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 \( \text{H}_2 \)-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 CO\(_2\)-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 % CH\(_4\)), 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 (≥2400°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.

**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 CO\(_2\) 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 graphic 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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