Asymmetric supercapacitor based on carbon nanofibers as the anode and two-dimensional copper cobalt oxide nanosheets as the cathode - DTU Orbit (24/07/2019)

This paper reports the fabrication of an ultra-high energy and power density asymmetric supercapacitor (ASC) containing a novel porous carbon nanofiber derived from hypercross-linked polymers (HCP-CNF) and two-dimensional copper cobalt oxide nanosheets (CCO-NS) as the negative and positive electrodes, respectively. The micropore-enriched HCP-CNF is obtained from a facile Friedel-Crafts reaction with naphthalene and α, α′-dichloro-p-xylene as the starting material. The CCO-NS have been prepared by a simple and inexpensive hydrothermal synthesis using polyvinylpyrrolidone (PVP) as a shape controlling agent. The fabricated CCO-NS/HCP-CNF ASC device exhibit a high specific capacitance, 244 F g⁻¹ at a current density of 1 A g⁻¹, owing to the unique porous architecture of CCO-NS and the interconnected microporous carbon skeleton with a high surface area of HCP-CNF. Furthermore, the assembled ASC device show an ultra-high energy density of 25.1 Wh kg⁻¹ at a power density of 400 W kg⁻¹ with maximum operating voltage of 1.60 V. The electrode shows good capacitance retention (91.1%) after 5000 cycles in a 3M aqueous KOH solution. In addition, two ASC devices are connected in series powered a 5mm diameter LED indicator for approximately 30 min, highlighting its efficient power supply.