

Nitrogen and Sulfur Co-doped Holey Graphene Aerogel For High-performance Compression-Tolerant All Solid-State Supercapacitors

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Abstract

Deformation-tolerant power-source devices are crucial for designing high-tech elastic electronics owing to their elasticity of integration into preferred levels of eccentric forms while maintaining the performance and reliability.^[1] Among various power-source devices, compression-tolerant all solid-state supercapacitors (ASSCs) could be a strong candidate for next-generation elastic electronics.^[2] However, the use of non-conductive compressible substrate and pseudocapacitor agents as additives could inhibit the compressibility as well as the performance of the devices. Therefore, proper selection of porous foam-like electrodes with remarkable compressibility, sustainable conductivities and electrochemical performances under varying compressions are the critical prerequisites to develop high-performance compressible ASSCs. Here, we introduce a facile technique without using any additives for fabricating highly compressible, electrically conductive, nitrogen and sulfur co-doped holey graphene aerogel (NS-HGA) as an efficient electrode for high-performance compressible ASSCs. Such covalently interconnected holey framework with heteroatom co-doping greatly increases repeatable elasticity and excellent structural robustness, high electrolyte ion storage ability, unimpeded ion channels to offer excellent conductivity (21.66 S m^{-1}) and significantly high volumetric capacitance (203 mF cm^{-3}) in ASSCs with good rate capability and almost unaltered capacitance at 50% compression with good durability for 200 cycles. The current unique methodology to develop heteroatom co-doped holey graphene aerogel for designing high-performance compressible ASSCs will pave a new approach in the modern era of elastic electronics.

References

- [1] J. A. Rogers, T. Someya, Y. Huang, *Science*, 327 (2010) 1603
- [2] Y. Zhao, J. Liu, Y. Hu, H. Cheng, C. Hu, C. Jiang, L. Jiang, A. Cao, L. Qu, *Advanced Materials*, 4, 25 (2013) 591

Figures

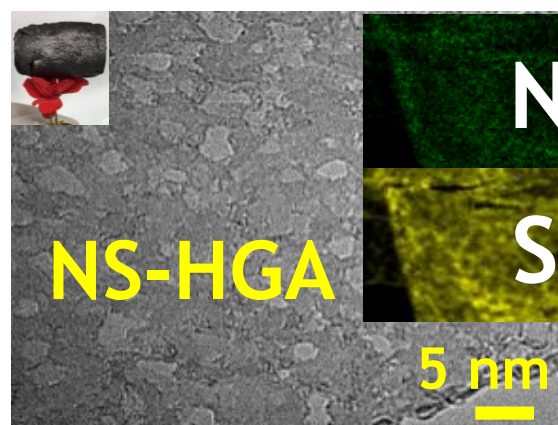


Figure 1. HRTEM and STEM images of N and S co-doped ultra-light graphene aerogel

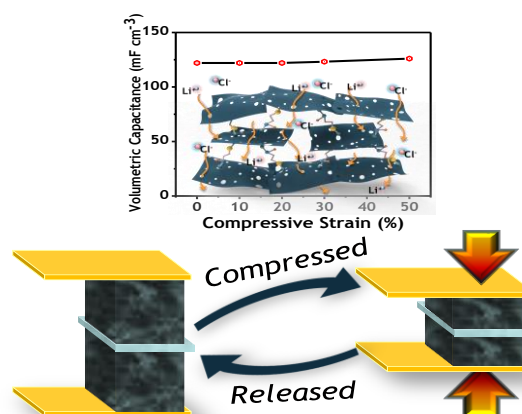


Figure 2. Compression-tolerant all-solid-state supercapacitors