ElectroGraph

Graphene-based Electrodes for Application in Supercapacitors

Prepared by:

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ElectroGraph
Grant Agreement No. 266391

Project Information

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Start date:
1st June 2011

Duration:
36 Months

Progress:
Month 23

OBJECTIVES

To present a functional model of supercapacitor

To optimize overall performance of supercapacitor

To produce graphene in volume and quality required to achieve above

To assess the hazard and exposure associated with graphene materials as well as their life cycle impact

To identify the potential for value recovery from graphene electrodes

Material synthesis and processing

Electrode processing and supercapacitor integration

Sustainability Health & Safety

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Integrated graphene based supercapacitor and PV cell for external rear-view mirror

Demonstrator Case Study

Concept and design of demonstrator prepared by FIAT Research center
The here presented concept is not a prototype product and is not to be considered for any particular car model.
The here presented car was chosen randomly as an example.

Material synthesis and processing

- Chemical Vapour Deposition (CVD)
- Chemical Exfoliation (graphite oxide)
- Electrochemical Exfoliation

Electrode processing and supercapacitor integration

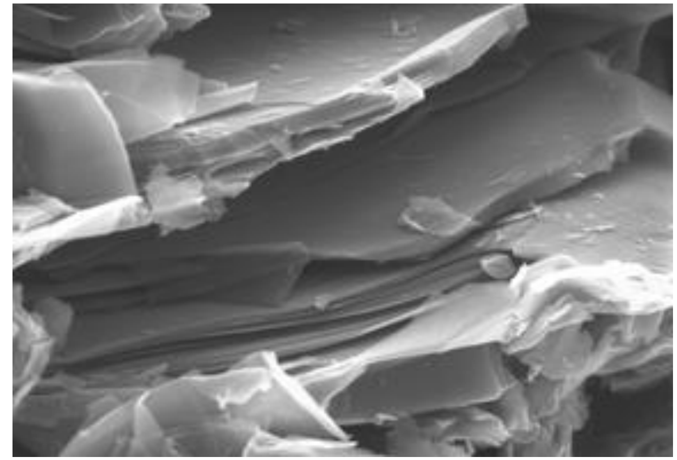
- Dispersions, Inks and Pastes
- Coating and Printing
- Electrochemical Characterization

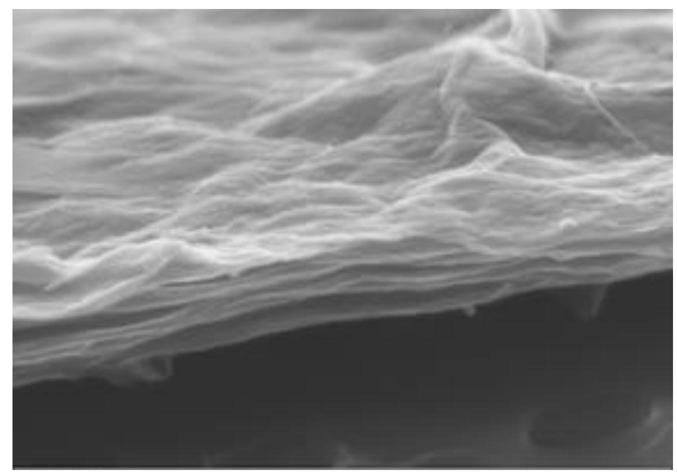
Sustainability Health & Safety

- Exposure Risk Assessment
- Recycling
- Life Cycle Assessment (LCA)

Electrochemical Exfoliation of Graphene Nanoplatelets (GNPs)

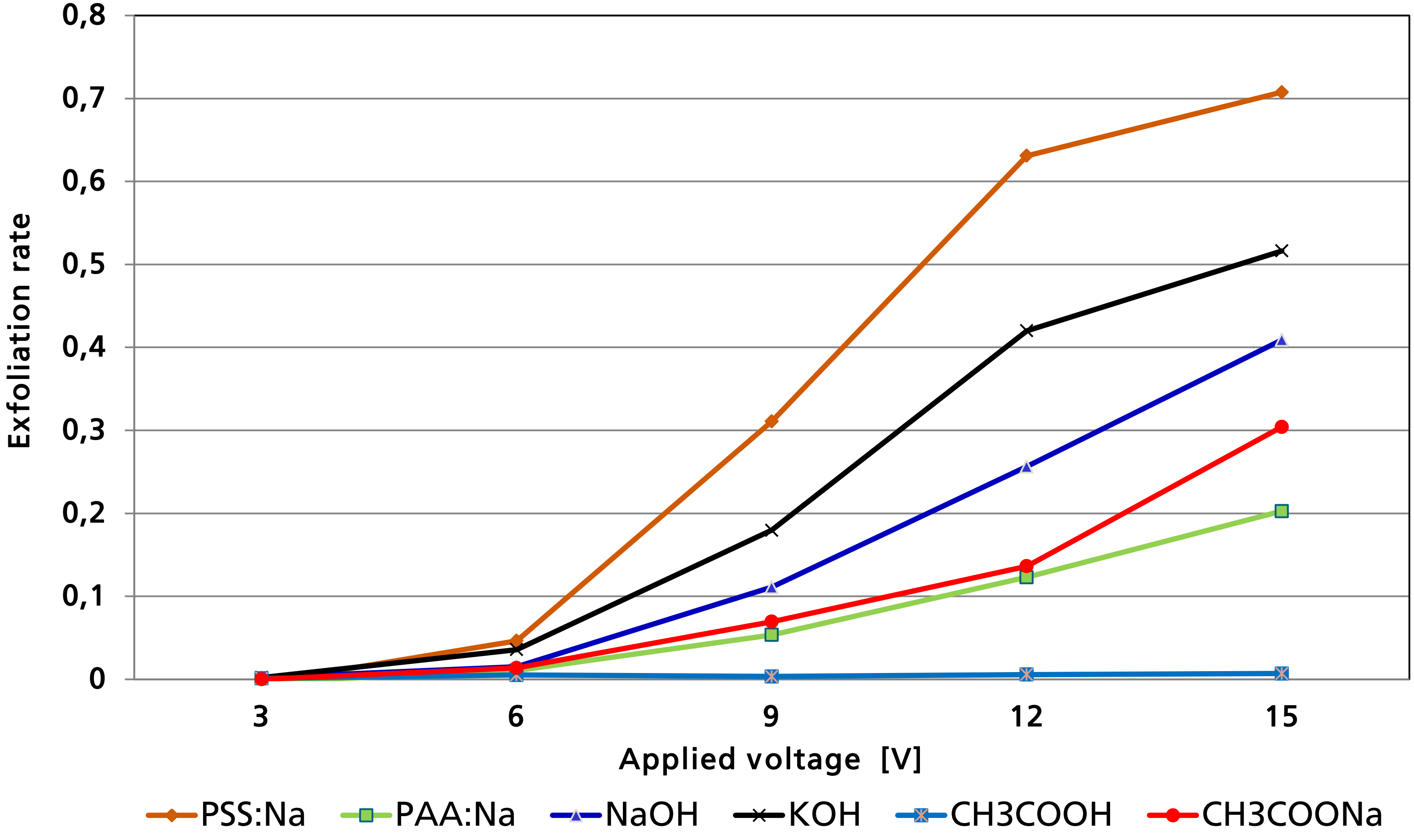
- Graphite rods as starting material – used as electrodes
- Water based electrolyte
- Polyelectrolytes, basic salts, weak acids
- Exfoliation by ion intercalation
- One-step production and functionalization






AC NaOH 10V 02
12 URK-CL

Exfoliation Rate



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GNPs → Dispersion → Particle separation → Coating

GNPs

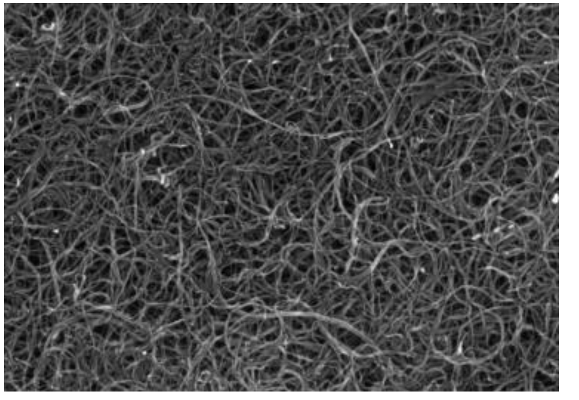
Dispersion

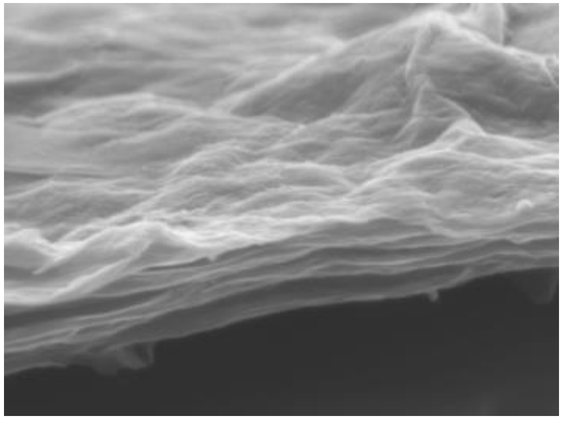
Particle separation

Coating

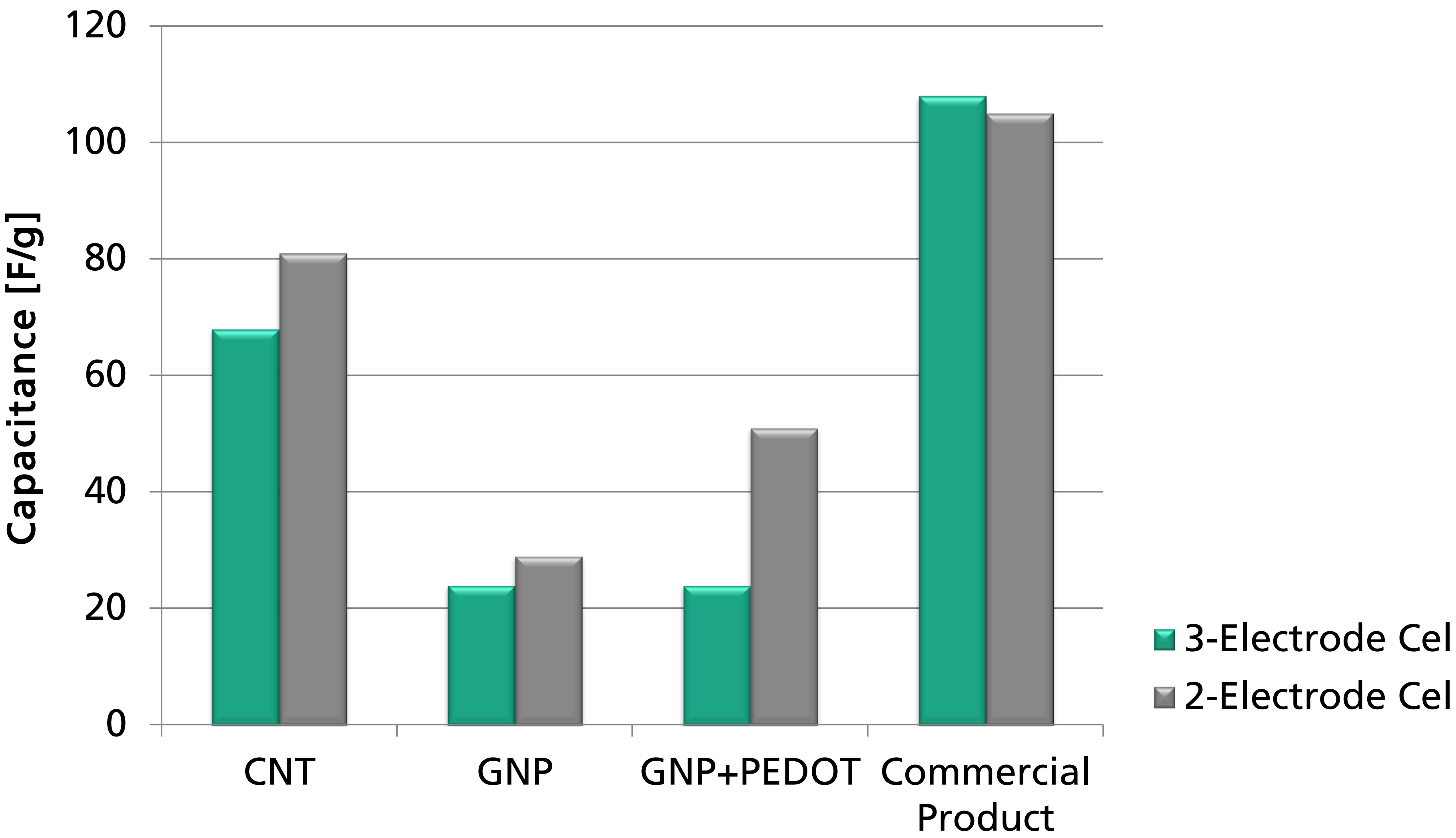
Characterization and Comparison

Sample	Material
Reference	Carbon Nanotubes
Sample 1	Electrochemically Exfoliated GNPs
Sample 2	Electrochemically Exfoliated GNPs + PEDOT
Sample 3	Commercial Product (GNPs)





Results - Capacitance



SEVENTH FRAMEWORK PROGRAMME
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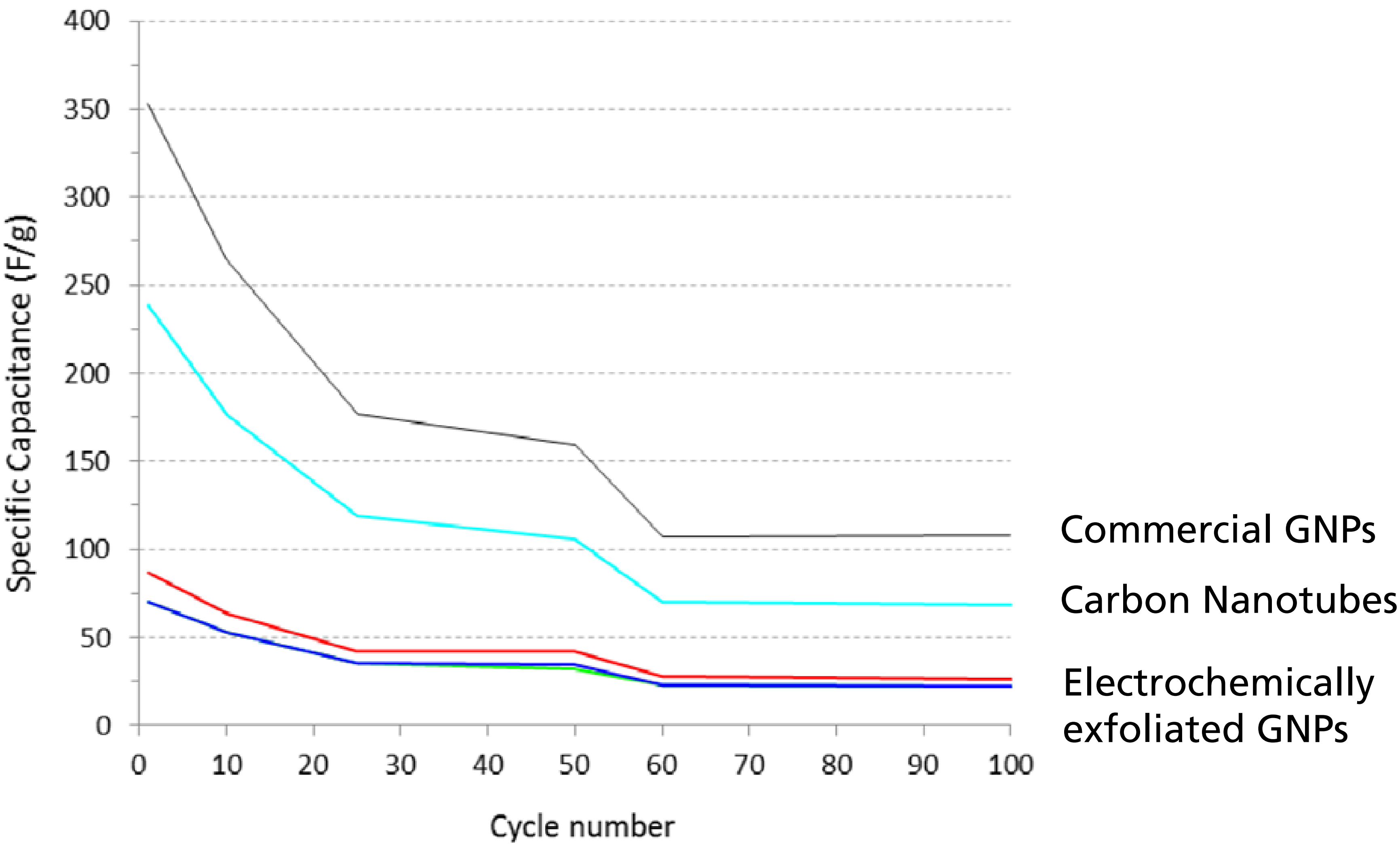
Measurements performed by ElectroGraph Partners:
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, CSIC-INCAR, Spain
CENTRO RICERCHE FIAT SCPA, Italy

Results – Cycling Behaviour



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Remarks and Outlook

- Samples containing commercial nanoplatelets exhibited higher capacitance than the electrode prepared with MWNTs only, while samples of electrochemically exfoliated graphene nanoplatelets are less capacitive.
- Large drop in capacitance during the cycling test indicated that a better adhesion between the electrode material and the substrate is required.
- While the addition of PEDOT aided better adhesion of the electrode material on substrate, the drop in capacitance deemed it to be unsuitable for the application.
- Besides the need to find a more suitable binder material, the coating methods have to be further investigated in order to create a more suitable surface for the application in a supercapacitor

Acknowledgements to ElectroGraph Consortium

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Thank you for your attention

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