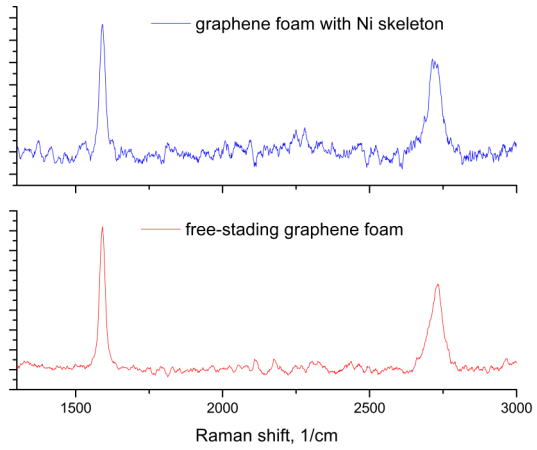
A NEW CLASS OF GRAPHENE-BASED MATERIALS: ULTRA-LIGHT FREESTANDING 3D FOAMS

Production of 3D Graphene Foams:

The Graphene Foam is made via chemical vapor deposition (CVD) processing. The graphene is formed in course of CVD process from hydrogen and methane introduced into a furnace that heats to 1000°. A nickel or copper film placed into the furnace captures a mono or multi-layer or graphene as the furnace is heated and the methane decomposes. To grow CVD Graphene Foam, instead of using a thin sheet of nickel to grow graphene, nickel foam is used. The nickel foam used as a template for the creation of Graphene Foam is also made via CVD and is highly porous itself. Nickel foam has applications similar to that of Graphene Foam, such as in fuel cells, and many of these applications are strengthened through the application of graphene to the foam[1].

The nickel is then removed, and left is a conductive, flexible, porous 3D Graphene Foam structure. This structure has a high surface area because of its many nanoscopic pores, which opens several exciting applications for Graphene Foam, while maintaining most of two-dimensional graphene's properties[2]. CVD processing of Graphene Foam opens a cost-effective route for engineering a new class of ultra-light, highly conductive graphene-based materials with exceptional mechanical strength, flexibility, and elasticity.

Raman Spectrum



SEM Image: High Magnification

Specifications:

- Composition: Carbon (99%)
- Thickness: 2 mm
- Thickness: 7-10 atomic layer .
- Color: Black

For more details: Visit https://graphene-supermarket.com/3D-Graphene-Foams/

GRAPHENE SUPERMARKET®

Graphene Laboratories, Inc.
4603 Middle Country Rd. suite 125
Calverton, NY 11933

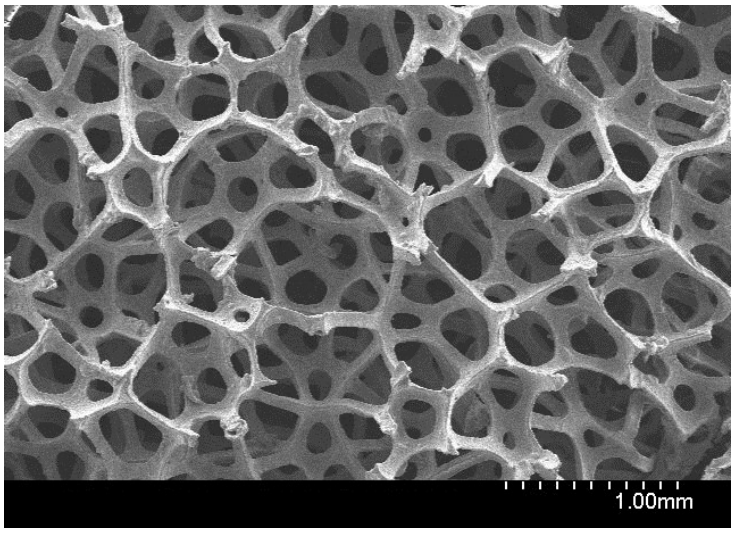
Phone: (516)-382-8649
Fax: (781) 287-1248
graphene-supermarket.com
info@graphene-supermarket.com

A New Class of Graphene-Based Materials: Ultra-Light Freestanding 3D Foams

Graphene's extraordinary properties have recently been taken to the third dimension with the advent of freestanding, ultra-lightweight Graphene Foams. Scientists have begun using metal foam to create a three-dimensional form of graphene, 3D Graphene Foam, with strong potential applications in chemical sensing as well as energy storage.

The electrical and structural properties of CVD grown Graphene Foam are superior when compared to the properties of its rivals, chemically derived reduced graphene oxide and few-layered graphene nanoplatelets. Both rivals suffer from a high concentration of defects as well as poor interflake mechanical contact[3]. This is because unlike CVD Graphene Foam, they require many separate sheets of graphene to connect with one another, whereas Graphene Foam grown via CVD is monolithic. Further, reduced graphene oxide is inherently less conductive than graphene, of which Graphene Foams[2] are made of.

Potential Applications



SEM Image: Low Magnification

One important application of Graphene Foam is in chemical sensing due to its high surface area. Graphene sensors which have been made with Graphene Foam were found to be about ten-times more sensitive than ones currently on the market, detecting 20 parts-per-million of nitrogen dioxide. The graphene sensors were able to detect gases at room temperature, while many commercial sensors today require high temperatures to work properly. The porous graphene is not only more effective than current commercial sensors; it also can easily be reused. In order to free the graphene foam of trapped gas molecules, all the graphene needs is an electric shock[4].

Graphene Foam may also be used in energy storage, such as supercapacitors and batteries. The structure of the graphene foam opens the potential to store massive amounts of energy. The Graphene Foam has a high surface area because of its porous nature, giving it a high electrochemical capacitance[5]. Graphene which is directly precipitated on nickel foam has good electrical contact with the nickel foam, further improving its performance as a supercapacitor. Graphene Foam on nickel was found to have a specific capacitance of 816 F g^{-1} at 5 mV s^{-1}, which is high when compared to other metal oxides[6].

References

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4. "High Sensitivity Gas Detection Using a Macroscopic Three-Dimensional Graphene Foam Network." Yavari, F. et al. *Scientific Reports*, article 166 (2011).
5. "Gram-scale synthesis of nanomesh graphene with high surface area and its application in supercapacitor electrodes." Ning, G. et al. *Chem. Commun.*, 47 (2011), pp. 5976-5978.
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Calverton, NY 11933

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