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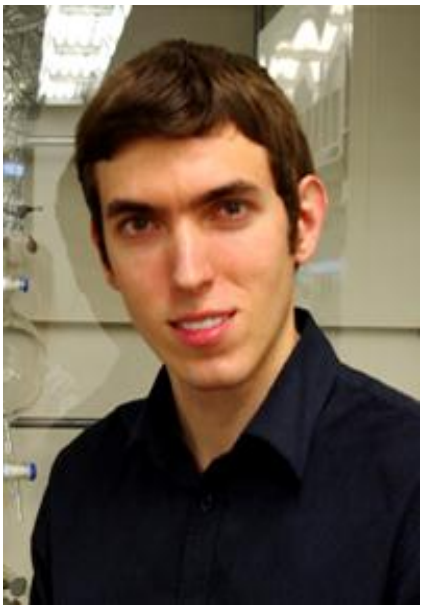

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T*hree-Dimensional Graphene-Based Scaffolds for Supercapacitor Applications*

Abstract.

A supercapacitor (SC) is an electrochemical capacitor that has an unusually high energy density compared to common capacitors. The conductivity and high specific surface area (2670 m^2/g) properties make graphene one of the best possible materials for SCs. However, when graphene or graphene oxide (GO) sheets are densely stacked to form a three-dimensional (3D) electrode of a SC, much of their surface is inaccessible to electrolyte and thus does not contribute to the SC performance. Here we propose a new class of graphene-based materials – 3D graphene-based scaffolds (3DGSs) – that are very promising for SC applications because of their very high specific surface area that is fully accessible to electrolyte. We demonstrate that 3DGSs could be fabricated by a simple and inexpensive procedure that is based on the co-assembly of pre-synthesized GO sheets and submicron polystyrene spheres followed by the annealing of a GO/polystyrene composite in air. Further studies will focus on the optimization of the synthetic approach for 3DGSs to achieve a high specific surface area material, which will be tested for SC applications. We will test different types of soluble graphene, as well synthetic graphene nanoribbons, recently advanced by Sinitskii group, as precursors for 3DGSs. The goal of this project will be accomplished by uniting the synthetic expertise of the PI, Sinitskii, with the complementary electrochemistry and measurement expertise of the co-PI, Lai. We expect to demonstrate SCs that could compete and possibly outperform the best graphene-based SCs reported elsewhere, as well as commercial SCs based on activated carbon.