

Electronic Supplementary Information

Spray Printing of Self-Assembled Porous Structures for High Power Battery Electrodes

Sang Ho Lee*, Amoghavarsha Mahadevegowda, Chun Huang, Jack D. Evans and

Patrick S. Grant

Department of Materials, University of Oxford, Oxford OX1 3PH, UK.

* Address correspondence to sangho.lee@materials.ox.ac.uk

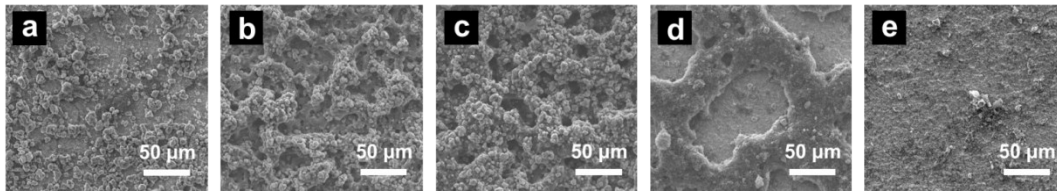


Fig.S1 A series of SEM images of the morphology change of the sprayed electrodes according to a change in the volume ratio of DI water to IPA in the liquid spray suspension: (a) 100:0, (b) 70:30, (c) 50:50, (d) 30:70 and (e) 0:100.

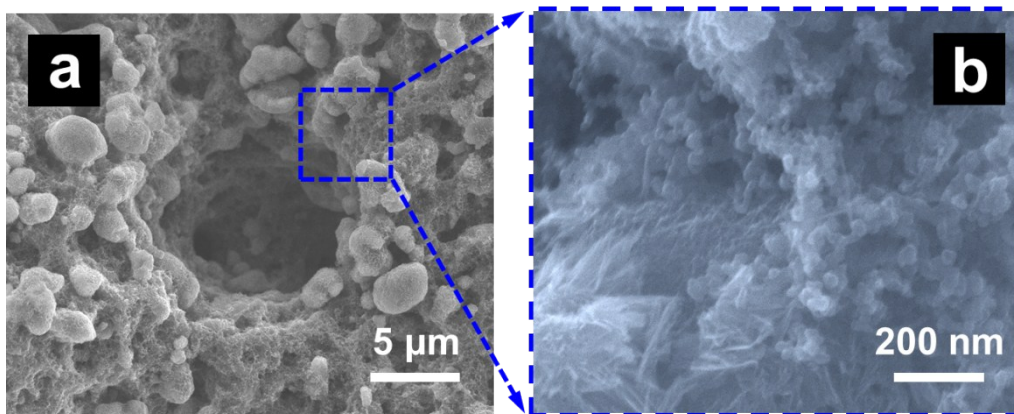


Fig.S2 (a) SEM image of the pore structure of the TiO₂(B)-based electrode. (b) A magnified view around the pore region.

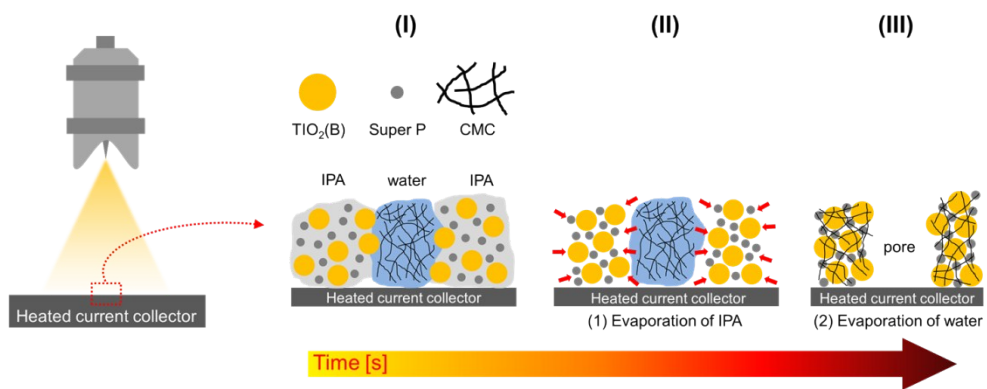


Fig.S3 Schematic diagram of a proposed, simple model of how to fabricate through-thickness pore channels in a battery electrode based on layer-by-layer spray printing and bi-solvent drying.

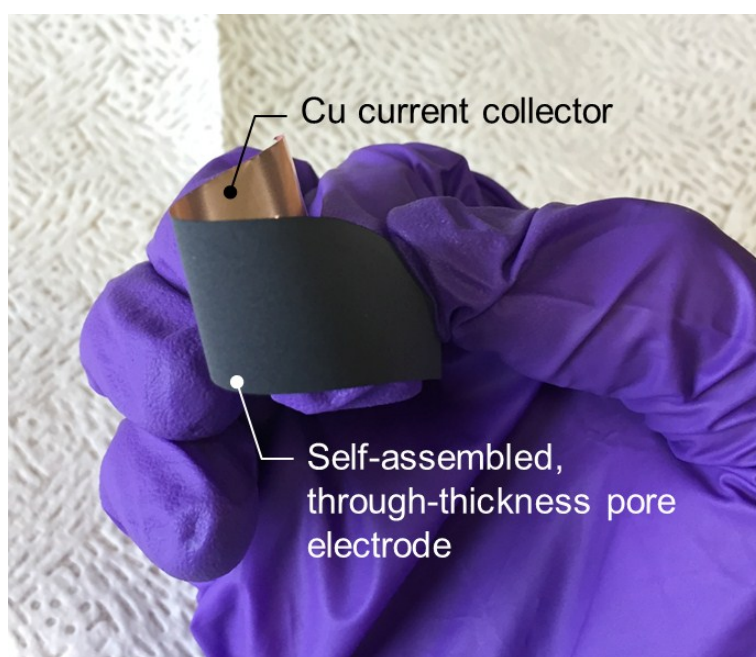


Fig.S4 A photograph of an as-spray printed, through-thickness pore electrode robustly withstanding severe bending and flexing by hand.

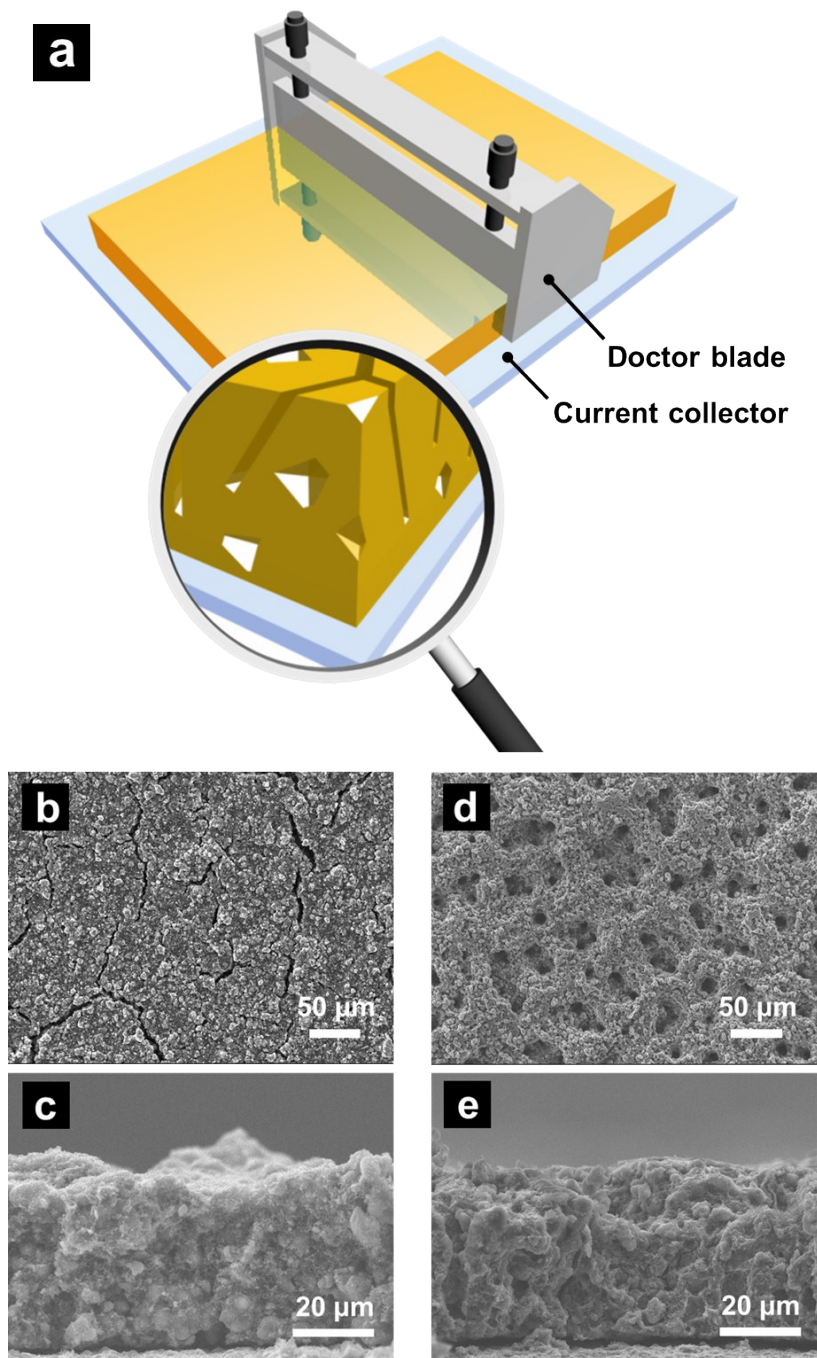


Fig.S5 (a) Schematic diagram of the conventional slurry casting process using a doctor blade. (b) Plan view and (c) cross-sectional view of the slurry cast $\text{TiO}_2(\text{B})$ -NT-based electrodes. (d) Plan view and (e) cross-sectional view of the spray printed $\text{TiO}_2(\text{B})$ -NT-based electrodes.

Table S1 Summary of the electrode mass loading according to a change in electrode thickness.

Thickness (μm)	Sprayed (mg/cm^2)	Slurry-cast (mg/cm^2)
10	0.53 ± 0.02	0.68 ± 0.03
20	0.98 ± 0.03	1.38 ± 0.04
40	2.01 ± 0.02	2.65 ± 0.05
80	3.99 ± 0.04	5.53 ± 0.06

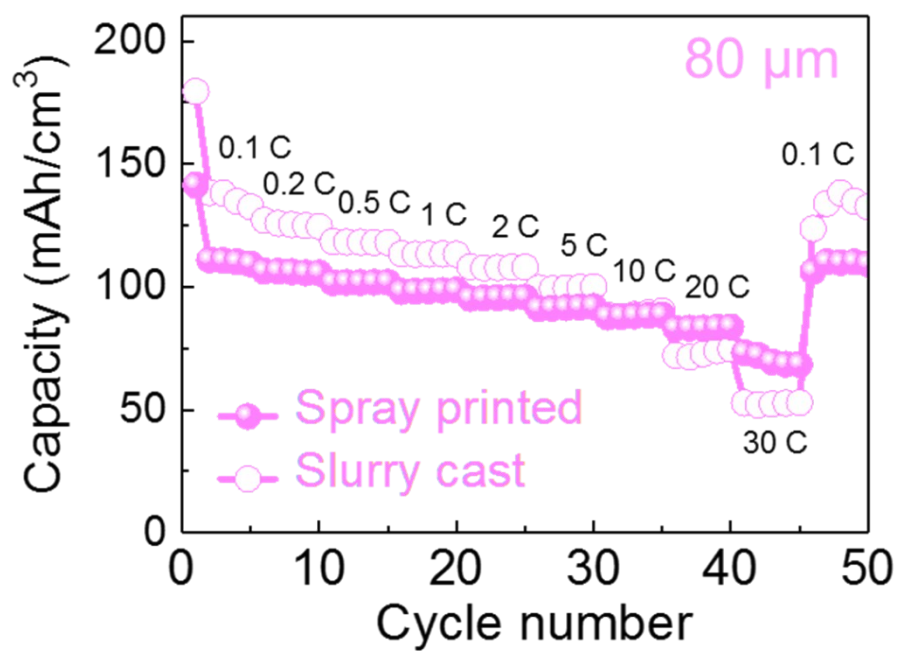


Fig.S6 Volumetric discharge capacities of 80 μm thick spray printed and slurry cast electrodes at various C-rates in the potential range of 1.0 to 3.0 V (vs. Li/Li⁺).

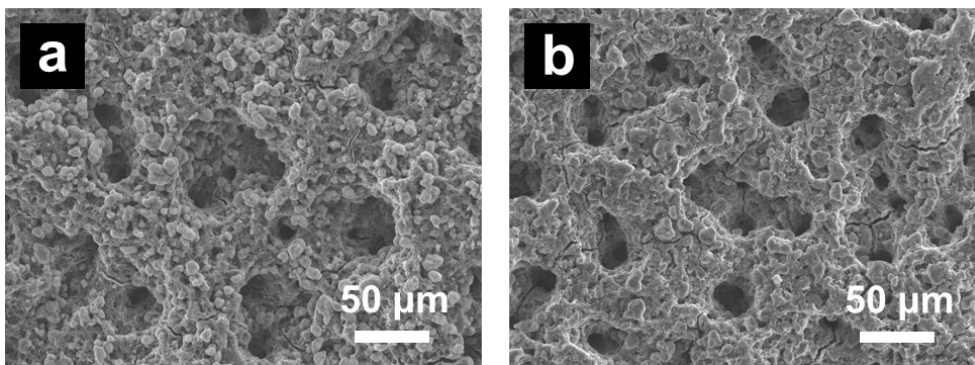


Fig.S7 SEM images of the 80 μm thick $\text{TiO}_2(\text{B})$ -NT-based electrodes (a) before and (b) after 200 cycles in the potential range of 1.0 to 3.0 V (vs. Li/Li^+) at 1 C.

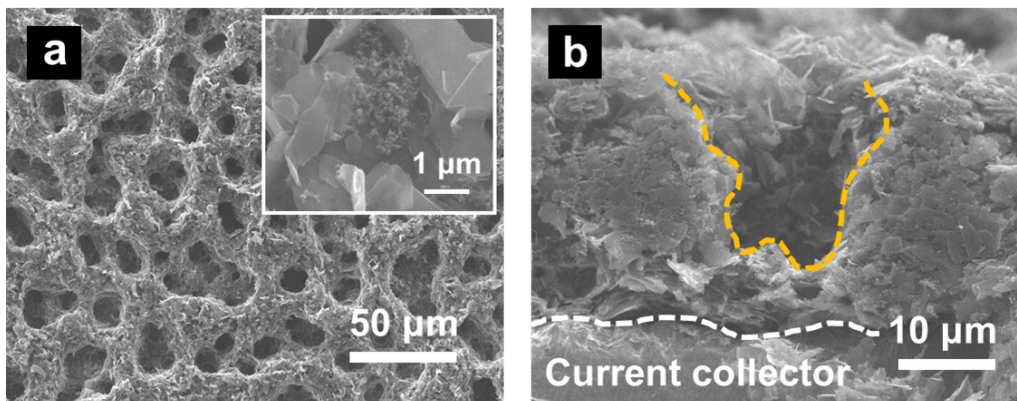


Fig.S8 (a) Plan view and (b) cross-sectional SEM images of through-thickness porous electrodes, manufactured by spray printing of graphene bi-solvent suspensions, where graphene flakes of $\sim 5\text{-}7\ \mu\text{m}$ diameter were exploited.