PPP- “European Green Cars Initiative”
Materials for Green Cars

NMP Call FP7-GC-2013-Materials

GC.NMP.2013-1
Improved materials for innovative ageing resistant batteries

PPP-EGCI information days
Brussels,
July 9th and 10th, 2012

European Commission
DG Research and Innovation
Industrial Technologies
Unit G3 - Materials
Martin Gieb
Industrial Technologies

NMP Call FP7-GC-2013-Materials

DG Research and Innovation
Directorate Industrial Technologies

Cross-thematic cooperation between NMP, ICT and Transport (including Aeronautics)
European Green Cars Initiative PPP

Public Private Partnership

- European crisis: Societal and environmental challenges and European competitiveness to be considered
- EC Policy goal: Planning a route to recovery
- Automotive industry is a key driver of the European economy and major dynamo for innovation
Public Private Partnership
European Green Cars Initiative

Recovery package:

- 4.0 billion € EIB loans, 1.0 billion € from FP7 and industry
- One of the three Public Private Partnerships (PPP) for research and development (R&D), first launched in 2009
- Industry is represented by members the European Technology Platforms ERTRAC, EPoSS, and SmartGrids as well as other stakeholders.

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Public Private Partnership
European Green Cars Initiative

- Managed in a quick and **efficient** manner
- Three rounds of annual calls for proposals have been launched since July 2009
- New, **last round in FP7. Horizon 2020?**
- More than 50 collaborative research projects have been started.
- **Joint EC – EGCI Clustering event 11 and 12 July**

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Why another call on materials?

• Green cars need to be Lighter and more sustainable → new concepts are being developed

• Novel materials allow the conception of new products - a considerable part of all innovation is based on new materials!

• In WP 2010/11/12/13 Concentration on materials for electric cars: structural materials and batteries

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Materials for Green Cars WP 2010-2013

- WP 2010  battery materials and electrical components
- WP 2011  battery manufacturing
- WP 2012  battery materials - post Li (NMP)
- WP 2012  structural materials
- WP 2013  *ageing of battery materials* (NMP)
### FP7 NMP-GC projects related to batteries:

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Why another call on batteries?

Challenges:

- Sufficient power density, energy density
- Low weight
- Quickly chargeable or re-chargeable,
- Maintaining safety necessary for the use in electrical vehicles

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Why another call on batteries?

And:

• Battery production and usage should be sustainable (considering a whole Life Cycle Assessment)
• Production and running costs
• Battery lifetime
Why another call on batteries?

BUT:
Charging modality during use in practice has not been considered thoroughly:

- Batteries may be charged slowly, overnight, or quickly in 30 minutes.
- New electrical grid technologies foresee also bi-directional charging/discharging as well as continuous charging.
- The depth of discharge (DOD) level thus may vary significantly at every single discharging cycle.
Why another call on batteries?

Result of charging under realistic conditions:

• Shorter battery lifetime,
• After certain charging cycles only a much reduced charging capacity and
• Respectively reduced battery power and performance
Motivation of the call

The full life-time performance and ageing of novel electrical vehicle battery cells and systems, including those based on the current Li-Ion technology, has not thoroughly been studied so far.
EGCI - Materials for Green Cars Call WP 2013

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Improved materials for innovative ageing resistant batteries

NMP Theme only, implemented considering a Cross-thematic cooperation between NMP, ICT and Transport (including Aeronautics)

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Call FP7-GC_Materials-2013
Call info (1)

**GC.NMP.2013-1**

- **Funding Scheme:** *Large Scale Integrating Collaborative Projects*
- **Minimum Funding:** 4.000.000 € *(tbc)*
- **Maximum Funding:** 10.000.000 € *(tbc)*
- **Budget:** 20 M € *from NMP Theme* *(tbc)*
- **Eligibility conditions:** *general conditions for LSCP*

* definitive values see call publication
Research proposals should focus on the investigation of **ageing mechanisms** in battery materials (including the current lithium-ion technology).

The **basic physical and chemical phenomena and processes** that lead to the **deterioration of battery performance** (at cell and system level) over time must be understood.

The active materials should be considered to be already **suited for automotive EV/HEV applications**.

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GC.NMP.2013-1

- Improvements in cell chemistry (liquid or solid electrolytes, separators, additives, non electrochemically active materials, surface treatments, innovative architectures in electrode micro or nanostructure) and
- Improvements in cell system (SOC strategy, thermal management)

should be developed to improve the minimum residual charging capacity after a suitable amount of charging cycles.

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Today a **life time** of 10-15 years and recharging number of 1200 cycles at 80% DOD is envisaged; ideally 3000-5000 charging cycles after 10-15 years of use should be reached (new promising high energy density battery materials actually permit only about 10 charging cycles, depending on the battery technology).

**Performance** (cells and systems) should at least equal the energy density and power density reachable with existing materials, taking into account the variety of user profiles and its translation in current regimes, average DOD, external temperature variation, etc.
• The development of new chemistries and technologies to overcome the aging mechanism should take into account the various types of charging that occur during the lifetime of the battery: overnight charging, fast charging, recharging, grid charging and grid de-charging, charging in different climatic conditions (-20 to +50°C, for instance);

• In particular the effects of fast charging/discharging and deep discharging that are related to huge temperature gradients should be considered, also with respect to safety issues!
The performance, lifetime and reliability of the advanced cells and battery systems should be assessed and tested under typical operational and extreme conditions with respect to:

- durability and intrinsic safety,
- environmental health and safety,
- external mechanical, electrical and climatic stress, e.g. safety after short circuit, fire and car accident/crash.
**GC.NMP.2013-1**

- **Proof of concept** in terms of product and/or process should be delivered within the project, excluding commercially usable prototypes (2006/C323/01),
- but convincingly proving **scalability** towards industrial needs, and
- maintaining the **safety and the stability** of the technology.
**GC.NMP.2013-1**

- **Test methods and simulation tools** that enable a thorough modelling and understanding of the aging and degradation processes at both cell and system levels are of great importance;

- **Dedicated modelling** can be developed to allow predicting the lifetime, reliability and residual value of the new electric vehicle battery and the results should be backed up with strong evidence provided by "post-mortem" analysis;

- A related **testing procedure** applicable at European level should be developed.
The proposals should thoroughly demonstrate that the new developed materials and technologies permit a considerable increase with respect to the state-of-the-art;

This should be underpinned by an extensive study and presentation of the existing knowledge at the date of proposals submission.

The new technologies should permit a sustainable maintenance of the battery at cell and/or system level.

Standardization and regulatory issues to be addressed.
• **The effect** of battery materials and cell production processes on the environment should be minimised,

• **An appropriate Life-Cycle Analysis** of the advanced materials and the respective components and systems, including dismantling and recycling technologies should be carried out.
The life-cycle cost of the materials and assemblies as well of the production technologies should be considered by carrying out an economic analysis, including material resources availability;

A thorough cost analysis should demonstrate the real advantages of the new materials, cells and systems.
• IPR issues and the use of background and foreground should be intensively discussed and the arrangements in the consortium should allow suitable access of the knowledge to all participants of the consortium,

• While safeguarding industrial competitiveness through adequate measures (i.e. through patents, licenses or other agreements).
Expected impact:

• (i) Understanding and verification of ageing and degradation processes in electrical vehicle batteries; and

• (ii) Considerable improvement of the battery lifetime while maintaining optimal battery performance:
  • it should be demonstrated that the new materials used in the cells and systems would allow recharging, at system level, of a minimum of 4000 cycles at 80% DOD in typical BEV conditions over 10 to 15 years,
  • while maintaining energy densities of at least 250 Wh/kg over the lifetime and
  • permitting a considerable reduction of the battery "memory effect"; and
**Expected impact:**

- (iii) Economic viability and technological feasibility of the advanced materials and the related processes with reference to real applications of industrial relevance; and/or
- (iv) Improvement of European battery production capacities; and/or
- (v) Options for the use of environmentally friendly and sustainable materials.
Thank you for your attention!

Find out more:

http://ec.europa.eu/research/fp7/index.cfm

http://ec.europa.eu/research/participants/portal

www.green-cars-initiative.eu