Novel Graphene Material for High Energy Storage Supercapacitors

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Supercapacitors have attracted great interest because of their fast, reversible operation and sustainability. However, their energy densities remain lower than those of batteries. In the last decade, supercapacitors with an energy content of ~110 W h L^{-1} at a power of ~1 kW L^{-1} were developed by leveraging the open framework structure of graphene-related architectures.

Here, we report that the reaction of fluorographene with azide anions enables the preparation of a highly nitrogen doped (~16%). This material, with diamond-like bonds and an ultra-high mass density of 2.8 g cm^{-3}, is an excellent host for the ions, delivering unprecedented energy densities of 200 W h L^{-1} at a power of 2.6 kW L^{-1} and 143 W h L^{-1} at 52 kW L^{-1}. These findings open a route to materials whose properties may enable a transformative improvement in the performance of supercapacitor components.

The presentation will elaborate on this high energy graphene based material structure, challenges and its potentials for future development.