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International Conference on

DIAMOND AND CARBON MATERIALS & GRAPHENE AND SEMICONDUCTORS

July 17-18, 2017 Chicago, USA

Porous worm-like $NiMoO_4$ coaxially decorated electrospun carbon nanofibers as binder-free high performance electrodes for supercapacitors and lithium-ion batteries

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Recently, various nanoscale $NiMoO_4$ structures have been synthesized and evaluated as electrode materials in both SCs and LIBs due to the relatively low cost, abundant availability, environmental benignity and inherent electrochemical advantages. Given the $NiMoO_4$ prepared in these works exhibits small surface area and dense structure, which impedes the fast ions transport and makes it difficult to alleviate the volume change. Therefore, it will be of great significance to grow porous $NiMoO_4$ nanostructure directly on flexible substrates for effective energy storage. As another carbon textile, electrospun carbon nano fibers (ECNFs) exhibit smaller diameter and lighter mass when compared with conventional carbon cloth, which is favorable to increase the loading of $NiMoO_4$, shorten ion/electron transport pathways and improve the utilization of $NiMoO_4$. The peculiar architectures consisting of electrospun carbon nanofibers coaxially decorated by porous worm-like $NiMoO_4$ were successfully fabricated for the first time to address the poor cycling stability and inferior rate capability of state-of-the-art $NiMoO_4$-based electrodes. The porous worm-like structure endows the electrode high capacitance/capacity due to large specific surface area and short electron/ion diffusion channels. Moreover, the robust integrated electrodes with sufficient internal spaces can self-accommodate volume variance during charge/discharge processes, which is beneficial to the structural stability and integrity. By the virtue of rational design of the architecture, the hybrid electrode delivered high specific capacitance (1088.5 F g-1 at 1 A g-1), good rate capability (860.3 F g-1 at 20 A g-1) and long lifespan (73.9% capacitance retention after 5000 cycles at 10 A g-1) when applied as supercapacitor electrode. For lithium-ion battery application, the electrode exhibited a high reversible capacity of 689.7 mAh g-1 even after 150 continuous cycles at a current density of 1 A g-1.

Biography

Song Y has her expertise in preparation and application of porous carbon and energy storage materials. She is Project Leader of the National 863 project, the University of Science and Technology Beijing, key research plan of Shanxi Province, etc. She made a breakthrough in the development of preparation of high performance carbon/silicon composite anode, the pore structure control of porous nano-carbon fibers. She got several awards, such as Lu Jiaxi Young Talent Award of CAS in 2009, second prize for Science Award in Shanxi Province in 2013, first prize for National Defense Science and Technology Innovation award in Shanxi Province in 2014 and so on.

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