Supporting Information

3D Printed Topological MoS_2/$MoSe_2$ Heterostructures for Macroscale Superlubricity

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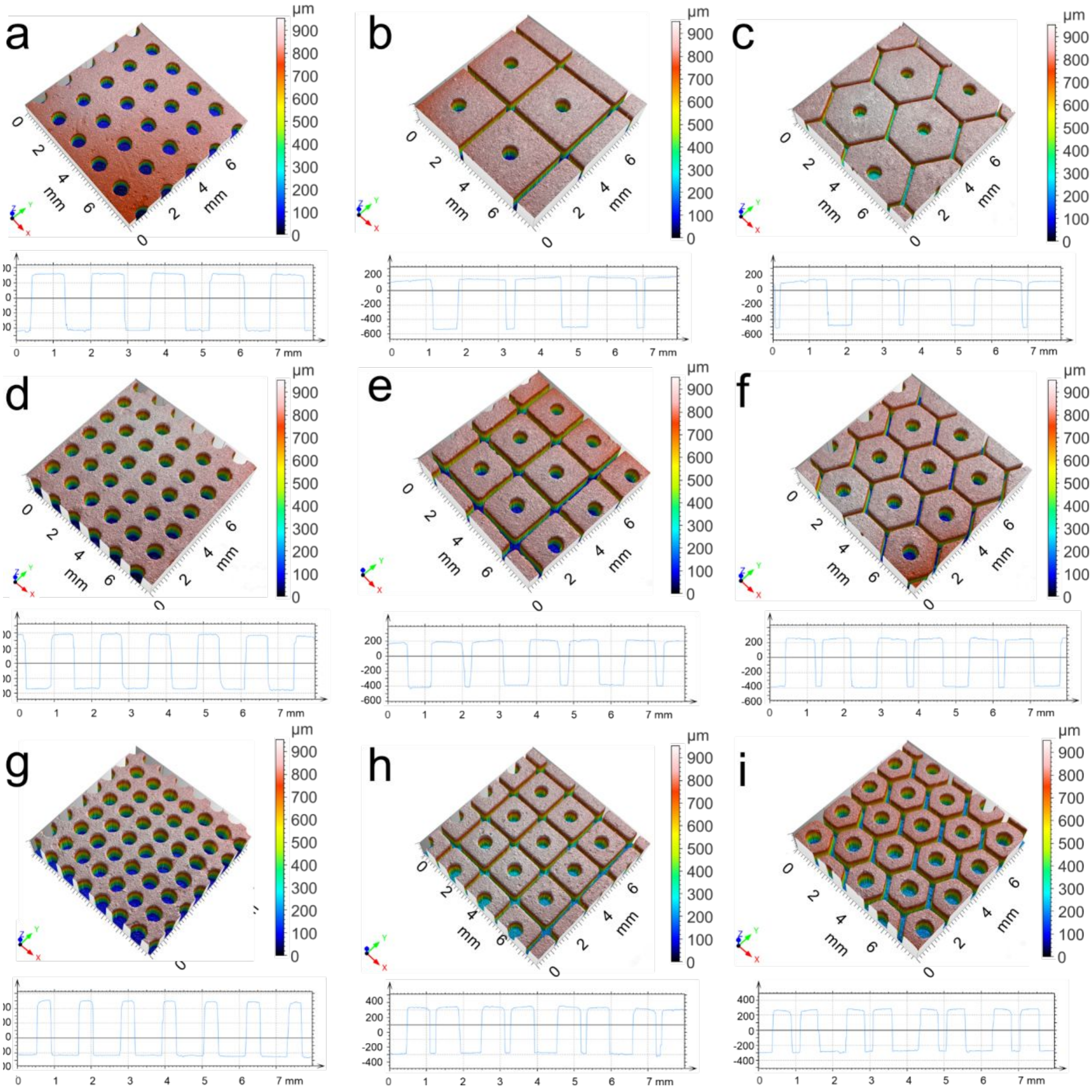

Figure S1. 3D morphologies of bioinspired topological structures with different texture densities. (a, d, g) C structure with texture densities of 20%, 30% and 40%, respectively. (b, e, h) CS structure with texture densities of 20%, 30% and 40%, respectively. (c, f, i) CH structure with texture densities of 20%, 30% and 40%, respectively.

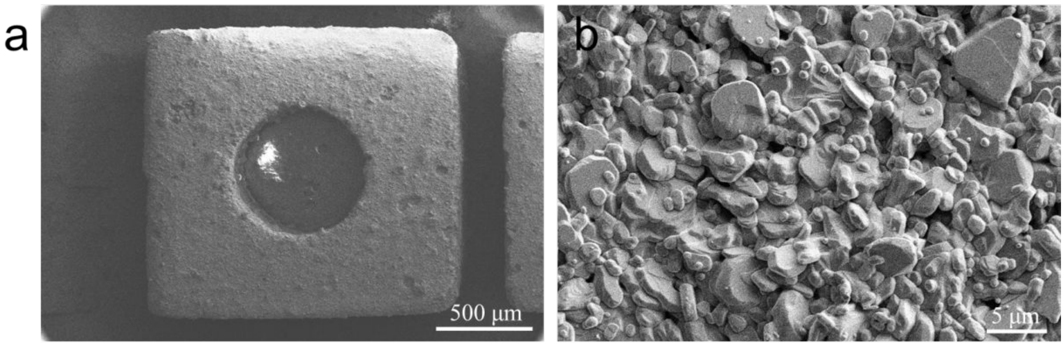

Figure S2. SEM images of 3D printed Al_2O_3 topological structures. (a) low-magnification. (b) high-magnification.

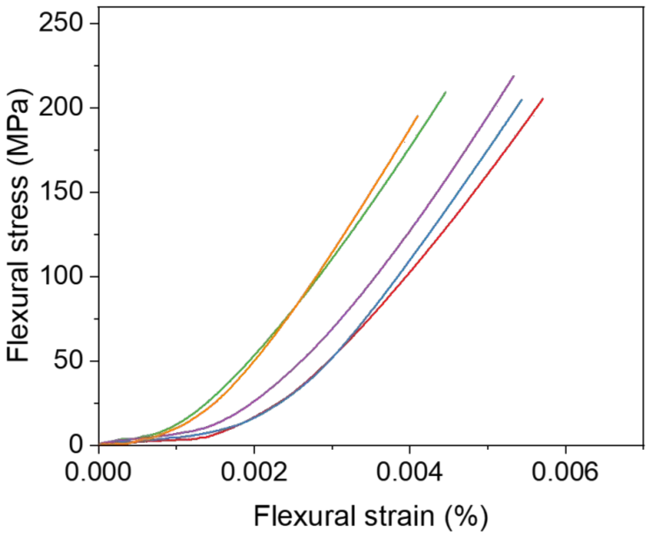

Figure S3. Flexural properties of 3D printed Al_2O_3 topological structures.

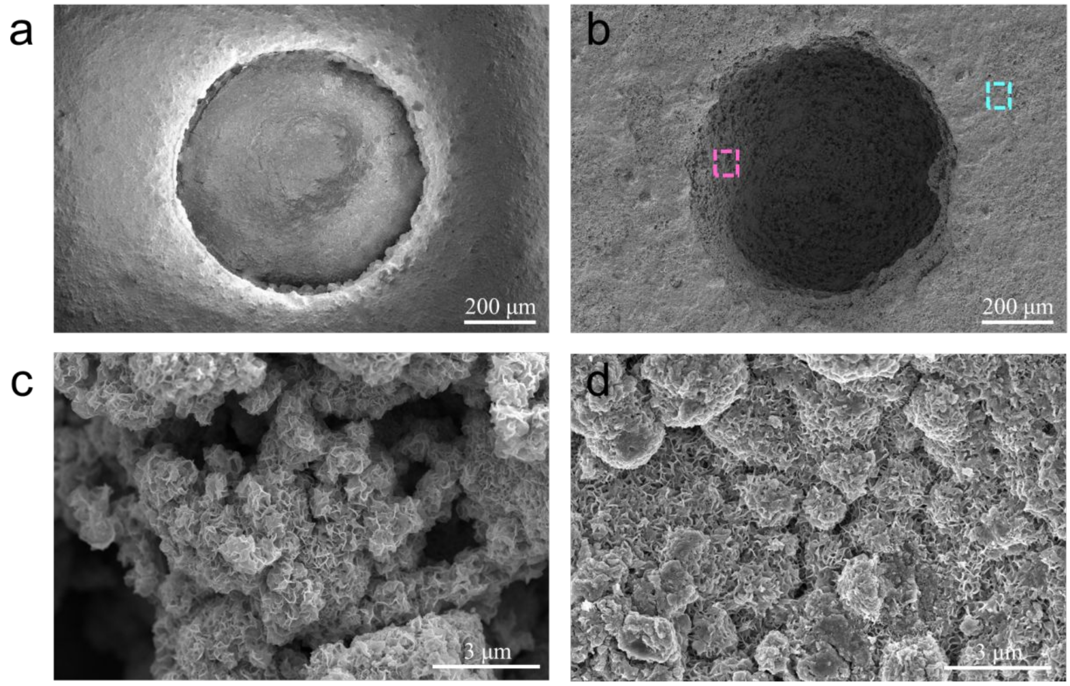

Figure S4. SEM images of bioinspired topological structures before and after introducing $MoS_2/MoSe_2$ heterostructures. (a) Printed pure Al_2O_3 topological structures. (b) $Al_2O_3/MoS_2/MoSe_2$ composites. (c) $MoS_2/MoSe_2$ heterostructures in the pits (the red rectangle in b). (d)s $MoS_2/MoSe_2$ heterostructures on the surface (the blue rectangle in b).

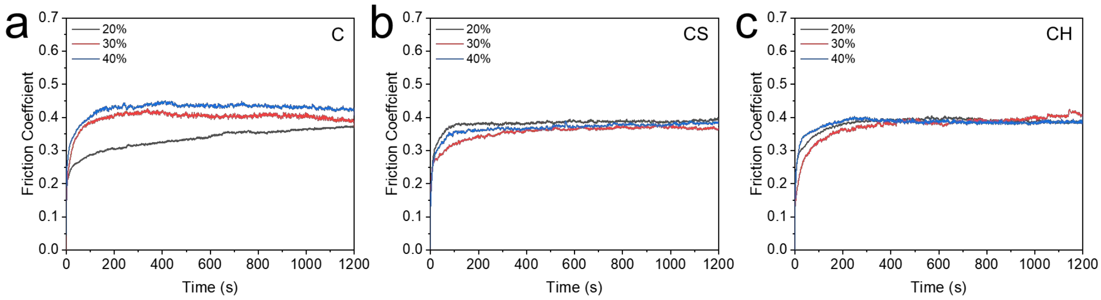

Figure S5. Friction coefficient curves of structures C (a), CS (b) and CH (c) under 2 N.

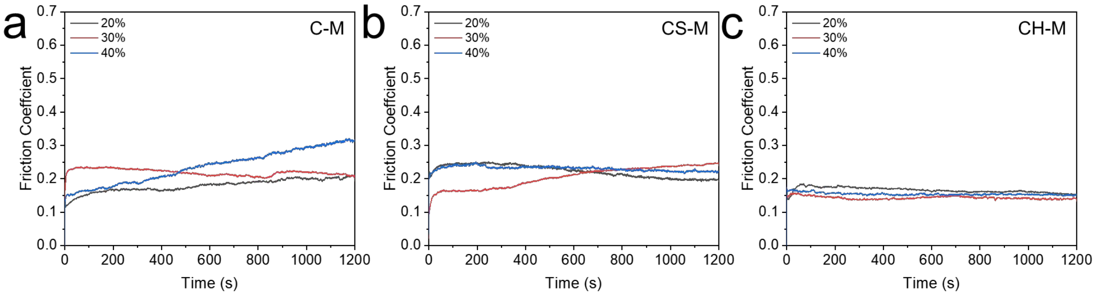

Figure S6. Friction coefficient curves of composites C-M (a), CS-M (b) and CH-M (c) under 2 N.

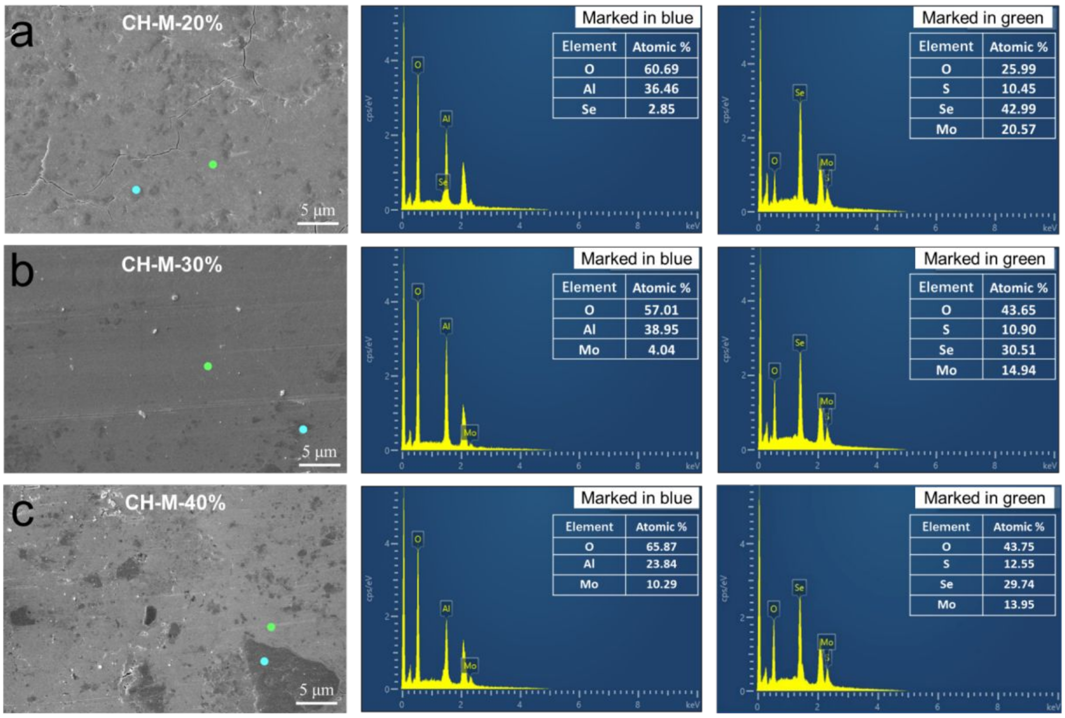

Figure S7. SEM images and corresponding EDS spectra of the wear tracks of CH-M composites with different texture densities (measured at 5 N). (a) CH-M-20%. (b) CH-M-30%. (c) CH-M-40%.

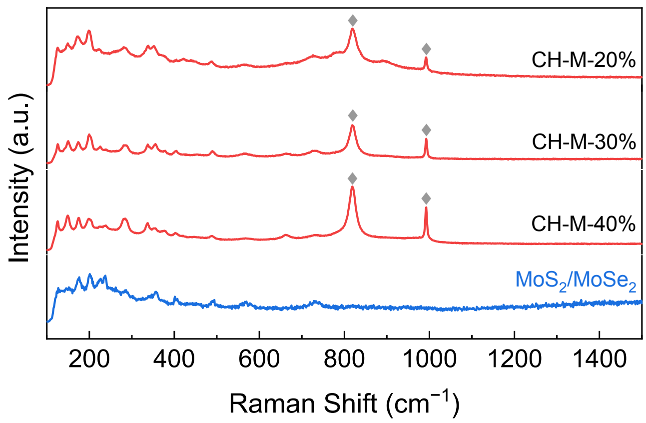

Figure S8. Raman spectra taken from the wear tracks of CH-M composites with different texture densities (measured under 5 N).

Table S1. A comparison of mechanical properties between printed topological structures and other recently reported ceramic materials.

Materials	Methods	Flexural strength (MPa)	Hardness	Ref
Topological Al_2O_3 structures	DLP printing	227.62	16.23 ± 1.7 GPa	This work
α-Al_2O_3	Inkjet printing	49.4	245 HV	[23]
SiOC	DLP printing	-	2.11 GPa	[42]
C/Si_3N_4	PIP	207	-	[37]
SiC_f/HfC-SiC	PIP	108.6	-	[38]
SiC/Mo/CaF_2	Hot pressed Sintering	-	731 HV	[39]
Al_2O_3/MoS_2-$BaSO_4$	SPS	-	15 ± 0.5 GPa	[40]
ZrB_2	SPS	-	13.2 ± 1 GPa	[41]

PIP: precursor infiltration and pyrolysis. SPS: spark-plasma-sintering.