



Review Topic: Direct Ink Writing (DIW) assisted by light

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Article

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3D printing of unsupported multi-scale and large-span ceramic via near-infrared assisted direct ink writing

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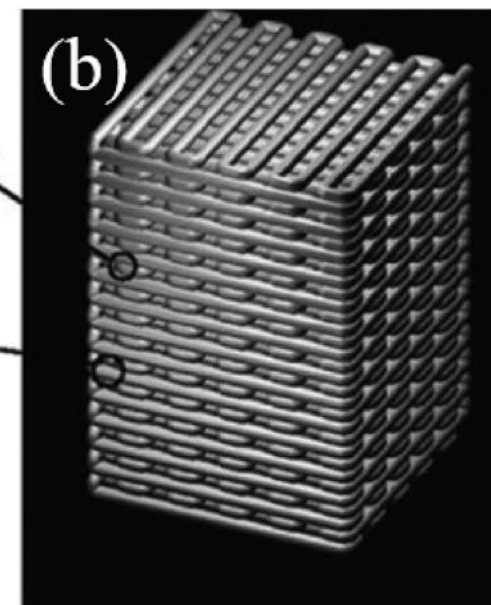
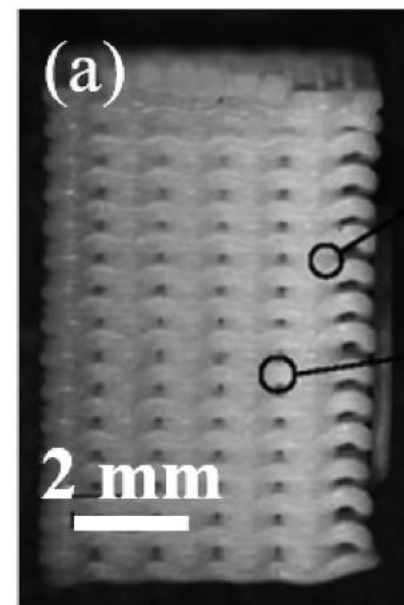
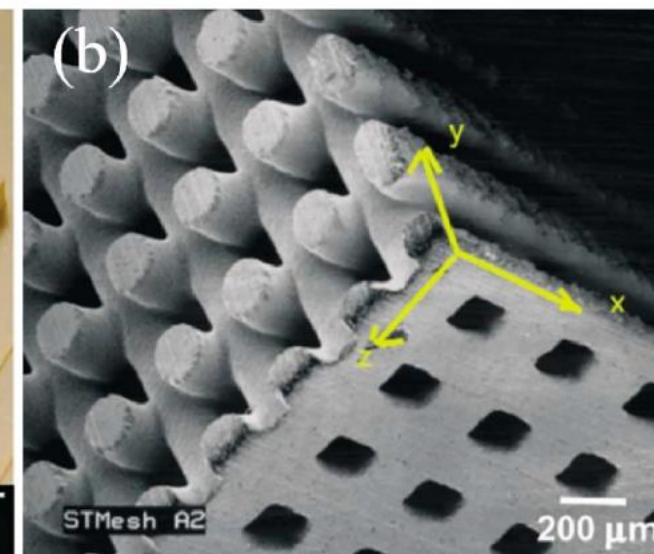
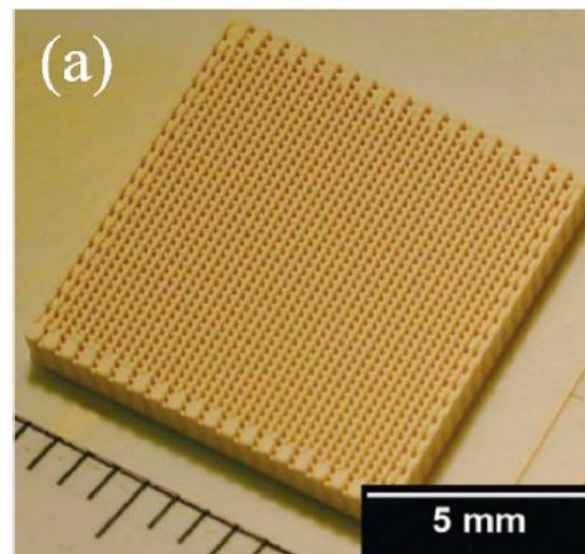
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Table 1

Ceramic 3D printing technologies.

Feedstock form	Ceramic 3D printing technology type	Abbreviation
Slurry-based	Stereolithography	SL
	Digital light processing	DLP
	Two-photon polymerisation	TPP
	Inkjet printing	IJP
	Direct ink writing	DIW
Powder-based	Three-dimensional printing	3DP
	Selective laser sintering	SLS
	Selective laser melting	SLM
Bulk solid-based	Laminated object manufacturing	LOM
	Fused deposition modelling	FDM

Z. Chen et al. "3D printing of ceramics: A review", Journal of the European Ceramic Society 39 (2019) 661–687

Pressure
source
ICentered on the extrusion
f

Column

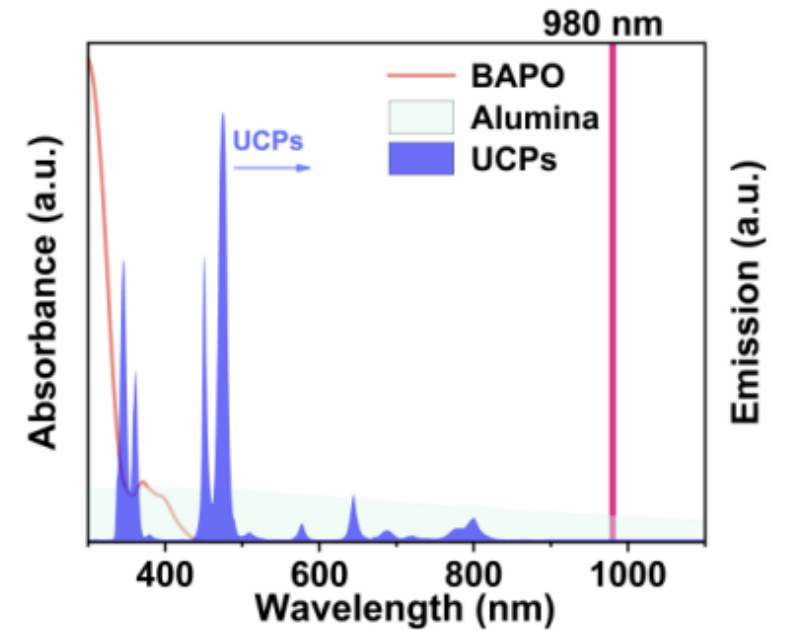
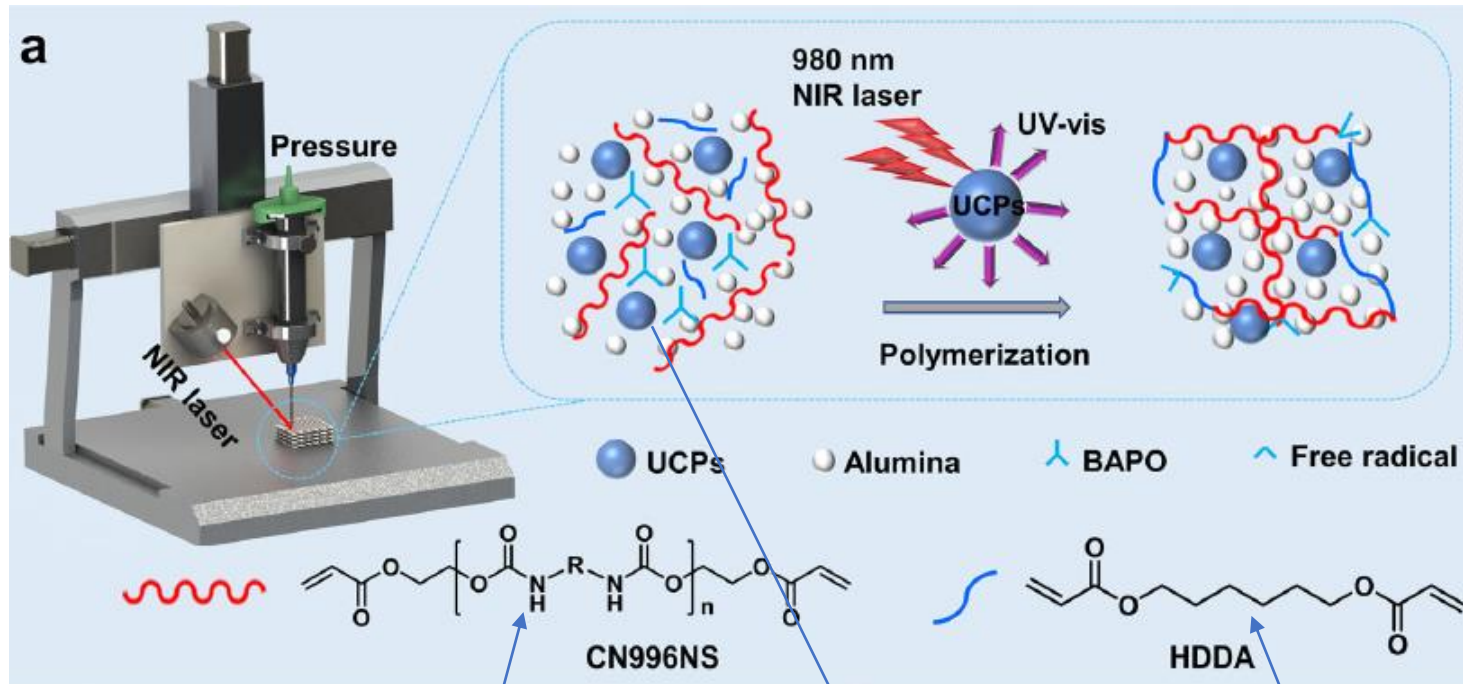
Span

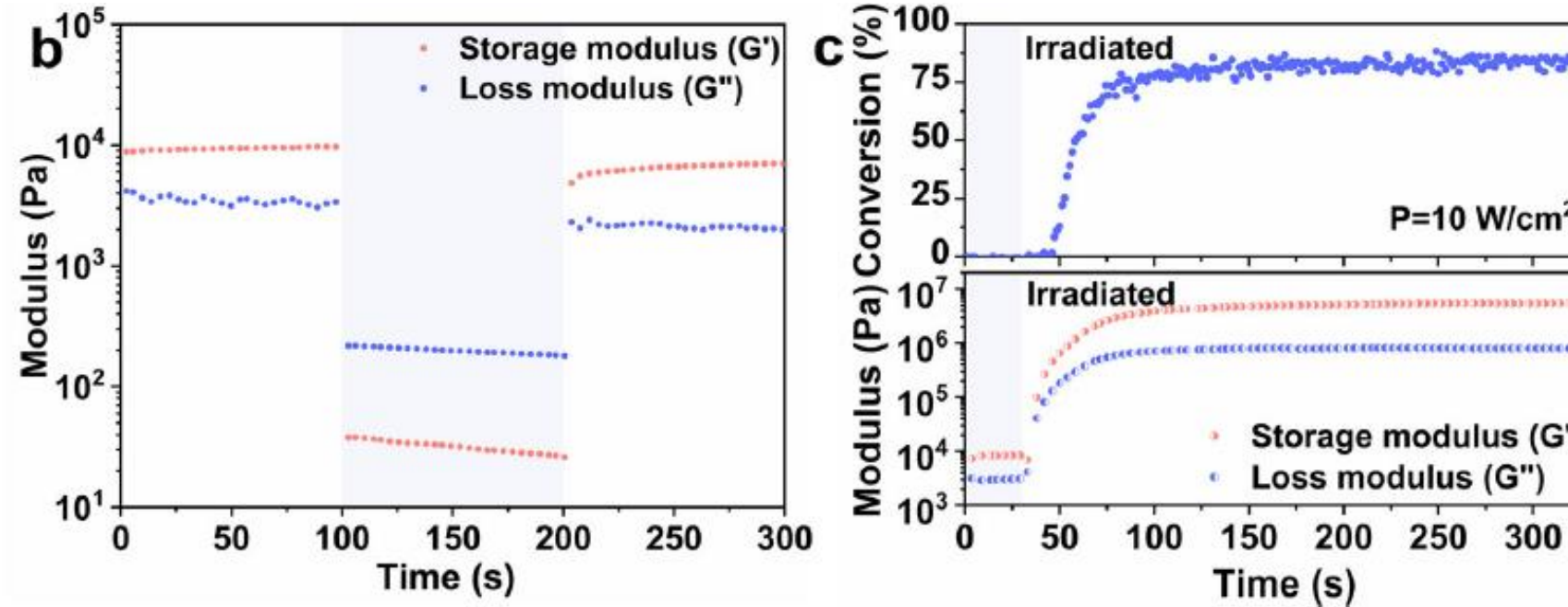
z
x

owing

Direct Ink Writing (DIW) NIR-assisted

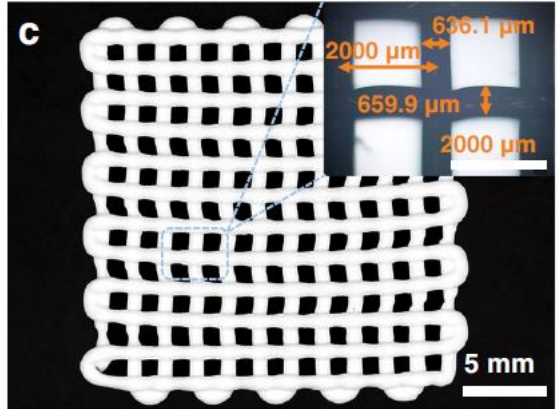
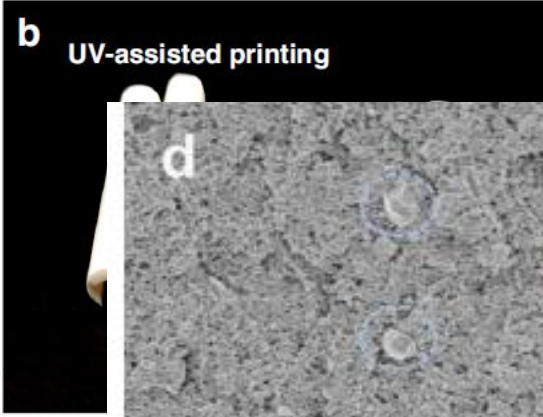
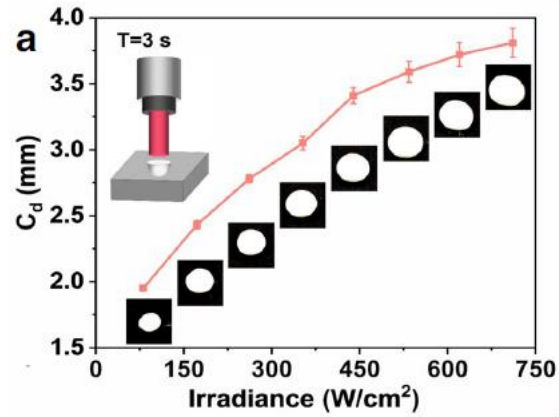
Schematic representation of NIR-assisted direct ink writing



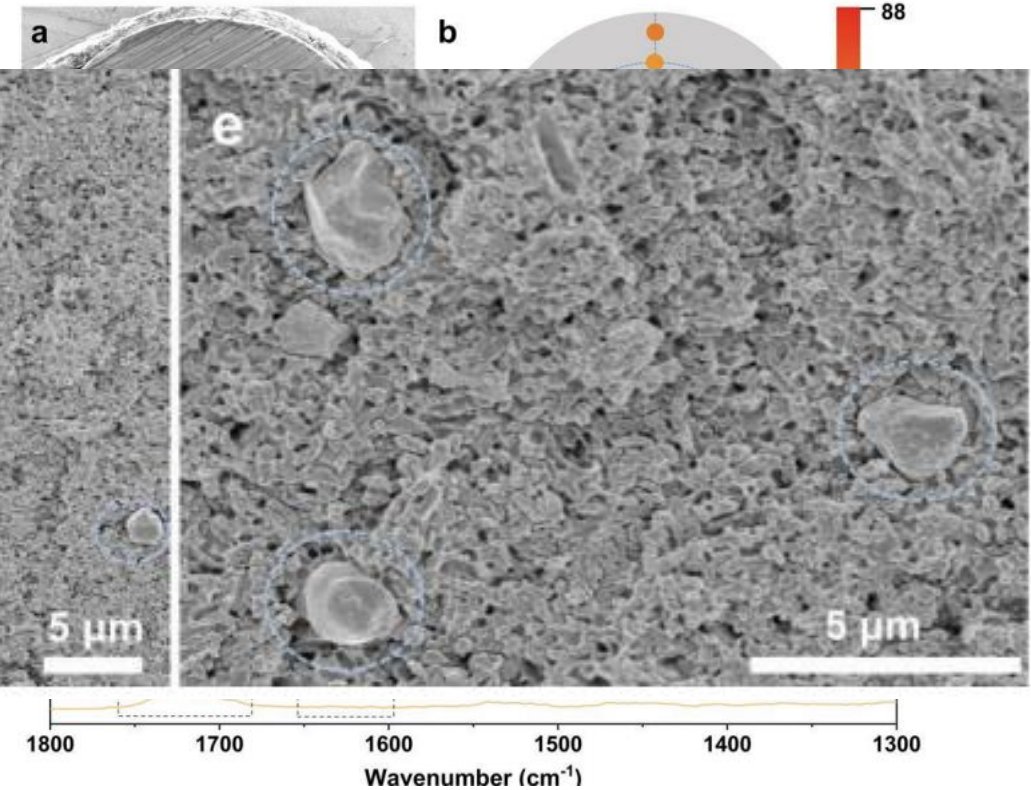


- Storage modulus $\rightarrow$ storage energy $\rightarrow$ elastic portion
- Loss modulus $\rightarrow$ energy dissipated as a heat $\rightarrow$ viscous portion
- Viscosity transition $G'' > G'$ to elastic transition $G' > G''$

3.50 mm nozzle diameter



Curing uniformity



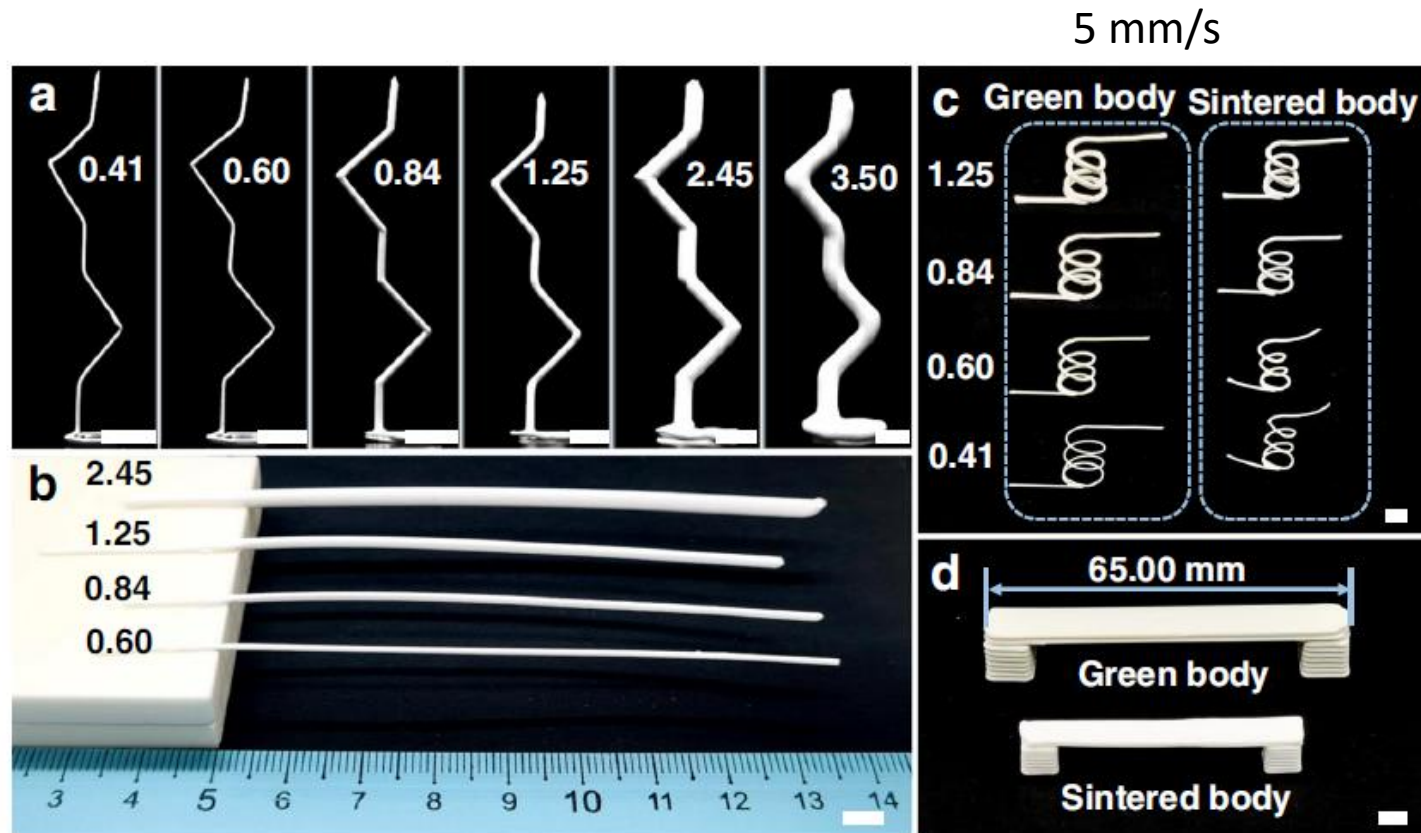
[b] To determine the effect of curing with NIR and UV on real-time.

2.45 mm nozzle (1 mm/s)

[c- d] 0.6 mm nozzle (5 mm/s)

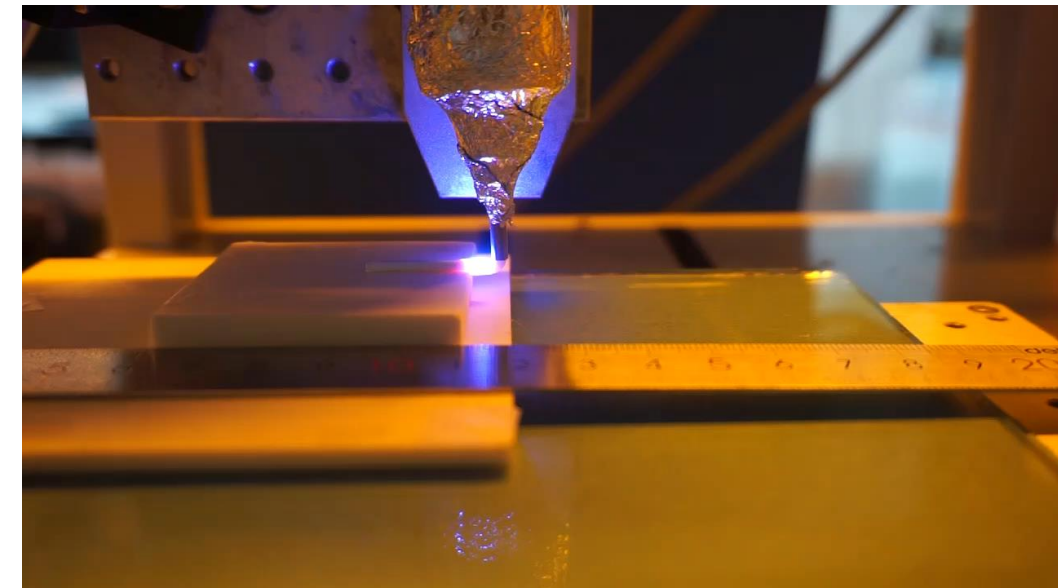
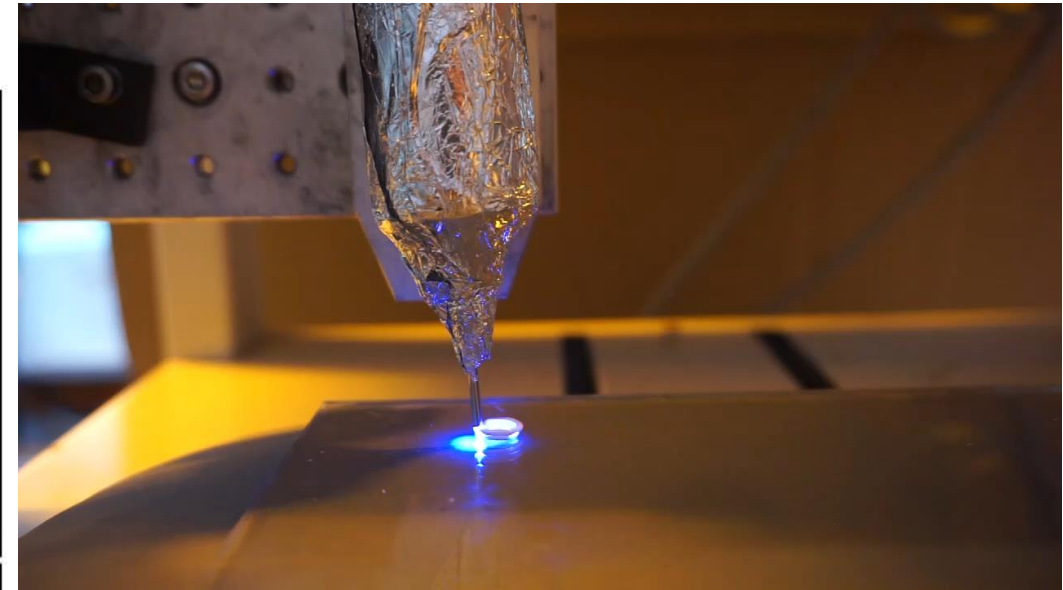
Doble bond conversion in different regions
[From Supplementary information]

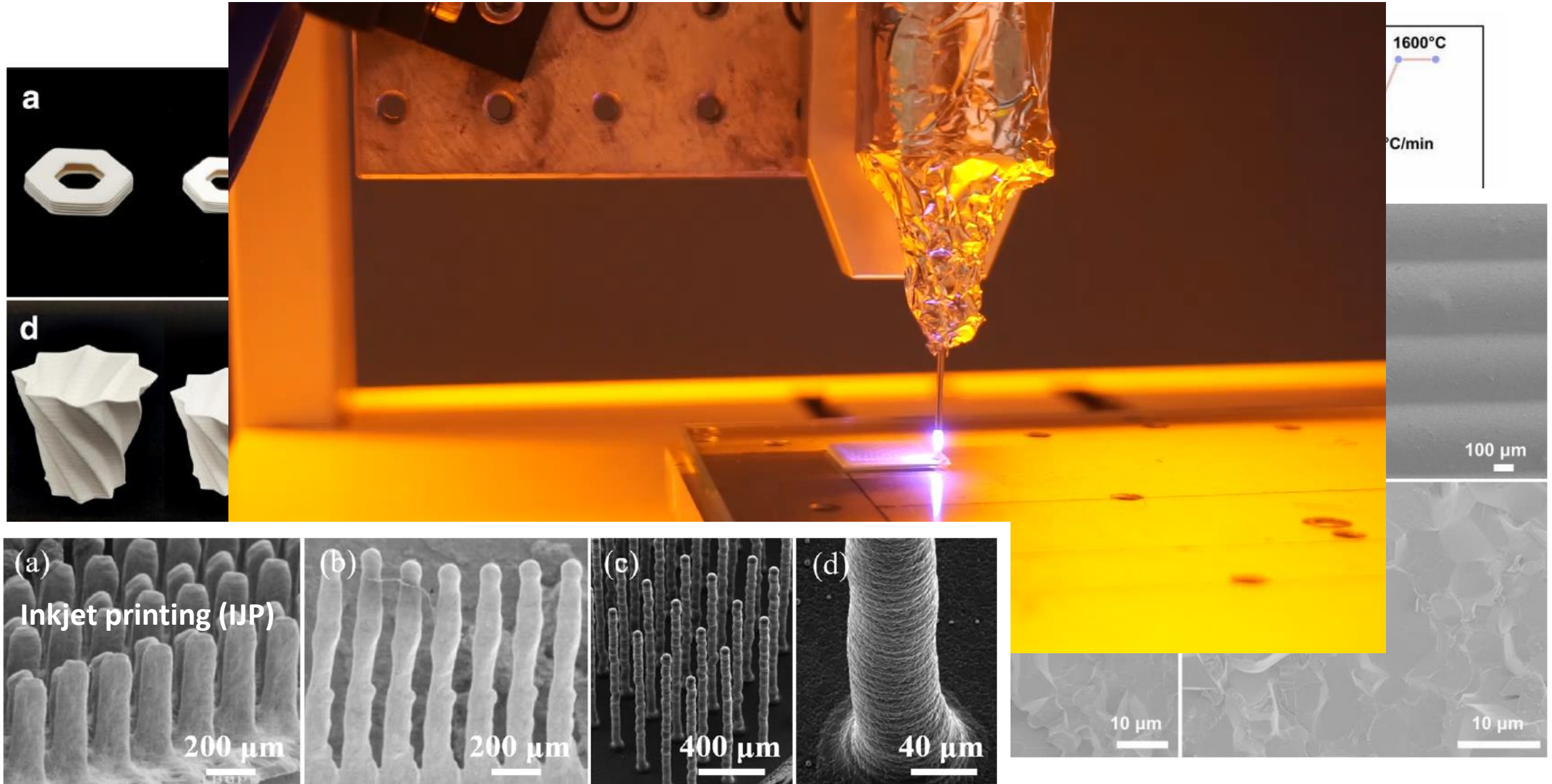
3D printing without support

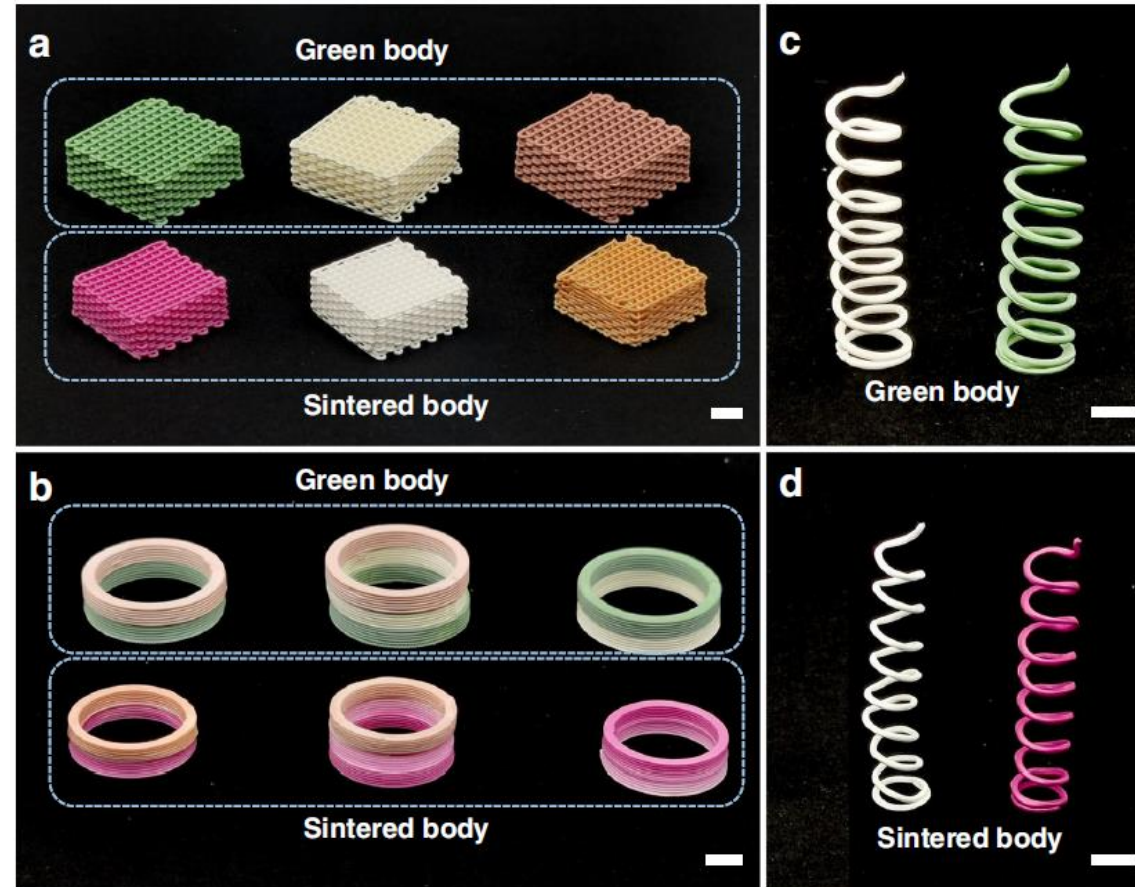


Printing speed: 1mm/s

To ensure structure stability different light intensity was adjusted.



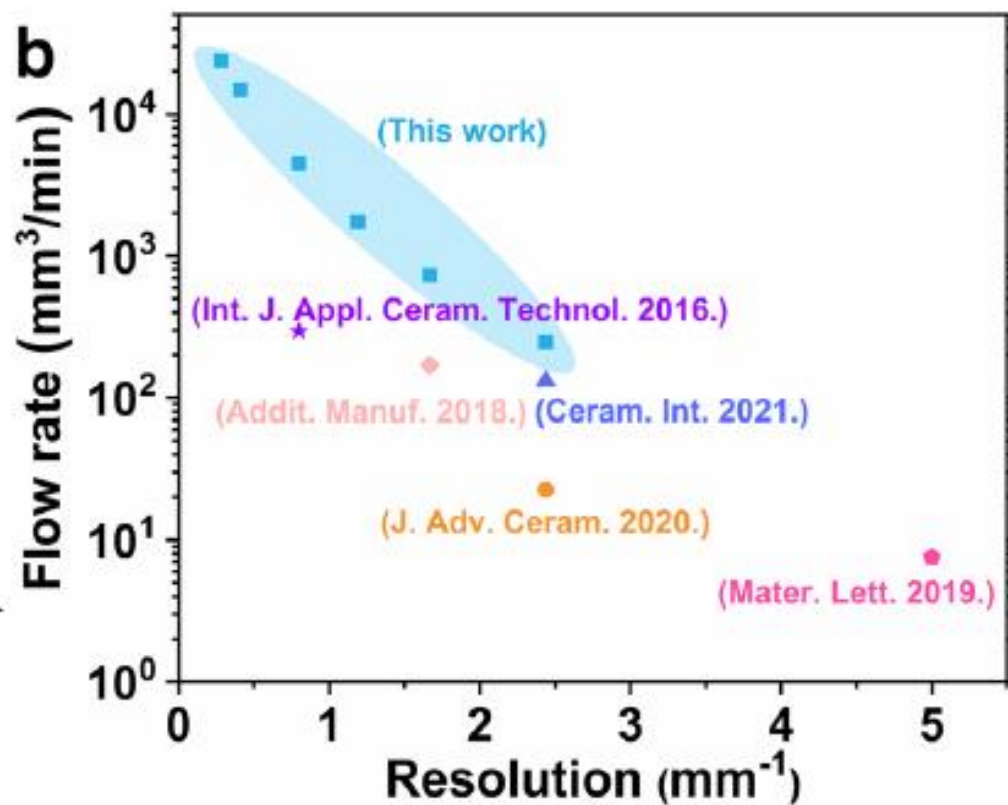
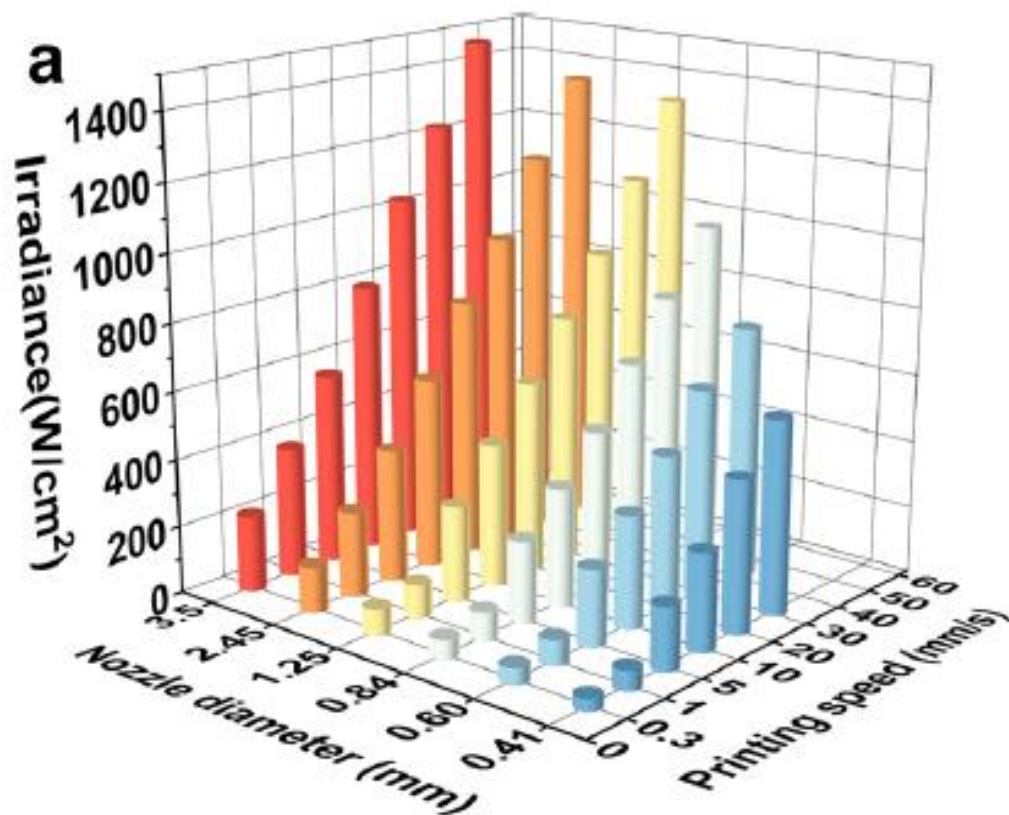


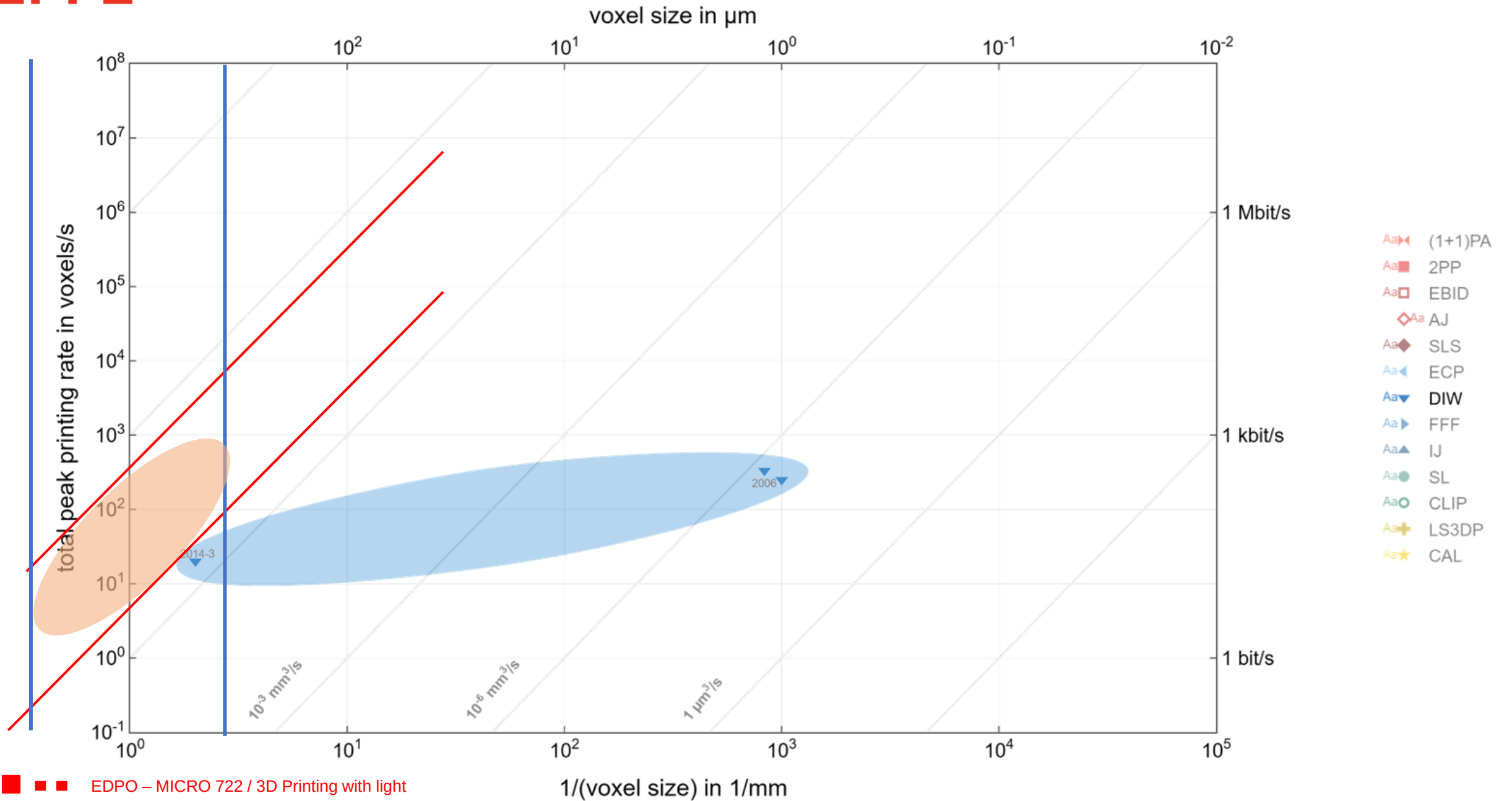


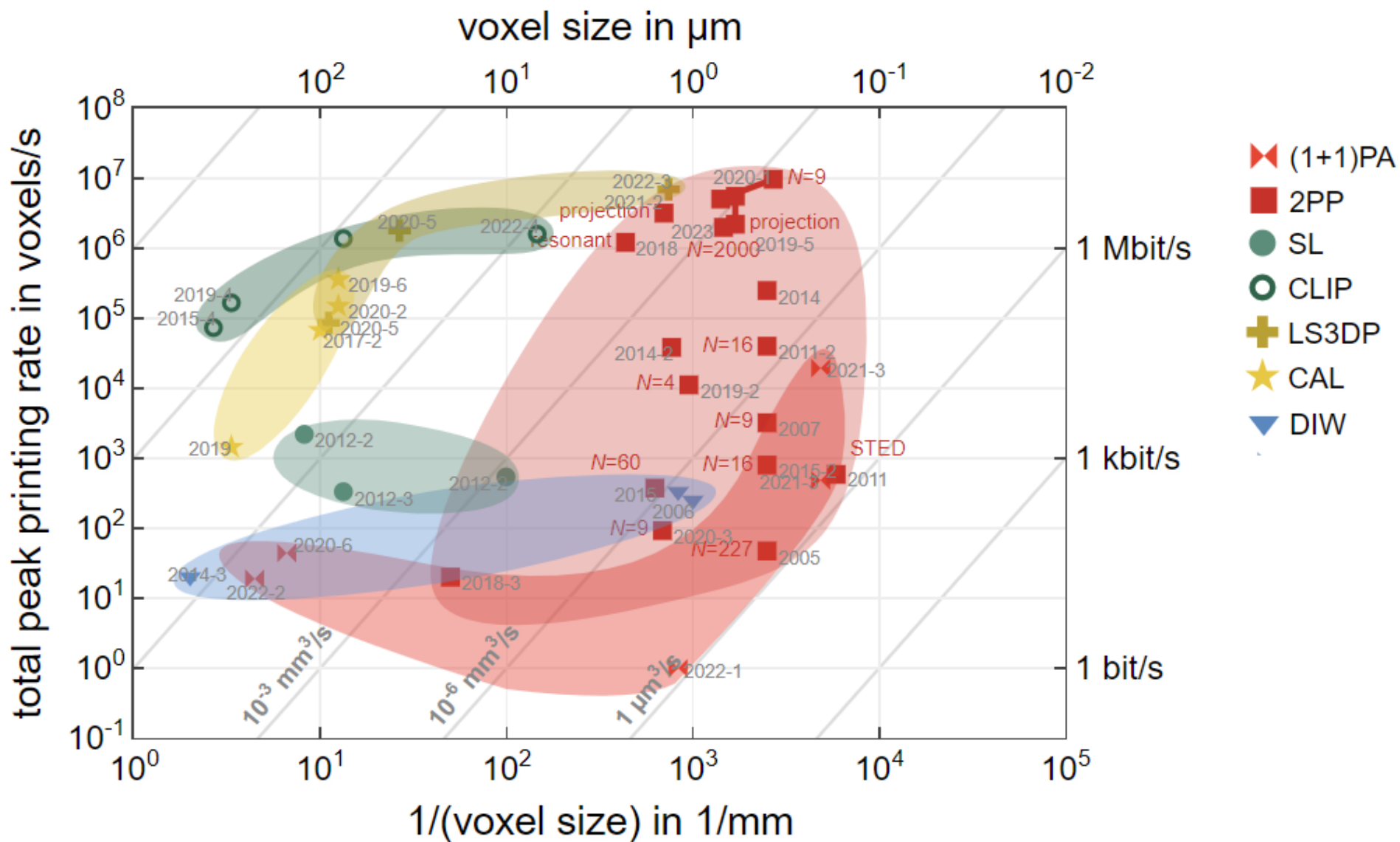
It is possible to 3D print different materials once without assembly.

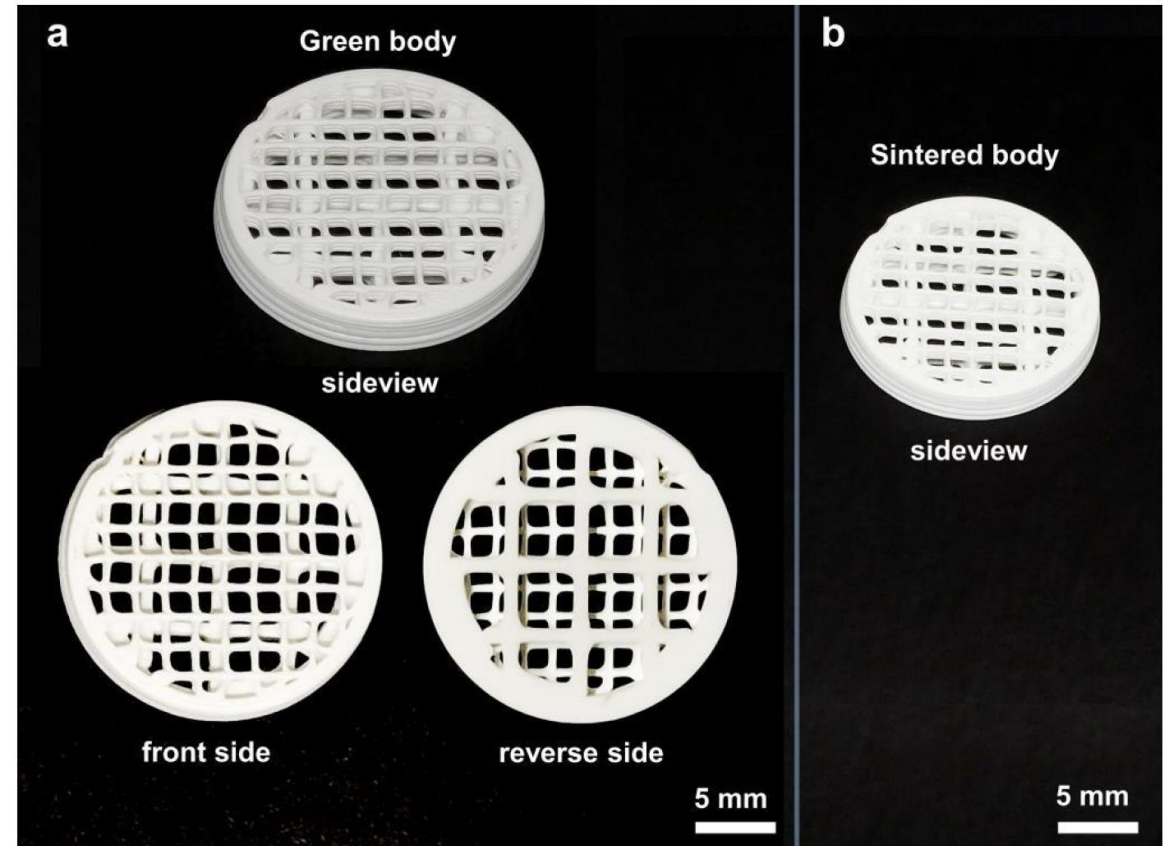
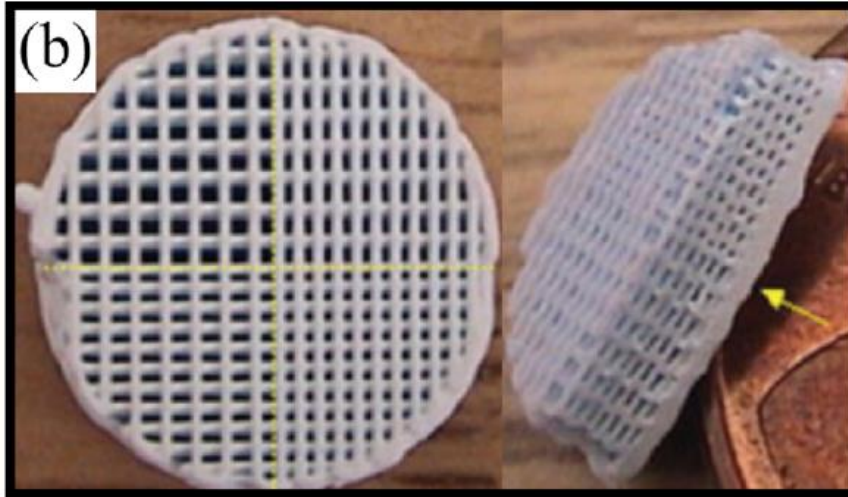
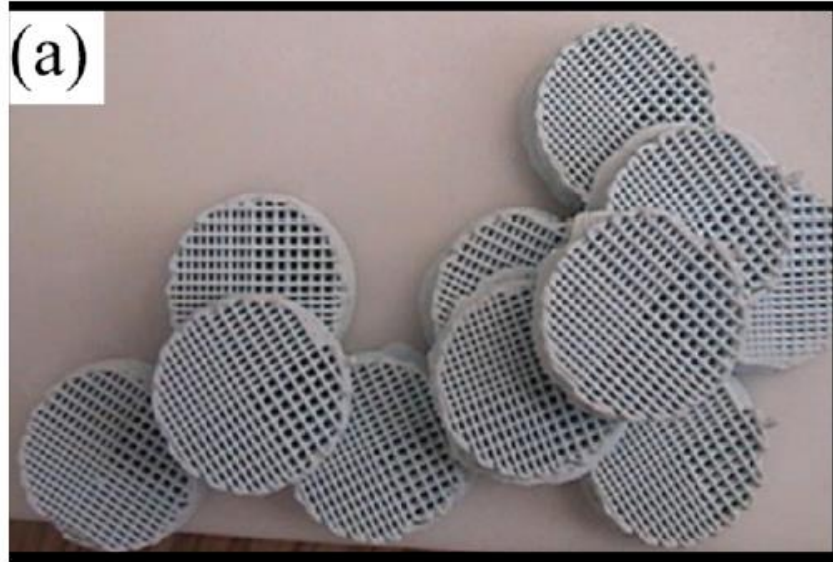
In order to ensure a better co-sintering process for multi-material components, the sintering temperature of the different materials is matched by sintering additives, adjusting the heat treatment profile and the solid content.

Throughput of NIR-DIW.



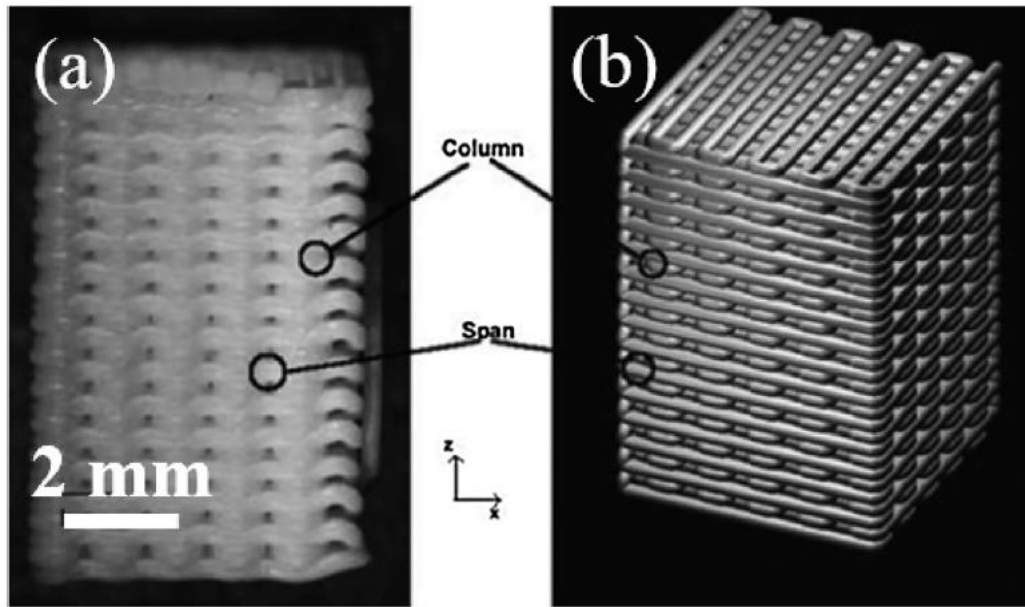
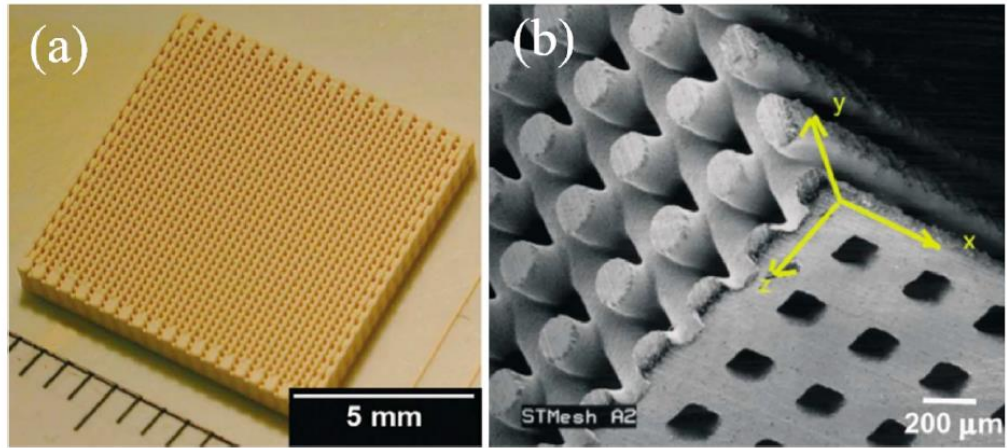






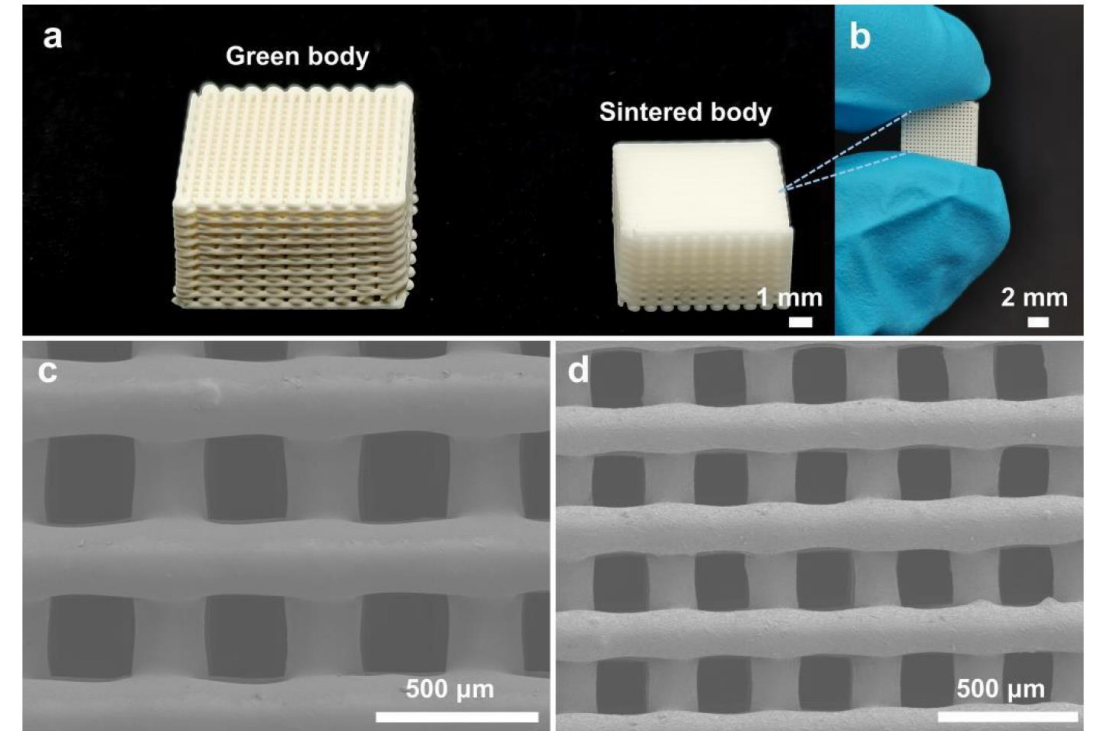
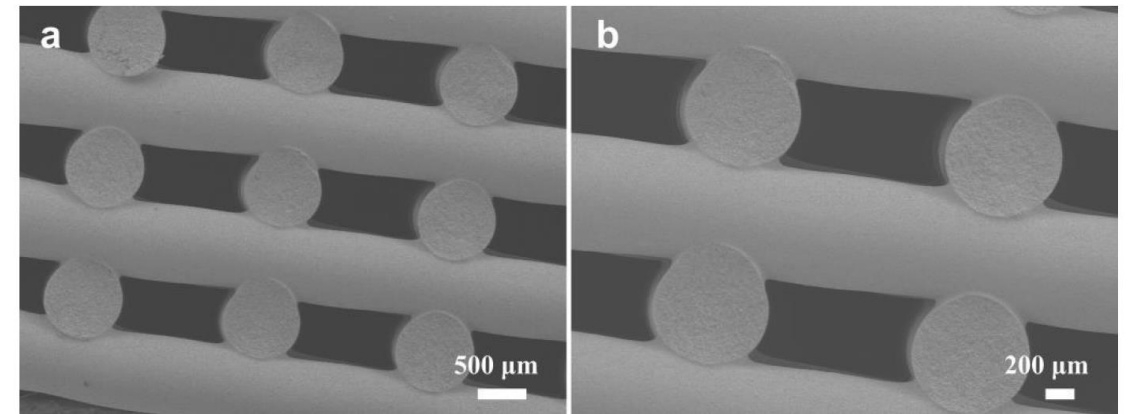
Supplementary

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EDPO – MICRO 722 / 3D Printing with light



Supplementary