De Novo Graphene-Based Electrodes, Ultracapacitors, Batteries, Biosensors, Photovoltaic Cells, Hierarchical And Layered -

Tech ID: 32643 / UC Case 2011-520-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,287,677	05/14/2019	2011-520

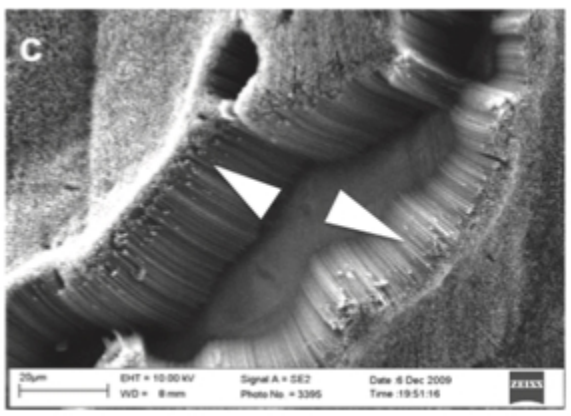
FULL DESCRIPTION

Background

Graphene is a one atom thick, honeycomb lattice of carbon atoms with outstanding electrical and physical properties and is exploited for several applications including solar cells and energy storage. Large area synthesis of high-quality graphene is vital for its widespread application. Carbon nanotubes (CNT), given their unique properties, have been extensively investigated. However, it is difficult to assemble graphene and CNTs with controllable architecture at the nanoscale.

Current Invention

UCR research team led by Prof. Cengiz Ozkan have developed a patented method for the fabrication of Pillared Graphene Nanostructures (PGN) comprised of stacked CNTs on large area, graphene layers. The Chemical Vapor Deposition (CVD) growth process uses either acetylene of methane as the carbon source to fabricate, in situ, a large area PGN with controlled architecture.



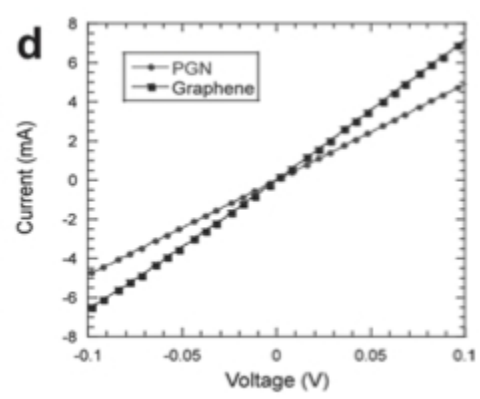


Figure c is a Scanning electron micrograph of a scratched PGN surface displaying the uniformity of the CNT pillars on the graphene layer.

Figure d shows the good ohmic contact between the CNT pillars and the graphene film.

ADVANTAGES

The benefits of their fabrication method are:

- Flexible PGN layer with no noticeable bulk defects.
- Highly aligned CNTs with uniform and regular morphologies over a large area, graphene layer.
- PGN can be grown, in situ, within 10 minutes on a 1 sq. Inch substrate at 750 deg. C.
- Heights of the CNT pillars can be controlled as a function of time or source gas.
- Good ohmic contact between the CNT pillars and the graphene layer.

CONTACT

Venkata S. Krishnamurty
venkata.krishnamurty@ucr.edu
tel: .

OTHER INFORMATION

KEYWORDS

Graphene, Carbon Nanotube, Pillared Graphene Nanostructures, Capacitors, Supercapacitors, Photovoltaics, Solar energy, Nanoelectronics, Biosensor

CATEGORIZED AS

- **Energy**
  - Hydrogen
  - Solar
  - Storage/Battery
- **Nanotechnology**
  - Electronics
- **Sensors & Instrumentation**
  - Biosensors

RELATED CASES

2011-520-0

- Controlled growth of CNT pillars and graphene at required locations of desired geometries.

SUGGESTED USES

- Energy storage – especially dielectric capacitors and electro-chemical supercapacitors.
- Photovoltaics or solar cells.
- Nanoelectronics.
- Biosensors.

RELATED MATERIALS

- Synthesis of a Pillared Graphene Nanostructure: A Counterpart of Three-Dimensional Carbon Architectures

University of California, Riverside

Office of Technology Commercialization

200 University Office Building,

Riverside,CA 92521

otc@ucr.edu

research.ucr.edu/