

Procedure to prepare graphite nanofibers from biogas

CSIC has developed a new procedure to prepare graphite nanofibers from carbon nanofilaments produced in the catalytic decomposition of biogas to simultaneously obtain H₂-rich fuel gas. The use of biogas is environmentally friendly. Graphite nanofibers are valuable materials with several applications, such as anode in lithium-ion batteries and other energy storage devices

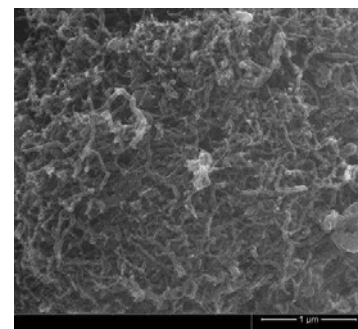
Sector Energy companies for development and commercialization are being sought.

Description of the technology

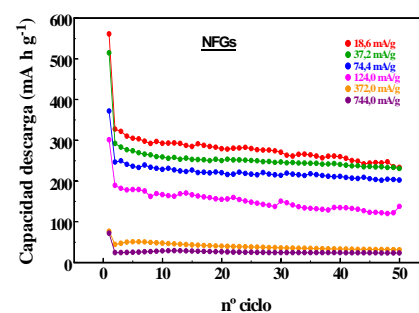
Carbon nanofibers (CNFs) have diameters <100 nm and are composed of graphene sheets stacked in different ways. The development of Catalytic Decomposition of Methane (CDM), for the simultaneous production of CNFs and CO₂-free hydrogen has been the subject of numerous research papers. Despite the quality and performance of graphite nanofibers prepared by CDM, methane is the main component of natural gas (90-95 % CH₄), a fossil fuel and therefore a non-renewable energy source.

In the developed technology, CNFs from catalytic decomposition of biogas, called bio-carbon nanofibers (BCNFs) are used instead. Taking advantage of the metal residues from the catalyst, nanofilaments are transformed into graphite nanofibers by high temperature treatment ($\geq 2400^{\circ}\text{C}$).

The graphite nanofibers (GNFs) obtained have suitable properties in terms of structure, texture and electrical conductivity for their use as anodes in lithium-ion and other energy storage devices. They are also interesting to develop lighter composites with better properties and for the manufacture of sensors and electrodes.



SEM image of the GNFs



Use of GNFS as anode in lithium-ion batteries

Main applications and advantages

- The use of biogas as starting material to prepare BCNFs instead of methane and other hydrocarbons, is environmentally more friendly.
- Avoiding the purification step to eliminate CO₂ when using biogas.
- Use of the BCNFs as precursor for the preparation of graphite nanofibers
- Addition of silica to BCNFs before the thermal treatment as catalyst allows obtaining GNFS with a higher degree of development of the graphitic structure.
- The nanometric size of the GNFS favors the ion lithium diffusion in the material *bulk* in such a way that the intercalation/de-intercalation of these ions could be faster, i.e., the use of GNFS as active material in anodes of lithium-ion batteries could allow to work at higher charge-discharge rates (higher electric current intensities).

Patent Status

Patent application filed

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