0.63	/	14.38 ± 0.87
PCL/PLA-20	/	20.98 ± 0.89	/	17.44 ± 0.56	/	16.32 ± 1.23
PCL/PLA-25	/	27.90 ± 0.73	/	25.11 ± 0.53	/	17.34 ± 1.54
PCL/PLA-30	/	31.02 ± 0.90	/	28.43 ± 0.82	/	18.29 ± 1.46

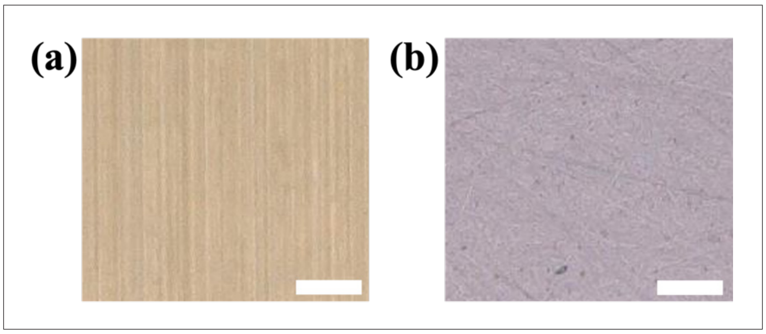

Figure S1. Light microscope images of flat (a) 3D-printed MicroArch™ S130 moulds and (b) PDMS moulds (scale bar: 50 μm).

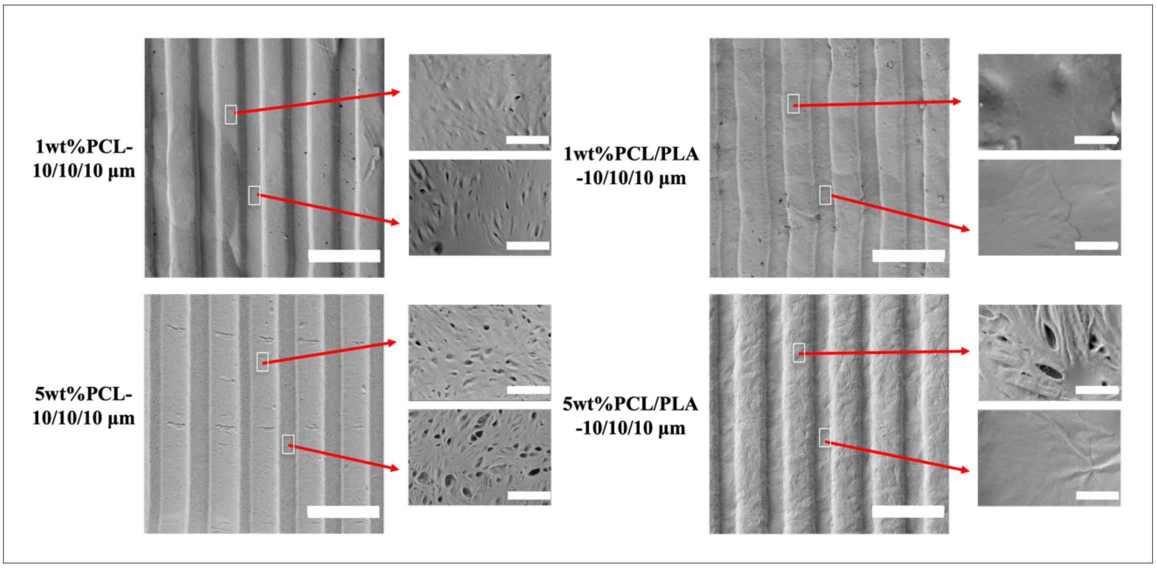

Figure S2. SEM images of the PCL and PCL/PLA thin films with 1 wt% and 5 wt% concentrations at 10/10/10 µm microgroove (scale bar: 30 µm, inset scale bar: 1 µm).

M-50 digital light processing 3D printer (M-50, CADworks3D, Canada) was utilised to create four sizes of microgroove. The print area (*xyz*) is 57 × 32 × 120 mm, and the resolution (*xy*) is 30 µm. Microgroove samples consisting of the designs, 30/30/10 µm, 100/100/50 µm, 150/150/50 µm, and 200/200/50 µm, are referred to as PCL-30, PCL-100, PCL-150, and PCL-200 or PCL/PLA-30, PCL/PLA-100, PCL/PLA-150, and PCL/PLA-200, respectively.

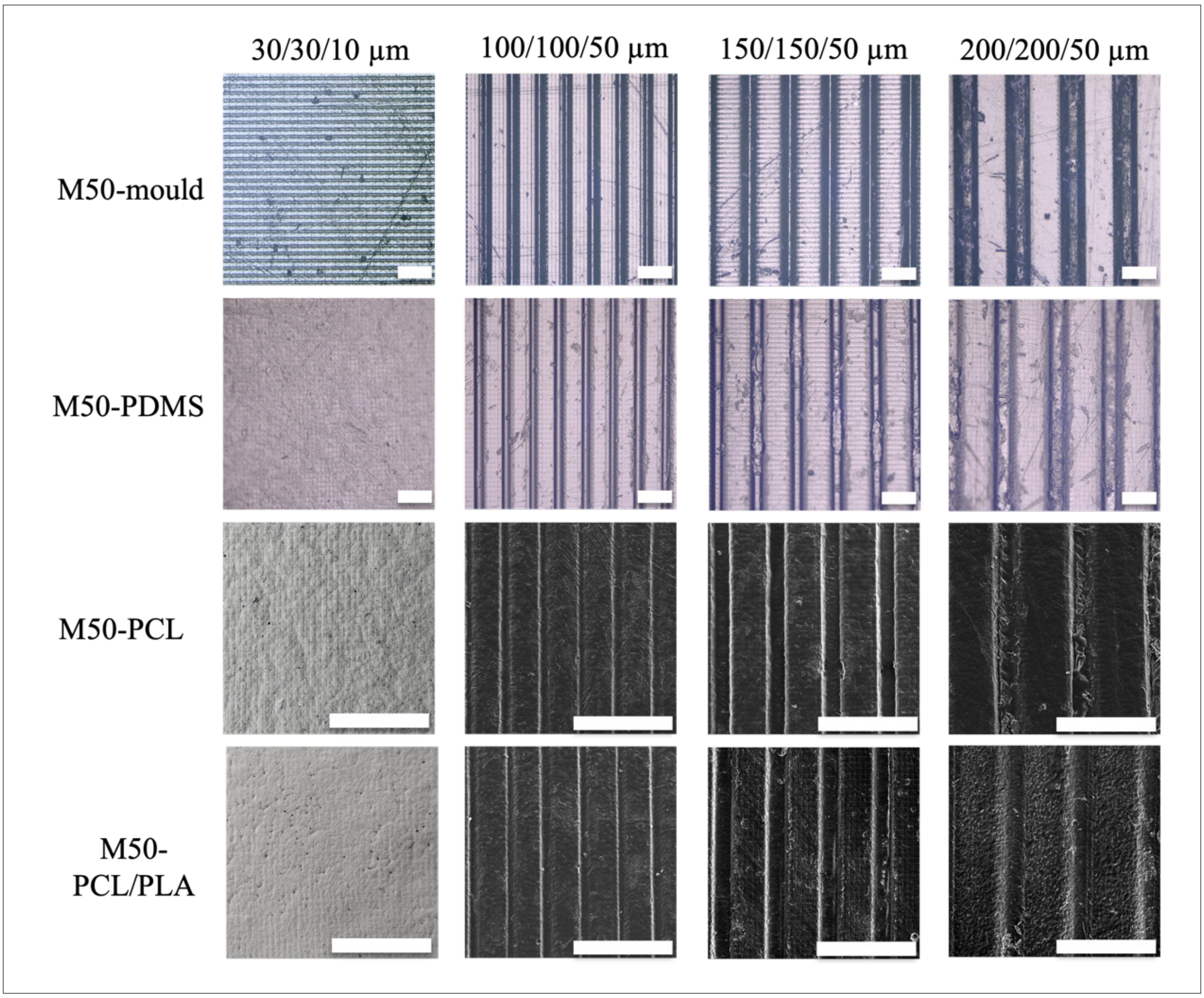

Figure S3. Light microscope images of M-50 3D-printed master mould and casted PDMS mould (scale bar: 200 μm) (top). SEM images of the PCL and PCL/PLA microgroove films casted from the PDMS mould (scale bar: 500 μm) (bottom).

Table S2. Dimensions of the M-50 3D-printed master moulds, PDMS moulds, and microgroove polymer films based on light microscopy measurement

	Average width (μm)			Average spacing (μm)			Average depth (μm)		
	Master mould	PDMS mould	Casted film	Master mould	PDMS mould	Casted film	Master mould	PDMS mould	Casted film
PCL-30	-	-	-	-	-	-	-	-	-
PCL-100	110.28 ± 2.31	97.07 ± 8.39	115.09 ± 7.65	78.97 ± 2.74	112.50 ± 7.49	102.75 ± 8.93	32.36 ± 2.09	34.57 ± 3.98	35.89 ± 4.58
PCL-150	160.94 ± 4.21	134.85 ± 7.49	165.75 ± 6.79	130.42 ± 3.64	161.43 ± 6.49	141.21 ± 5.34	35.7 ± 2.78	37.87 ± 2.77	38.67 ± 4.04
PCL-200	202.68 ± 4.23	187.36 ± 8.56	213.26 ± 8.09	180.76 ± 4.02	207.14 ± 6.65	190.23 ± 5.39	37.42 ± 2.54	38.64 ± 3.85	40.59 ± 3.17
PCL/PLA-30	-	-	-	-	-	-	-	-	-
PCL/PLA-100	/	/	117.34 ± 5.98	/	/	101.54 ± 5.43	/	/	35.66 ± 3.09
PCL/PLA-150	/	/	167.58 ± 6.07	/	/	143.56 ± 5.40	/	/	38.22 ± 3.71
PCL/PLA-200	/	/	213.75 ± 5.93	/	/	191.23 ± 6.77	/	/	39.58 ± 3.52

The 30/30/10 μm dimension cannot be measured due to the low resolution.

Table S3. Surface roughness measurements of 3D-printed master mould and PCL and PCL/PLA films using 3D laser scanning confocal microscopy

	Master mould				PCL				PCL/PLA			
(μm)	10	20	25	30	10	20	25	30	10	20	25	30
Ssk	0.36 ± 0.09	0.18 ± 0.02	0.09 ± 0.02	-0.2 ± 0.03	0.65 ± 0.16	0.94 ± 1.41	0.04 ± 0.37	0.14 ± 0.09	-0.18 ± 0.03	0.76 ± 0.03	0.35 ± 0.02	0.55 ± 0.02
Excess kurto-sis	0.34 ± 0.07	0.51 ± 0.12	0.65 ± 0.01	0.58 ± 0.08	2.50 ± 0.65	2.18 ± 0.46	1.02 ± 0.08	0.23 ± 0.09	1.76 ± 0.69	2.44 ± 0.24	4.75 ± 0.15	4.79 ± 0.93
Sp	0.43 ± 0.11	0.48 ± 0.03	0.27 ± 0.01	0.22 ± 0.04	3.65 ± 0.88	4.71 ± 0.52	2.21 ± 0.46	1.83 ± 0.03	1.11 ± 0.02	2.68 ± 0.39	1.26 ± 0.04	2.41 ± 0.76
Sv	0.18 ± 0.03	0.28 ± 0.01	0.25 ± 0.02	0.23 ± 0.05	4.72 ± 1.63	2.18 ± 0.83	2.58 ± 0.21	2.01 ± 0.13	1.46 ± 0.69	0.84 ± 0.046	1.89 ± 0.05	1.5 ± 0.68
Sz	0.41 ± 0.06	0.49 ± 0.13	0.53 ± 0.02	0.44 ± 0.01	8.37 ± 2.49	6.9 ± 1.73	4.79 ± 0.67	3.84 ± 0.16	2.58 ± 0.68	3.51 ± 0.44	3.15 ± 0.1	3.91 ± 1.45

Abbreviations: Sp, max peak height; Ssk, skew; Sv, max pit depth; Sz, max height.

TGA and derivative thermogravimetric (DTG) experiments were carried out to investigate the thermal degradation behaviour of PCL, PLA, and the PCL/PLA blend (Figure S4). Neat PCL has an initial degradation temperature (T_d) of 375.8°C and is more thermally stable than PLA and the PCL/PLA blend which have a T_d of 340.4°C and 365.9°C, respectively. These results agree with previous reports.[1,2] The DTG curves show that the maximum degradation rate for the PCL/PLA blend is at 406.2°C, higher than neat PCL and PLA, 404.3°C and 369.4°C, respectively. The addition of PLA can decrease the thermal stability, possibly related with its cleavage of final and side chains of macromolecules.

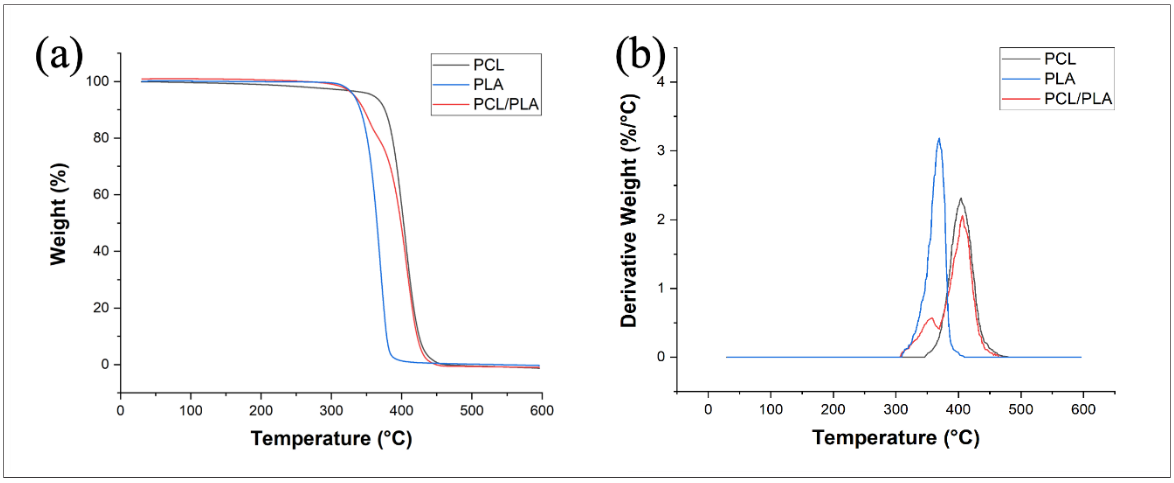

Figure S4. (a) Thermogravimetric (3 wt%) and (b) derivative thermogravimetric (3 wt%) analysis.

References

1. Patricio T, Bartolo P. Thermal stability of PCL/PLA blends produced by physical blending process. *Procedia Eng*. 2013;59:292-297. doi: 10.1016/j.proeng.2013.05.124

2. Carmona VB, Corrêa AC, Marconcini JM, Mattoso LHC. Properties of a biodegradable ternary blend of thermoplastic starch (TPS), poly (ε-caprolactone)(PCL) and poly (lactic acid)(PLA). *J Polym Environ*. 2015; 23(1):83-89. doi: 10.1007/s10924-014-0666-7