Ultrahigh power thin-film micro-supercapacitors based on onion-like carbon

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Achievement

Micro-supercapacitors based on onion-like carbon have been manufactured by electrodeposition of carbon onions on micropatterned gold plated Si/SiO_2 wafers. An extremely small time constant of < 30 ms enables these electrodes to operate at very high scan rates over several volts per second while only a marginal loss of the capacitance is observed.

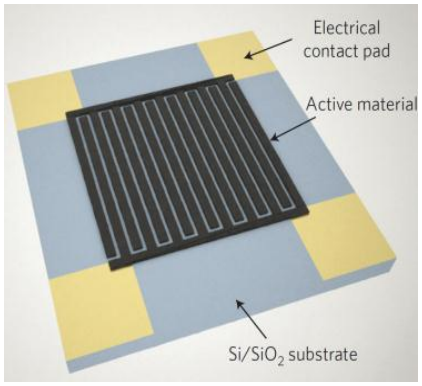

Fig. 1: Model of carbon-onion micro-supercapacitor on a gold plated Si-chip.

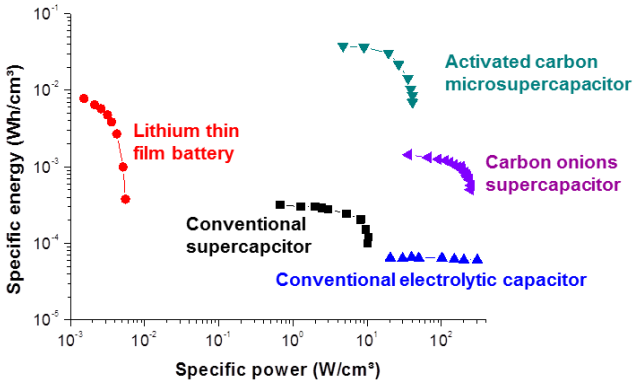

Fig. 2: Ragone plot comparing micro-supercapacitors with Li-batteries and other capacitors

Significance

Our work marks the first time that binder-free carbon onion micro-supercapacitors have been manufactured and the resulting devices allowed ultra-high scan rates of up to 200 V/s. This is two orders of magnitude higher than conventional supercapacitors resulting in very high specific power. The on-chip fabrication of micro-supercapacitors is an important step towards a fully integrated solution for energy storage and marks a milestone in achieving high specific power and energy for advanced electrochemical energy storage devices.

Credit

Reference: D. Pech, M. Brunet, H. Durou, P. Huang, V. Mochalin, Y. Gogotsi, P.-L. Taberna and P. Simon, Nature Nanotechnology, 2010, 5, 641 - 654. The effort at Drexel University is based upon work supported as part of the Fluid Interface Reactions, Structures and Transport (FIRST) Center, an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences under award no. ERKCC61.