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## Supplementary Material

## **3D-Printed Metal Column for Micro Gas Chromatography**

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Fig. S1. A schematic diagram of direct metal laser sintering (DMSL) technique used in printing of 3D-column. 1. The thin layer of Ti6Al4V powders in the build platform was melted down by a Yb-fiber laser.
2. The build platform was moved down and the second layer of powders was deposited from the powder dispenser platform by using the recoater arm. 3. The process was repeated until completion of the model.



**Fig. S2.** CAD drawing of 3D-column showing a 1 m-long square-spiral microchannel with two inlet and outlet ports.



Fig. S3. Enlarged side images of 3D-column (a) at and (b) outside the center of the 3D-column in Figure 2.



**Fig. S4.** Chromatograms of (a) alcohol mixture (1. 2-propanol, 2. 1-butanol, 3. 1-pentanol, 4. 1-hexanol, 5. 1-heptanol) and (b) ketone mixture (1. 2-butanone, 2. 2-pentanone, 3. 2-hexanone, 4. 2-heptanone) obtained with 3D-column (black), PHPS-treated 3D-column (blue), OV-1 coated 3D-column (pink) and post-treated 3D-column (orange). 99.999% N<sub>2</sub> was used as a carrier gas at an isothermal condition of 50°C with 0.45 psi inlet pressure.



Fig. S5. Golay plot (*n*-nonane) for (a) OV-1 coated 3D-column and (b) commercial column (DB-1) using 99.999%  $N_2$  as carrier gas in an isothermal condition of 70 °C.



**Fig. S6.** Chromatograms of the mixture (1. benzene, 2. toluene, 3. ethylbenzene, 4. *n*-nonane) obtained with 3D-column during (a)  $1^{st}$  and (b)  $20^{th}$  cycle of temperature ramping. The temperature ramping condition: 40 °C to 200 °C at a rate of 15 °C/min (at 200 °C held for 1 min). 99.999% N<sub>2</sub> was used as a carrier gas with 0.2psi inlet pressure.

**Table S1.** Comparison of resolutions of analytes in alkane mixture and aromatic mixture from thechromatograms of Fig. 5.

	Alkane mixture (C5-C9)					Aromatic mixture				
	Pentane	Hexane	Heptan e	Octane	<i>n</i> -Nonane	Benzene	Toluene	Ethylbenzen e	<i>m</i> -xylene	Styrene
3D- colum n	0		0		-	0.	0.84			-
	- 0.8		34		0.99	-	0.64		0.65	
PHPS- treated	0					0				
OV-1- coated	2.53		4.34		-	4.54		1.09		-
	- 3.5		54		4.86	-	6.84		1.29	