Supporting Information

for the Light: Advanced Manufacturing article

A multi-photon (7×7)-focus 3D laser printer based on a 3D-printed diffractive optical element and a 3D-printed multi-lens array

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Supporting Information

Voxel-size measurements

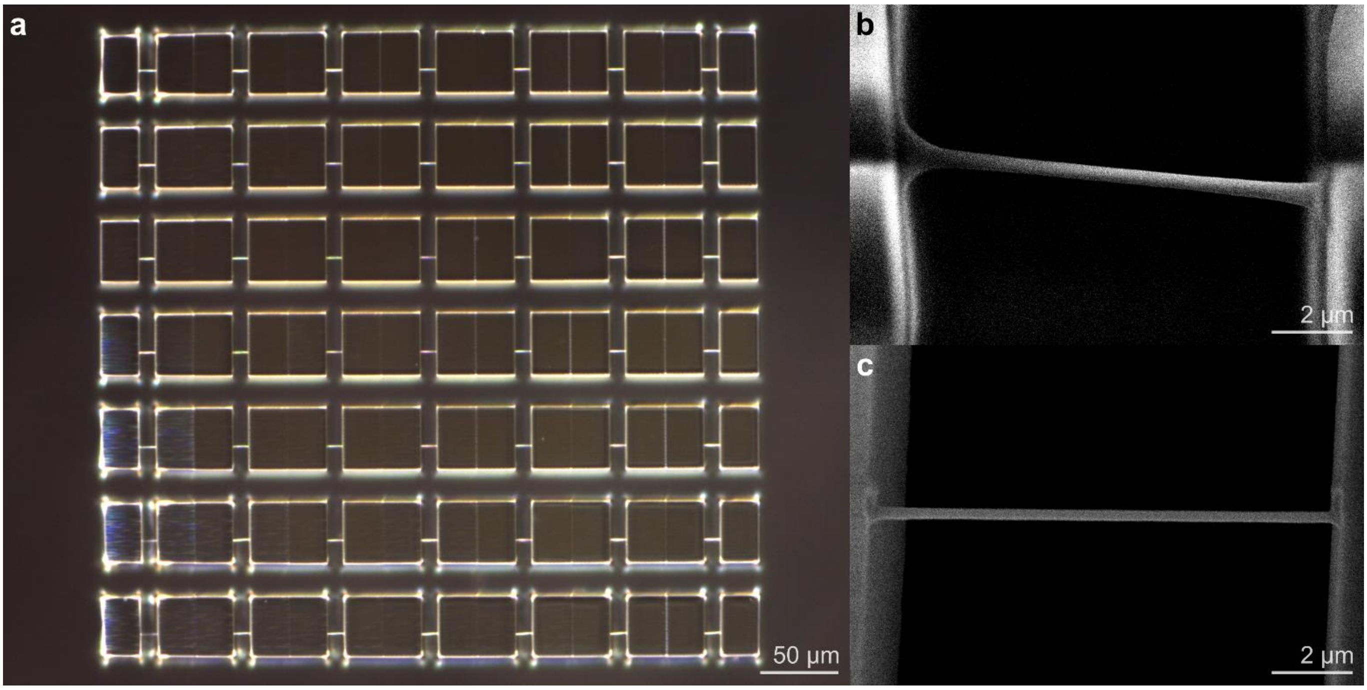

Figure S1. Multi-focus 3D-printed structures for determining the voxel size. a, light-microscopy image showing an array of 3D-printed cuboids interconnected by single voxel lines fabricated using the $7 \times 7 = 49$ focus array. Each individual focus polymerized one of these suspended lines and the cuboids connected to it. Analyzing this sample by using a scanning-electron microscope allows for determining the voxel size for each focus of the focus array. **b,** scanning-electron micrograph of one of these suspended voxel lines taken at an angle of $85°$. The thereof measured line heights have been corrected for the $5°$ angle deviation from $90°$ and used to determine the axial voxel size. **c,** scanning-electron micrograph of one suspended voxel line taken at an angle of $0°$. These data have been used to determine the lateral voxel size by image analysis.

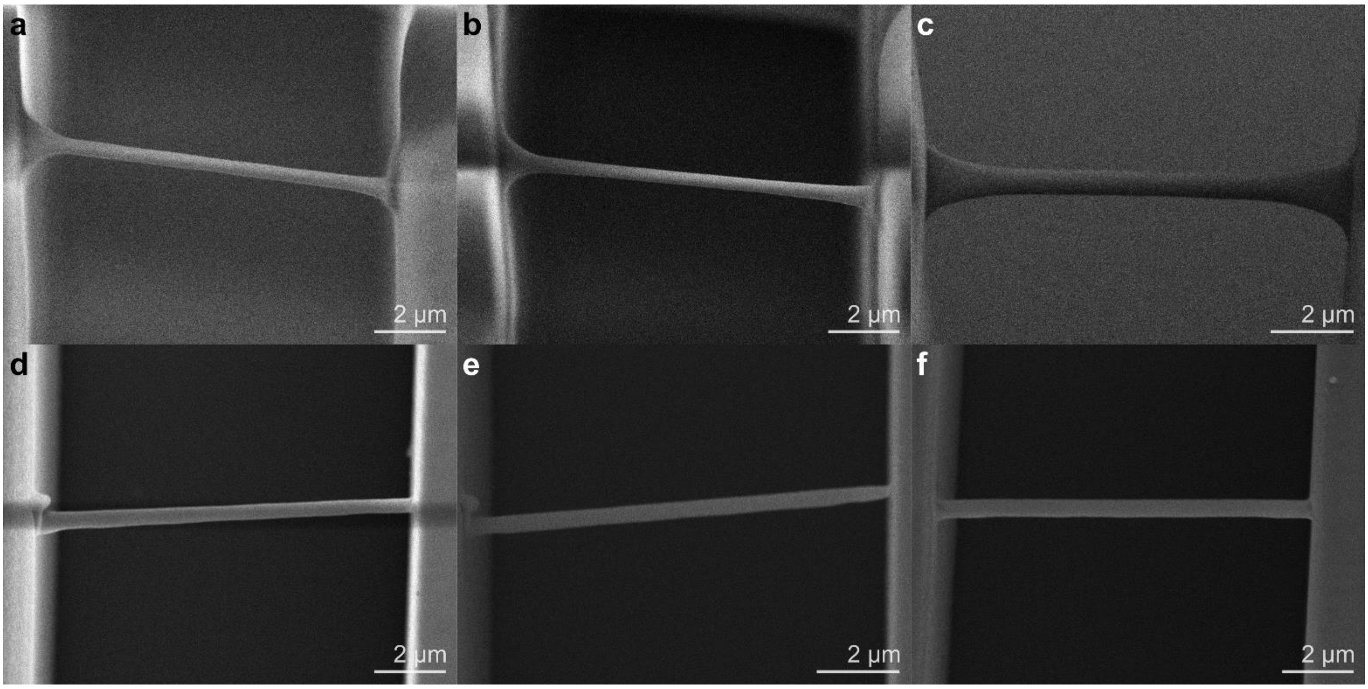

Figure S2. Scanning-electron micrographs of suspended voxel lines. a-c, three examples of suspended voxel lines acquired at an angle of $85°$. **d-f,** the same voxel lines as in **a-c** but acquired at an angle of $0°$.

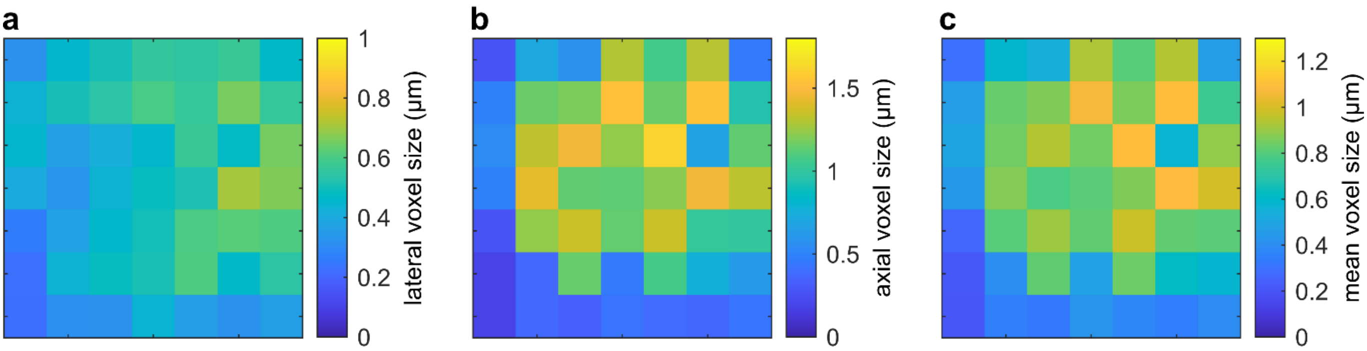

Figure S3. Analysis of all voxel sizes across the $7 \times 7 = 49$ focus array. a, false-color overview of the measured lateral voxel size across the full focus array. Each tile of the plot represents the lateral voxel size of one focus. The mean lateral voxel size is (475 ± 117) nm. **b,** false-color overview of the measured axial voxel size across the full focus array. Each tile of the plot represents the axial voxel size of one focus. The mean axial voxel size is (905 ± 435) nm. **c,** calculated mean voxel size using the data from **a** and **b**. The mean (lateral and axial) voxel size results as (690 ± 260) nm.

Lens system information

Table S1. Optical design of lens group LG1 (cf. Figure 2). We specify the radius of curvature (ROC), the center distance between two interfaces, and the material. The information specified in the lens-name column refers to the Thorlabs lens catalog.

lens name	ROC in mm	distance in mm	material
LA1725-B	206.03	4.57	N-BK7
	Inf	1.89	
LE1015-B	-171.60	6.18	N-BK7
	-65.16	0.20	
LA1301-B	Inf	5.52	N-BK7
	-128.77	0.20	
LA1979-B	103.01	6.18	N-BK7
	Inf	1.38	
LE1076-B	30.34	9.70	N-BK7
	65.80	5.13	
LC1582-B	Inf	3.50	N-BK7
	38.59	2.25	
LC1582-B	Inf	3.50	N-BK7
	38.59	0.00	

Table S2. Optical design of lens group LG2 (cf. Figure 2). We specify the radius of curvature (ROC), the center distance between two interfaces, and the material. The information specified in the lens-name column refers to the Thorlabs lens catalog.

lens name	ROC in mm	distance in mm	material
LC1582-B	-38.59	3.50	N-BK7
	Inf	2.15	
LC1582-B	-38.59	3.50	N-BK7
	Inf	5.10	
LE1076-B	-65.80	9.70	N-BK7
	-30.34	2.00	
LA1399-B	Inf	6.65	N-BK7
	-90.13	0.10	
LA1050-B	Inf	9.69	N-BK7
	-51.50	93.77	
LA1727-B	386.31	3.83	N-BK7
	Inf	0.00	

Table S3. Optical design of lens group LG3 (cf. Figure 2). We specify the radius of curvature (ROC), the center distance between two interfaces, and the material. The information specified in the lens-name column refers to the Thorlabs lens catalog.

lens name	ROC in mm	distance in mm	material
LA1727-B	Inf	3.83	N-BK7
	-386.31	101.14	
LA1050-B	51.50	9.69	N-BK7
	Inf	0.10	
LA1399-B	90.13	6.65	N-BK7
	Inf	2.70	
LE1076-B	30.34	9.70	N-BK7
	65.80	5.10	
LC1582-B	Inf	3.50	N-BK7
	38.59	2.15	
LC1582-B	Inf	3.50	N-BK7
	38.59	0.00	

Table S4. Optical design of lens group LG4 (cf. Figure 2). We specify the radius of curvature (ROC), the center distance between two interfaces, and the material. The information specified in the lens-name column refers to the Thorlabs lens catalog.

lens name	ROC in mm	distance in mm	material
LC1715-B	-25.70	3.50	N-BK7
	Inf	9.20	
LE1076-B	-65.80	9.70	N-BK7
	-30.30	0.26	
LA1050-B	Inf	9.70	N-BK7
	-51.50	0.23	
LA1399-B	90.10	6.70	N-BK7
	Inf	0.00	

Table S5. Optical design of lens group LG5 (cf. Figure 2). We specify the radius of curvature (ROC), the center distance between two interfaces, and the material. The information specified in the lens-name column refers to the Thorlabs lens catalog.

lens name	ROC in mm	distance in mm	material
LC1315-B	Inf	3.50	N-BK7
	38.59	58.00	
LA1384-B	Inf	8.22	N-BK7
	-64.38	25.35	
LA1301-B	128.77	5.52	N-BK7
	Inf	0.00	