Nanocellulose-Assisted Exfoliation of Graphite to Few Layer Graphene

Tech ID: 30089 / UC Case 2019-302-0

ABSTRACT

Researchers at the University of California, Davis have developed a high-yield method that utilizes the unique properties of cellulose nanofibrils (CNFs) to fabricate high-quality graphene from bulk graphite. This graphene can then be fabricated into graphene nanopapers, which have unique moisture and heat-sensing capabilities for applications in "smart" electronic devices and other uses.

FULL DESCRIPTION

Currently, graphene is employed in various applications, including electric circuits, solar cells and medical processes. Although graphene has many desirable properties in these applications, existing production processes for graphene typically yield low-quality or low volumes of graphene using excess surfactant or in organic liquids. A process for producing high-quality graphene in significant volumes is thus highly desirable.

Researchers at the University of California Davis have developed a robust, simple and fast process for exfoliating graphite to single-layer to few layer graphene. This process utilizes novel amphiphilic cellulose nanofibrils (CNFs) derived from readily available agricultural and food processing biomass that is non-toxic. Additionally, the fabrication process is aqueous and easily scalable for bulk graphene production. Graphene flakes produced from this method are stable in aqueous media without aggregation. By comparison, current techniques for fabricating graphene from bulk graphite at comparable concentrations require harsh organic compounds or significant quantity of surfactants and often result in graphene flakes that aggregate over time. The graphene flakes fabricated using CNFs can be readily formed into graphene nanopapers - which display unique moisture-responsive properties, as well mechanical strength and flexibility. The features of this graphene enable it to be beneficial for various applications such as electronics, pulp and paper products, and nano-composite products.

APPLICATIONS

- Moisture-responsive electronics
- Pulp and paper production
- Thin film deposition
- 3D printing
- Conductive inks
- Battery production

FEATURES/BENEFITS

- Simple and cost-effective fabrication method that can be scaled readily
- Absence of previously-required harsh organic chemicals and surfactants
- Graphene with both thermo- and moisture-responsive properties

CONTACT

Amir J. Kallas
ajkallas@ucdavis.edu
tel: .

INVENTORS

- Hsieh, You-Lo
- Xu, Xuezhu

OTHER INFORMATION

KEYWORDS

Graphene, Cellulose nanofibrils, Graphite, Responsive electronics

CATEGORIZED AS

- **Energy**
  - Other
- **Materials & Chemicals**
  - Chemicals
- **Sensors & Instrumentation**
  - Other

RELATED CASES

2019-302-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,920,304	03/05/2024	2019-302

Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Ultra Light Amphiphilic and Resilient Nanocellulose Aerogels and Foams
- Conductive and Elastic Nanocellulose Aerogels
- Nanocellulose-based Aerogel Fibers as Insulation
- Method for Producing Amphiphilic and Amphoteric Soy Protein Colloids, Sub-Micron Fibers, and Microfibrils

University of California, Davis
Technology Transfer Office
1 Shields Avenue, Mrak Hall 4th Floor,
Davis,CA 95616

Tel:
530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax:
530.754.7620