Graphene-based electroactive fluids for Energy Storage

Researchers from the Spanish National Research Council at the Institut Català de Nanociència i Nanotecnologia- CIN2 (CSIC) and the Catalan Institute of Nanoscience and Nanotechnology (ICN2) have recently developed a novel type of nanocarbon-based fluids for energy storage in flow cells. They can be used for a wide range of systems that require high power and medium energy densities such as distributed and smart grid applications, stand-alone power systems, load balancers, uninterruptible power supply, etc. The technology has been proof as prototype and shows high performance, fast charge-discharge and efficient cyclability (98% after 1.500 cycles).

Industrial partners are being sought to collaborate and/or exploit the existing know-how through a patent license agreement.

High performance flow supercapacitor

Energy storage is in the midst of a revolutionary change which will turn it into a key factor within the upcoming sustainable energy model.

Among Electrochemical Energy Storage Systems (EES), redox flow batteries are considered the strongest technology to tackle higher-power applications at a low cost. Their feasible design makes it suitable for their use a wide range of systems that require high power and medium energy densities such us distributed and smart grid applications, However, the limited solubility of electroactive solutions hinders their energy density. Electroactive Nanofluids (ENFs) can provide a higher concentration of active material and higher energy density. Also capacitive nanocarbon provides a fast energy storage mechanism.

The novel nanocarbon-based fluids are based on dispersions of electroactive nanoparticles in an electrolytic solution that makes it suitable for fast electrical energy storage in flow cells with high-power storage comparable to state-of-the-art supercapacitors plus increased energy density (10KW/Kg; 100 Wh/Kg).

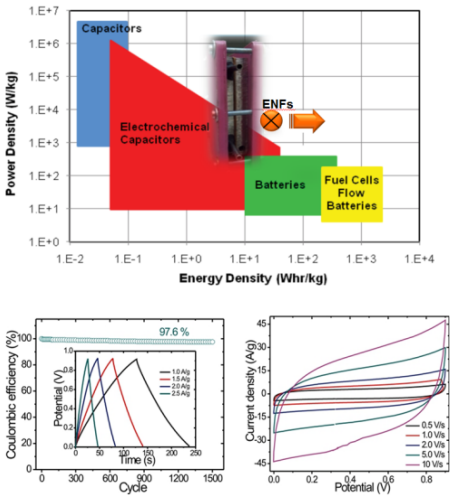

Fig) Top: *Power and energy densities of various Electrochemical Energy Storage (EES) systems. The orange circle marks the performance of the electroactive nanofluid electrode for flow cells. Image of flow cell used for the charge-discharge measurements.* ***Bottom****: Charge-discharge curves at various current densities and excellent cyclability at least up to 1500 cycles.*

Main advantages and applications

The novel storage technology can be used in systems that require high power and medium Energy densities such as distributed and smart grid applications, stand-alone power systems, load balancers, uninterruptible power supply UPSs, as well as in ones that demand a fast and refueling recharge like flow cells batteries, automobiles, etc.

The main advantages are:

- High Performance (170 F/g(C)),13 Wh/Kg(C)
- Faster charge/discharge than conventional batteries 450W/kg (C) and high lifetime.
- Efficient cyclability (98% after 1.500 cycles).
- Low cost and highly stable electroactive nanofluids.
- Easily scalable and modular.
- Environmentally-friendly.

Patent Status

European Priority Patent.

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