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Electronic Supplementary Informations

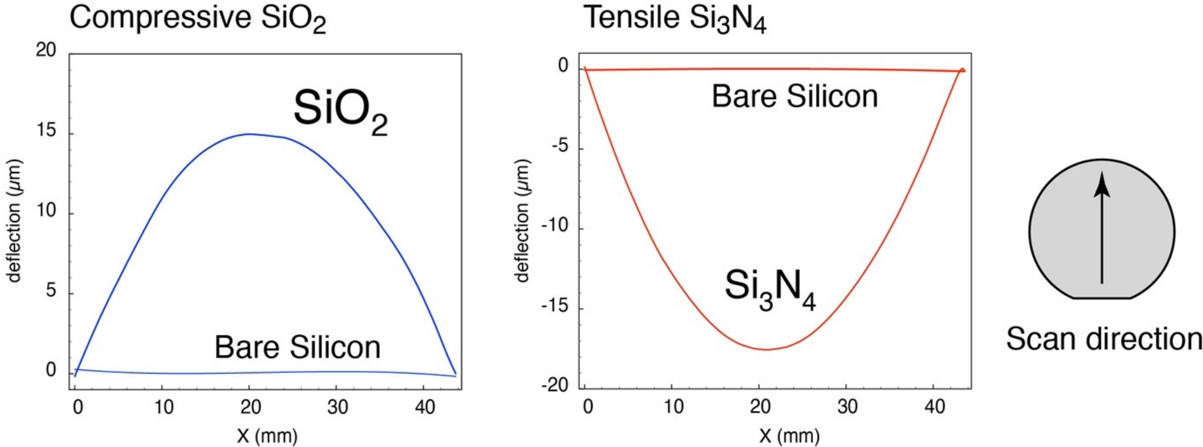

Fig. ESI 1. Stress analysis of thin film layers. 40 mm long profiles of 3 inches silicon wafers measured with Dektak mechanical stylus profilometers on bare and thin film PECVD deposited silicon wafer. Left with Compressive SiO_2 layer and right with tensile Si_3N_4 layer.

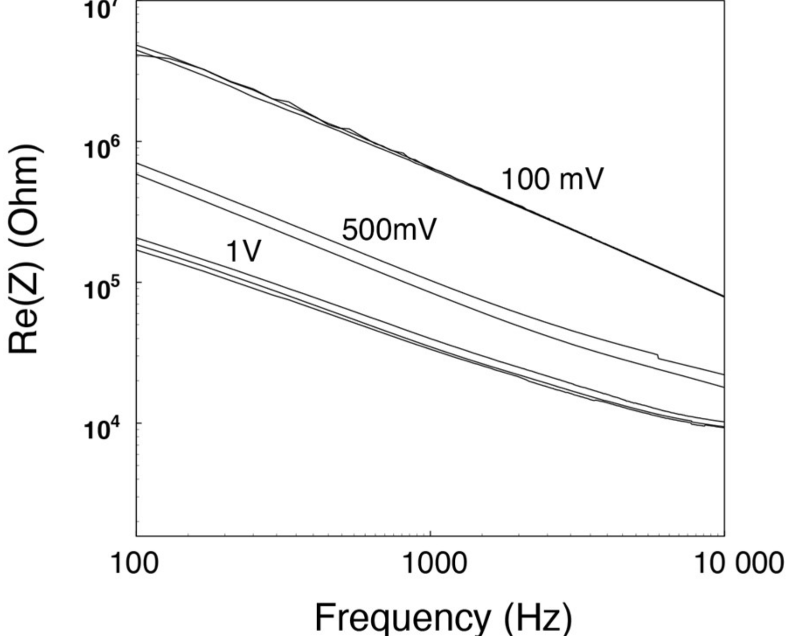

Fig. ESI 2. Impedance analysis, real part of the impedance of different electrodes as function of the frequency and for different values of peak to peak signal.

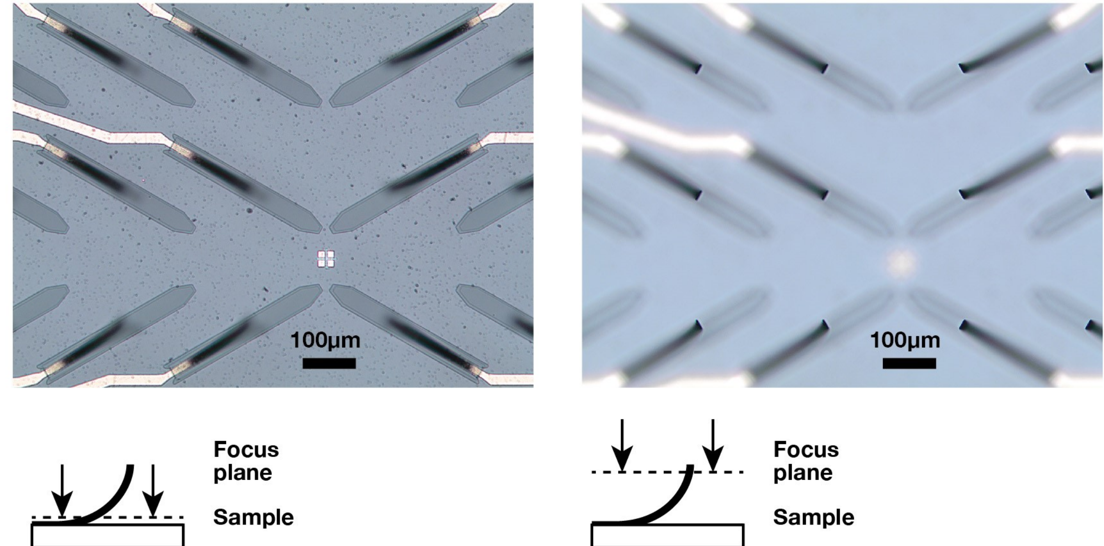

Fig. ESI 3. Optical microscope photographs of the MEAs (10X objective) at two distinct focal plane, left on the surface of the sample and right at the apex of the beams.

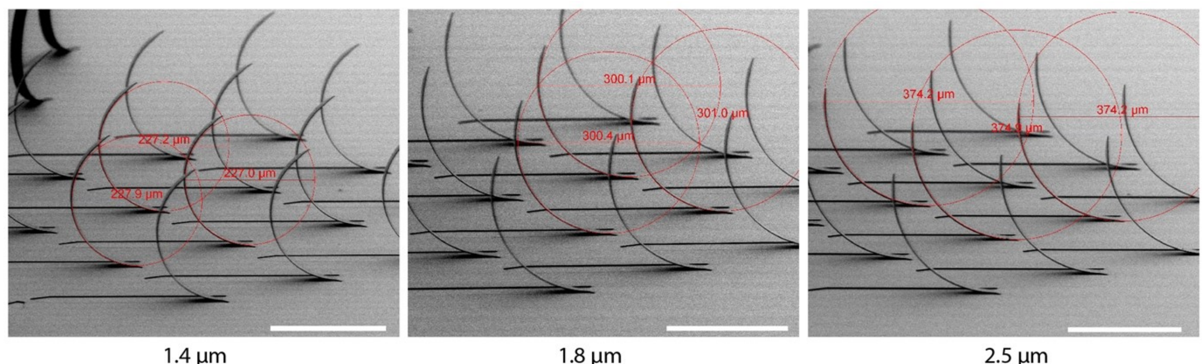

Fig. ESI 4. Radius of curvature measurement of cantilevers of different thickness using scanning electron microscopy.

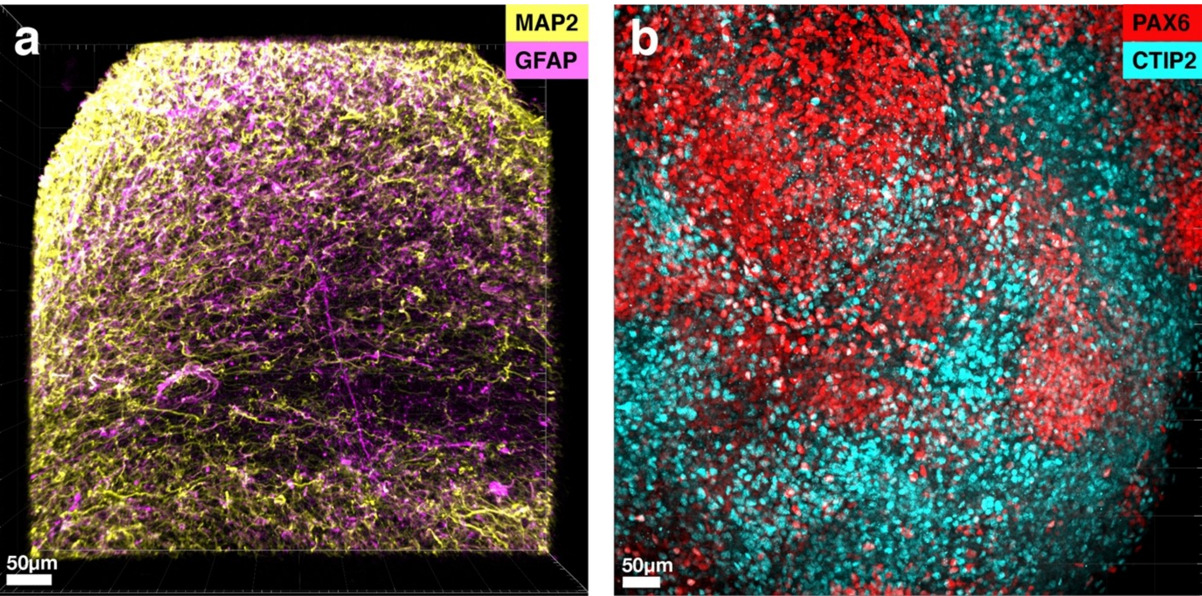

Fig. ESI 5. Cortical organoids were cultured for 44 days, cut into 300-µm slices and prepared for immunostaining. Confocal image acquisition revealed neurons (a, MAP2, yellow), astrocytes (a, GFAP, purple), neural progenitor cells (b, Pax6, red), and neuron (layers V and VI) nuclei (b, CTIP2, cyan).

#	Step	Process	Cross section schematic
1	Glass substrate	4.9x4.9 cm, 500 µm thick glass blades (Paul Marienfeld GmbH)	Glass
2	Substrate cleaning	Piranha etch (sulfuric acid and peroxide)	Aluminium
2	Aluminium sacrificial layer deposition	Evaporation of 300nm thick aluminium, whole plate	
3	First lithography, mask #1	AZ 1518 (Microchemicals GmbH, Germany), spincoat 3000 rpm, baking 110°C, development	AZ 1518
4	Aluminium etching	H_3PO_4, HNO_3, CH3COOH, H_2O (80/5/5/10%) at 40°C	
5	SiO_2 deposition	PECVD, 280°C, whole plate, 300s deposition time	SiO_2
6	Second lithography mask #2	AZ nLOF 2020, spincoat 3000rpm, baking 110°C 1minute, exposure and post exposure bake 110°C, development, plasma oxygen hashing	AZ2020
7	Metal deposition	Electron gun evaporation. Ti/Au 20/150nm	Ti/Pt
8	Metal Lift off	Remover PG, 80°C, 10minutes	
9	Si_3N_4 deposition	PECVD, 280°C, whole plate, 300s deposition time	Si_3N_4
10	Third lithography mask #3	AZ nLOF 2020, spincoat 3000rpm, baking 110°C 1minute, exposure and post exposure bake 110°C, development, plasma oxygen hashing	AZ2020

11	Pad and active sites opening	ICP RIE Plasma dry etch of Si_3N_4 layer. $CHF_3/0_2$ gazes, 100W. Laser interferometry etching end detection on Au layer.	
12	Resist stripping	ICP RIE Plasma dry 0_2 + remover PG	
13	Fourth lithography mask #4	AZ nLOF 2020, spincoat 3000rpm, baking 110°C 1minute, exposure and post exposure bake 110°C, development, plasma oxygen hashing	
14	Cantilever opening	ICP RIE Plasma dry etch of Si_3N_4 and SiO_2 layers. $CHF_3/0_2$ gazes,100W. Laser interferometry etching end detection on Al layer.	
15	Resist stripping	ICP RIE Plasma dry 0_2 + remover PG + final piranha cleaning	
16	Cantilever release Sacrificial layer etching	H_3PO_4, HNO_3, CH3COOH, H_2O (80/5/5/10%) at 40°C + DIW rinse + IPA rinse + N_2 drying	

Table ESI 1. Process chart