3D printed microsupercapacitors from 2D material inks

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Programmable assembly of nanomaterials in three-dimensional miniaturized architectures can lead to the fabrication of new small-scale devices. These are of central importance for future on-chip technologies where efficiencies need to be optimized over small footprints. This is a new challenge, as device miniaturisation has been mainly developed to achieve planar-geometries. Here, we demonstrate 3D printed microsupercapacitors from highly concentrated, water-based 2D atomically thin material inks. The printed architectures, from woodpile structures to interdigitated and stacked electrodes, are extended over hundreds of micrometres in three-dimensions and present structural integrity with 100 µm-sized features. Their mechanical robustness and high density allow their employment as miniaturised supercapacitor and hybrid supercapacitor-battery devices. The use 2D nanosheets as the elementary building blocks leads to a unique microstructure of the electrodes, which enables the exceptionally high energy density of 0.5 mW h/cm^2 [1]. Our general approach to ink formulation and device assembly can have a great impact on the manufacturability of miniaturised energy storage devices.

References

[1] C. Grotta, P. Sherrell, P. Palczynski, M. Sokolikova, A. Panagiotopoulos C. Mattevi *under review*.