Light and sound in 3D graphene sponge

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Due to its unique structure, exceptional properties and large surface area, graphene is highly promising for a wide range of applications in electronics, sensor technology and energy storage. Nevertheless, a full utilization of its intrinsic large surface makes essential to prevent graphene sheets forming irreversible agglomerates or even restacking. Therefore, exotic three-dimensional architectures have been built, by assembling multiple sheets of graphene or arranging them into new porous designs [1]. Combining their peculiar 3D structure with the intrinsic features of pristine graphene, which are indeed preserved, these materials show an even larger surface area and much more storage capability for electrons or ions, gas or liquid.

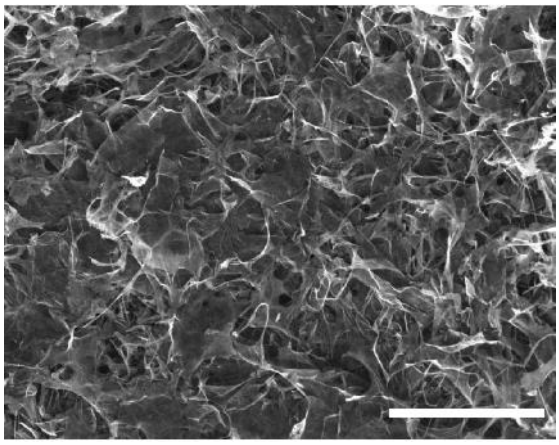

Figure 1. SEM images of 3D graphene sponge. The scale bar is 50 μm.

Within the framework of three-dimensional (3D) graphitic architecture, an ultra-lightweight graphene sponge materials, providing a combination of both cork-like and rubber-like properties has been synthesized [2]. With its density similar to air, its near-zero Poisson ratio in all direction and its high elasticity, this pioneering material paves the way to manifold applications, from environmental cleanup or liquid transfer to the realization of magnetic actuator or gas sensing. Although mechanical and structural properties of this carbon-based sponge have been widely investigated, the knowledge of its electronic and optical properties is still in its infancy.
Here we characterize the electrodynamic properties of a 3D graphene sponge structure (Fig. 1). In particular, we show that the unique combination of thermal, mechanical and electronic properties of 2D graphene sheets arranged in a 3D structure results in a nontrivial interaction with light which is converted in sound with high efficiency [3].

References

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