Scientists develop integrated electrodes for high-energy-density flexible supercapacitors

June 3 2021, by Zhang Nannan

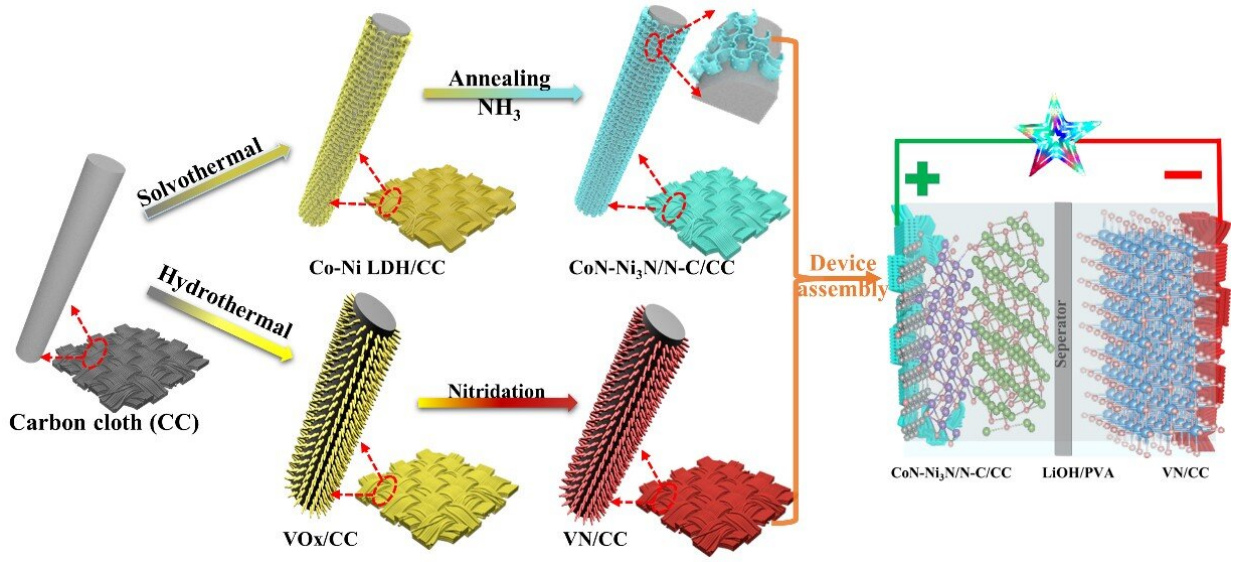

Figure 1. Schematic diagram of the formation process of CoN-Ni3N/N-C/CC, VN/CC, and the assembly of the flexible quasi-solid-state asymmetric supercapacitor device. Credit: LI Kunzhen

Recently, a research team led by Prof. Zhao Bangchuan from the Institute of Solid Materials of the Hefei Institutes of Physical Science (HFIPS) synthesized 3D porous honeycomb-like CoN-Ni_3N/N-C nanosheets and vanadium nitride (VN) nanobelt arrays via in-situ growth method, respectively, and constructed a high-energy-density flexible supercapacitor device. The result has been published in *Advanced*

Functional Materials.

Transition metal nitrides (TMNs) are potential electrode materials for high-performance energy storage devices, but the structural instability severely hinders their application. Therefore it is urgent to construct advanced cathode materials for flexible, wearable, long-life and high-energy-density energy storage devices.

In this research, scientists designed and fabricated an integrated cathode with 3D porous honeycomb-like CoN-Ni_3N/N-C nanosheets, which were grown on flexible carbon cloth (CC) via a mild solvothermal method after post-nitrogenizing treatment.

Further experiments proved that the intrinsic conductivity was enhanced, and concentration of the active sites was increased. It gives advantage to the optimized CoN-Ni_3N/N-C/CC, which can be used as an integrated electrode for the supercapacitor to achieves remarkable electrochemical performance.

This supercapacitor delivers an excellent energy density of 106 μWh cm^2 with maximum power density of 40 mW cm^2, displaying an outstanding cycle stability.

This work provides a viable strategy to construct high-energy flexible wearable electronics in next-generation electrochemical energy storage field.

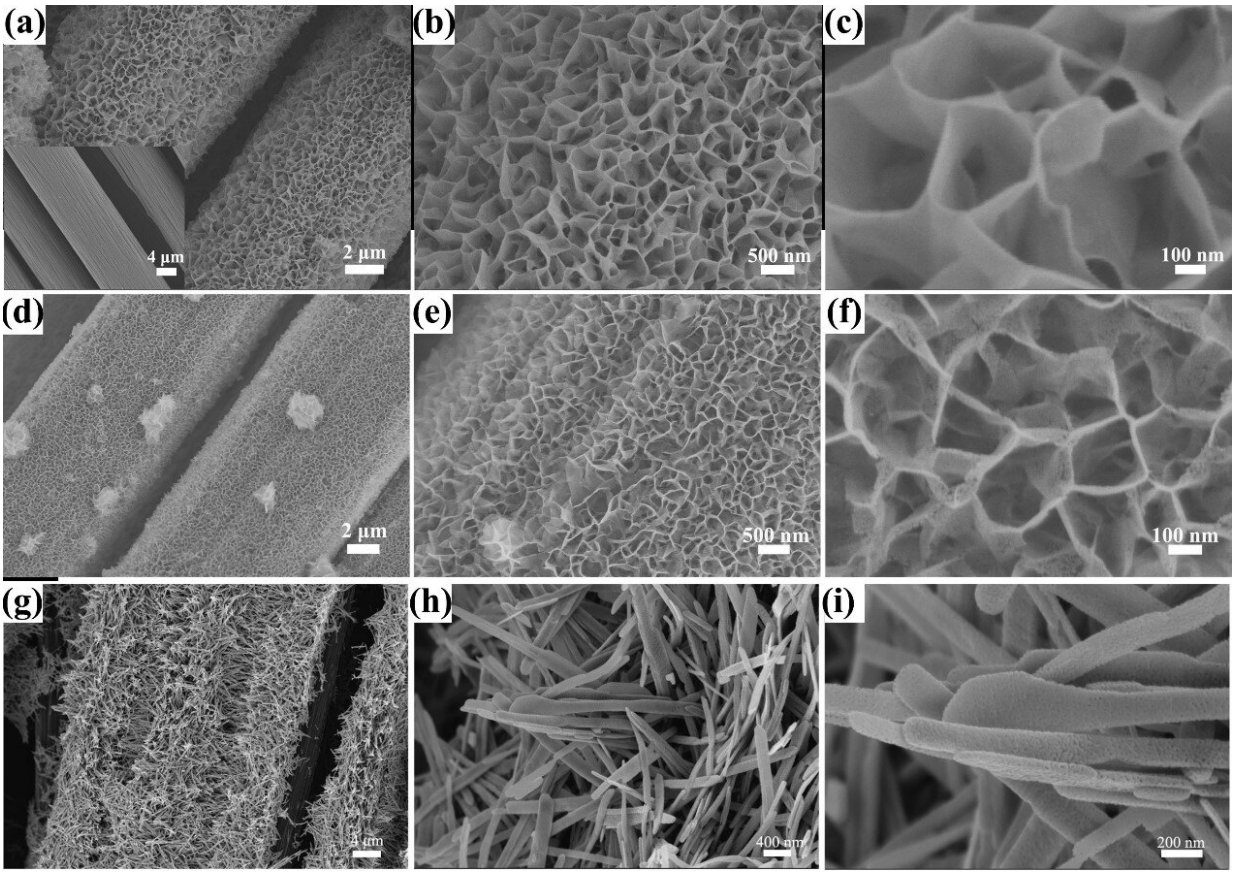

Figure 2. SEM images of (a-c) Co-Ni LDH/CC, (d-f) CoN-Ni_3N/N-C/CC, and (g-i)VN/CC at different magnification. Credit: LI Kunzhen

More information: Kunzhen Li et al, 3D Porous Honeycomb-Like CoN-Ni 3 N/N-C Nanosheets Integrated Electrode for High-Energy-Density Flexible Supercapacitor, *Advanced Functional Materials* (2021). DOI: 10.1002/adfm.202103073

Provided by Chinese Academy of Sciences