

Status report

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Graphene Flagship Director

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graphene-flagship.eu



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Flagship structure

Ramp-up phase,
74-142 partners, 2013-2016

Core Project 1
156 partners,
'16-18

Core Project 2
155 partners,
'18-20

Core Projects 3-
≈ 165 partners,
'20-23

2D-EPL
11 partners, '20-24

National
projects

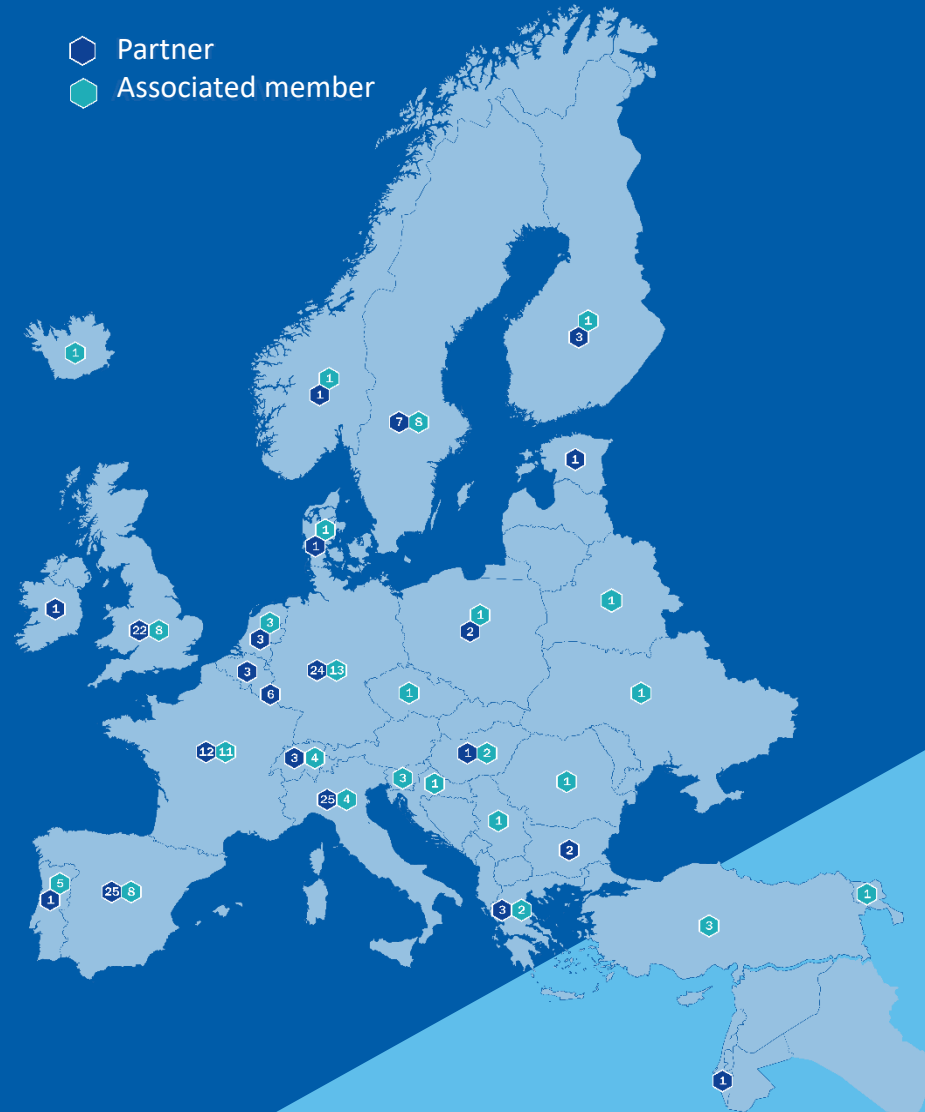
FLAG-ERA

Regional
projects

Other EU
projects

Horizon Europe? 2023-?

Partner
Associated member

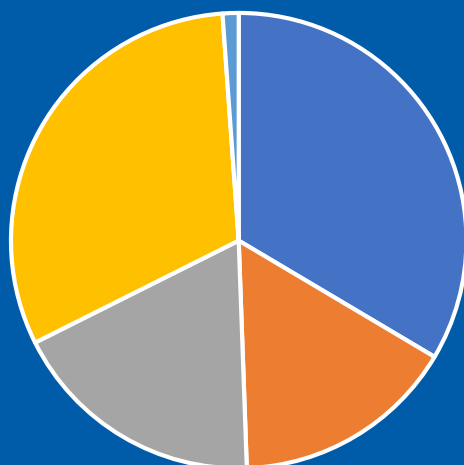


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Flagship consortium



Type of organisation



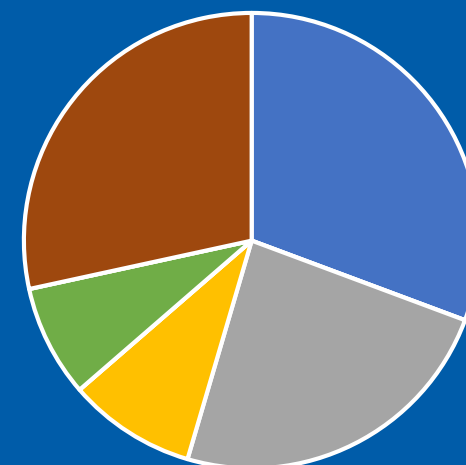
■ Enterprise ■ SME ■ Research organisation ■ Education establishment ■ Non for profit

The Framework Partnership is evenly split between commercial partners and academic/research organizations

In addition, we have 36 Partnering Projects and 101 Associated Members coming from 26 countries

Entry year

■ 2013
■ 2014
■ 2015
■ 2016
■ 2017
■ 2018
■ 2019
■ 2020



The consortium has demonstrated great ability for renewal: 28% of our partners have joined this year, and only 31% have been involved since the start



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OVERVIEW OF THE PARTNERING DIVISION



GRAPHENE
FLAGSHIP

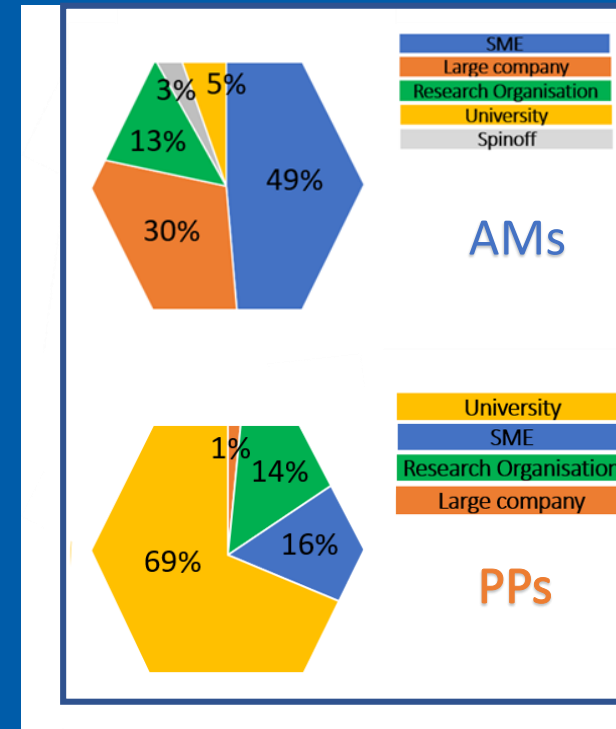
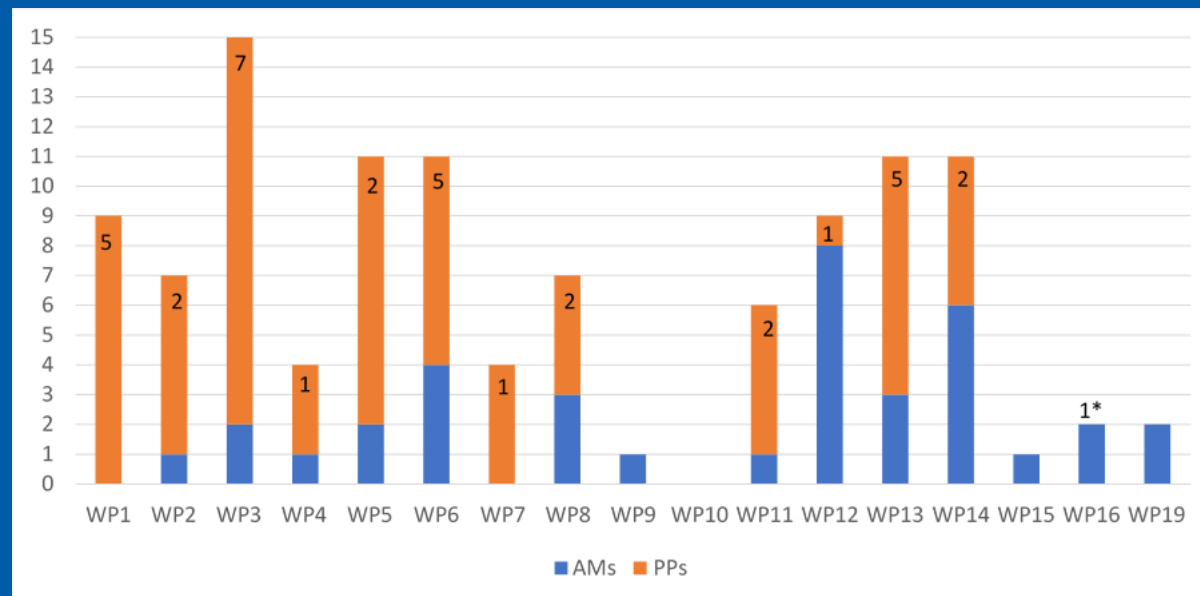
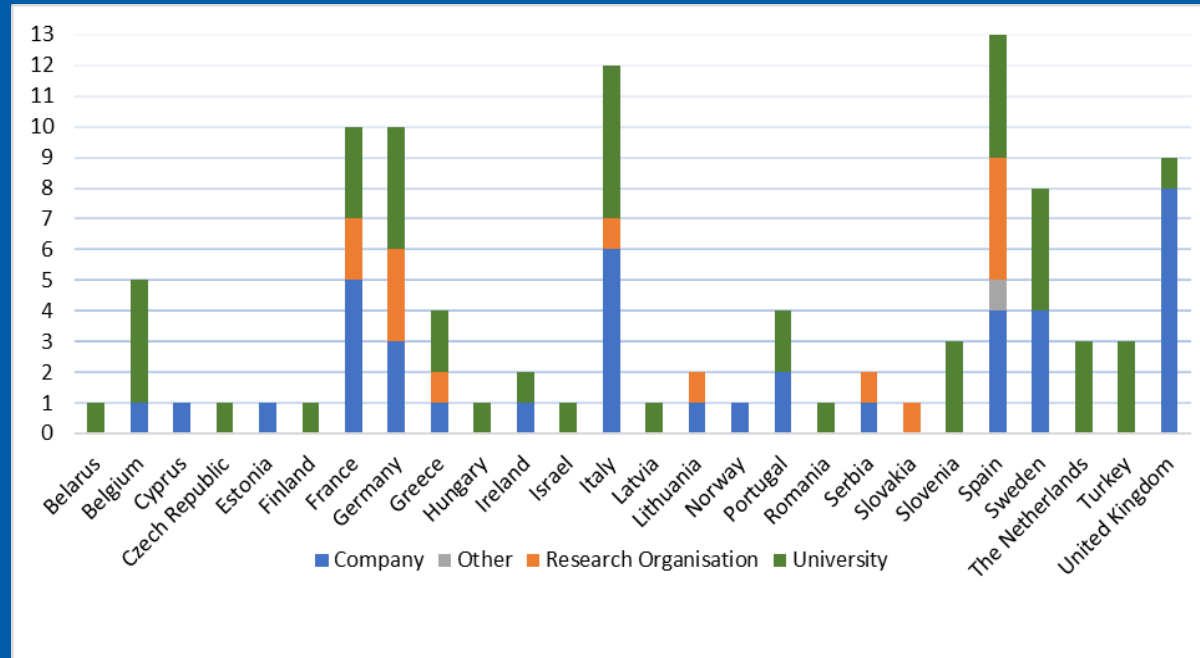
36 PPs

101 AMs

26 EU and Associated countries

37 individual AMs

64 AMs belonging to the PPs



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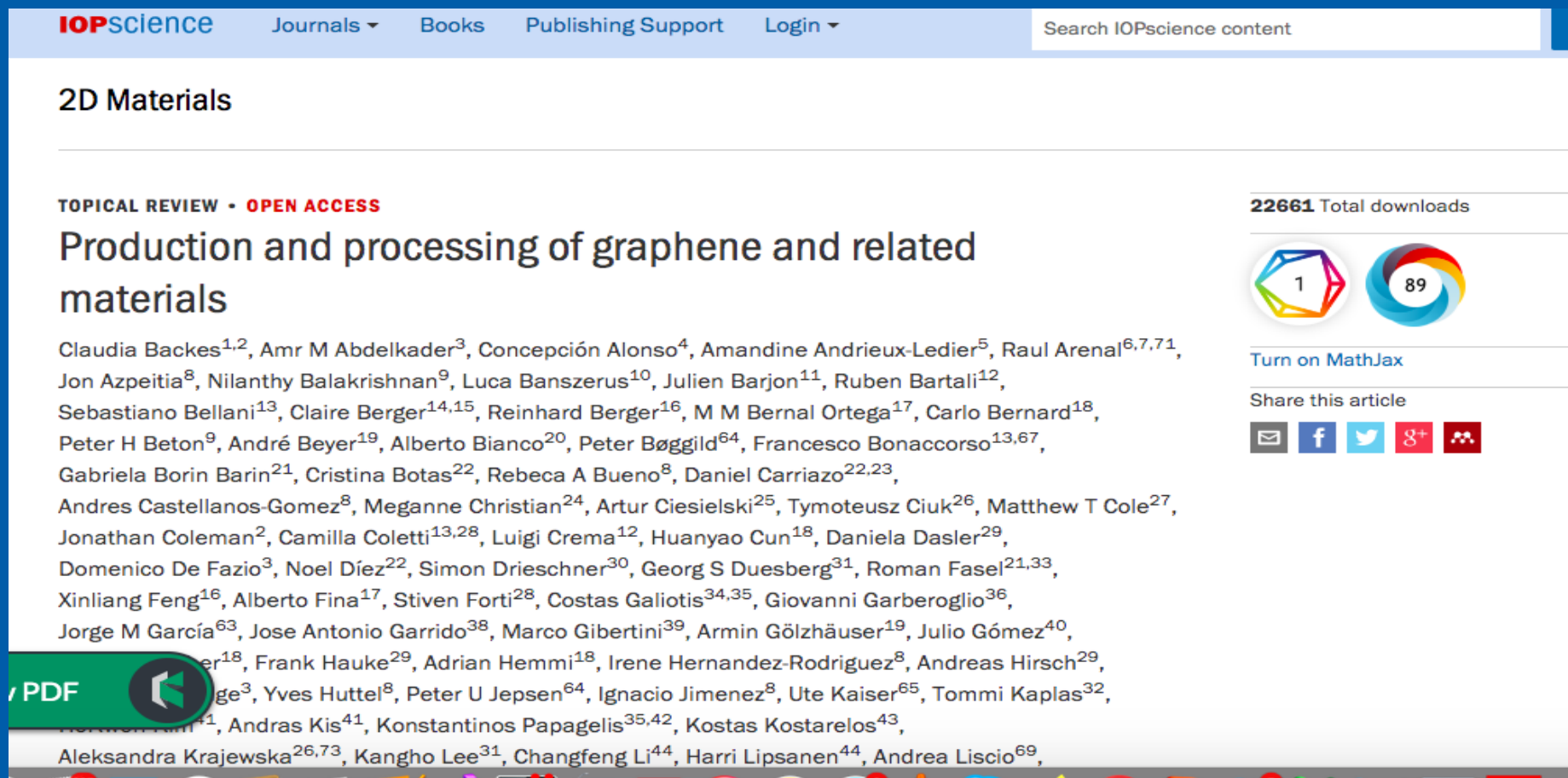
Recent results (Core 2, in May 2020 unless otherwise stated)

KPI	C2 realized	C2 target	Cumulative realized
Publications (26.11.)	891	703	3,864
Citations (26.11.)	5,842	660	135,428
Number of patent applications	117	62	272
Number of patents	28	13	34
Number of prototypes	149	67	250
Number of products on market	31	19	76
Number of spin-offs established	4 (5)	7	15



Some highlights

Authoritative white book on 2D materials



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2D Materials

TOPICAL REVIEW • OPEN ACCESS

Production and processing of graphene and related materials

Claudia Backes^{1,2}, Amr M Abdelkader³, Concepción Alonso⁴, Amandine Andrieux-Ledier⁵, Raul Arenal^{6,7,71}, Jon Azpeitia⁸, Nilanthy Balakrishnan⁹, Luca Banszerus¹⁰, Julien Barjon¹¹, Ruben Bartali¹², Sebastiano Bellani¹³, Claire Berger^{14,15}, Reinhard Berger¹⁶, M M Bernal Ortega¹⁷, Carlo Bernard¹⁸, Peter H Beton⁹, André Beyer¹⁹, Alberto Bianco²⁰, Peter Bøggild⁶⁴, Francesco Bonaccorso^{13,67}, Gabriela Borin Barin²¹, Cristina Botas²², Rebeca A Bueno⁸, Daniel Carriazo^{22,23}, Andres Castellanos-Gomez⁸, Meganne Christian²⁴, Artur Ciesielski²⁵, Tymoteusz Ciuk²⁶, Matthew T Cole²⁷, Jonathan Coleman², Camilla Coletti^{13,28}, Luigi Crema¹², Huanyao Cun¹⁸, Daniela Dasler²⁹, Domenico De Fazio³, Noel Díez²², Simon Drieschner³⁰, Georg S Duesberg³¹, Roman Fasel^{21,33}, Xinliang Feng¹⁶, Alberto Fina¹⁷, Stiven Forti²⁸, Costas Galiotis^{34,35}, Giovanni Garberoglio³⁶, Jorge M García⁶³, Jose Antonio Garrido³⁸, Marco Gibertini³⁹, Armin Gölzhäuser¹⁹, Julio Gómez⁴⁰, Frank Hauke²⁹, Adrian Hemmi¹⁸, Irene Hernandez-Rodriguez⁸, Andreas Hirsch²⁹, Yueshan Hu³, Yves Huttel⁸, Peter U Jepsen⁶⁴, Ignacio Jimenez⁸, Ute Kaiser⁶⁵, Tommi Kaplas³², Konstantinos Papagelis^{35,42}, Kostas Kostarelos⁴³, Aleksandra Krajewska^{26,73}, Kangho Lee³¹, Changfeng Li⁴⁴, Harri Lipsanen⁴⁴, Andrea Liscio⁶⁹

22661 Total downloads

1 89

Turn on MathJax

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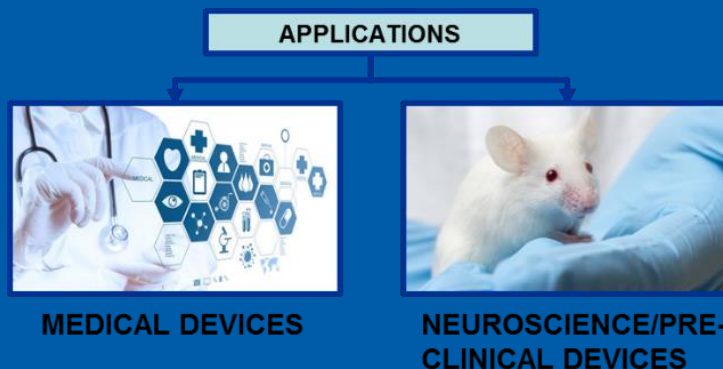


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Some highlights

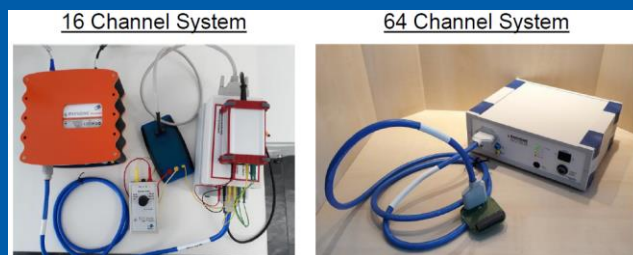
First products in biomedical technologies

Commercialisation of first
two products
in two different markets by two
different industrial WP5 partners

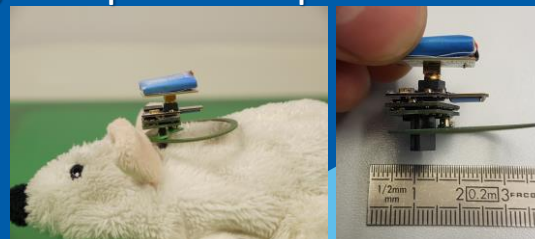


Commercialisation of *wired* 16 and 64 channel electronic systems for **gFETs**

2 Products
launched



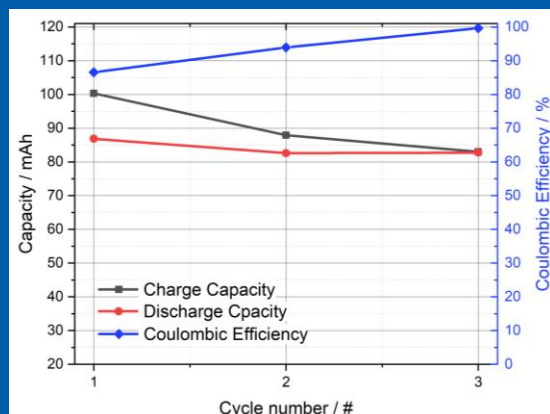
Commercialisation of *wireless* gFET epicortical probe



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Some highlights

High-Energy CoinPower® Cell

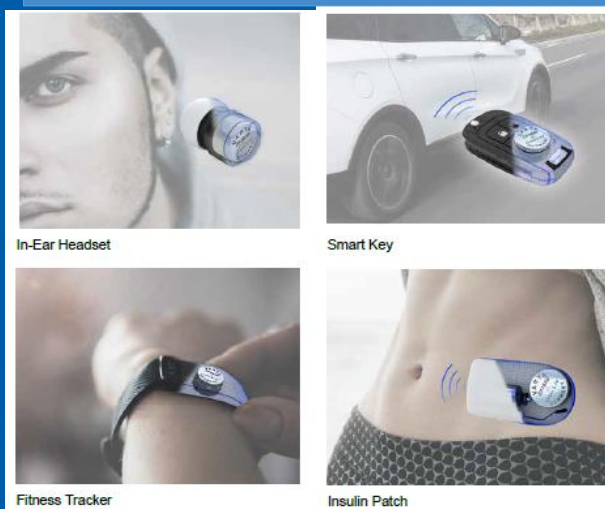


Parameter	Value
Total Capacity*	88 mAh (+35%**)
Total Energy*	300 mWh (+25%**)
1 st CE	86,0%
3 rd CE	99,7%

*0.1C Discharge

** compared to benchmark

Applications



In SH5, the partners developed a high-energy silicon/graphene prototype that outperforms SotA graphite-based cells by up to 35% in capacity and 25% in energy density.

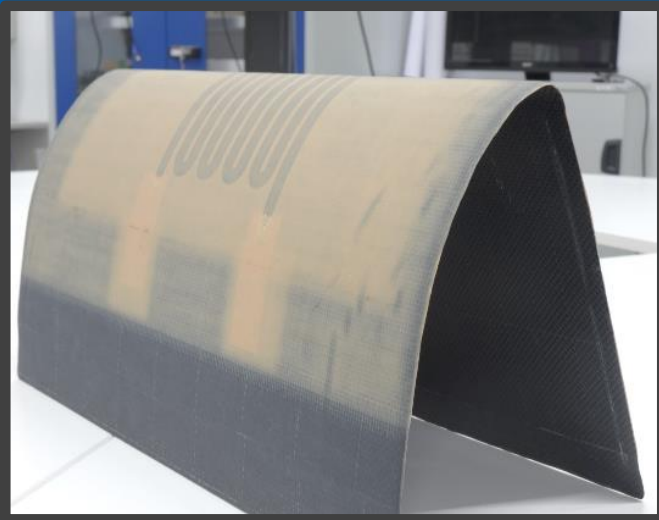
<https://graphene-flagship.eu/news/Pages/Graphene-enabled-silicon-based-lithium-ion-battery-boosts-capacity-by-30.aspx>



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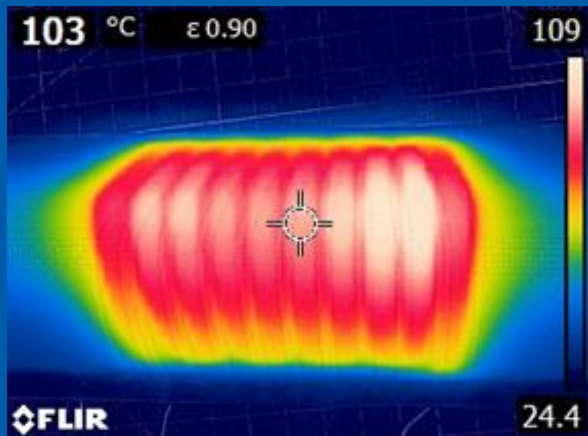
Some highlights

De-/ Anti-icing Demonstrator for airplanes



- Co-curing of graphene serpentine in complex SA LE shape
- No issues identified with leading edge shape, good adaptation of graphene serpentine to complex shape
- Confirmation of graphene serpentine heating capability in curve shape
- Patent submitted: 14739 - Graphene flexible paper for IPS - patent CO-55907 V5. Application number is 19382383.8.

Evaluation / testing of SA LE demonstrator @ Room Temperature



- Different voltages (10, 20, 30, 50 & 85V)
- Sheet resistance: 20 Ohm
- Homogeneity ok, but room for improvement (hotter areas)
- **Good / quick heating**
 - 70°C in 60 seconds, at 30V & 1,5A
 - 50°C in 30 seconds, at 85V & 4A
- **Maximum specific power: 13 KW/m² at 85V & 4A**



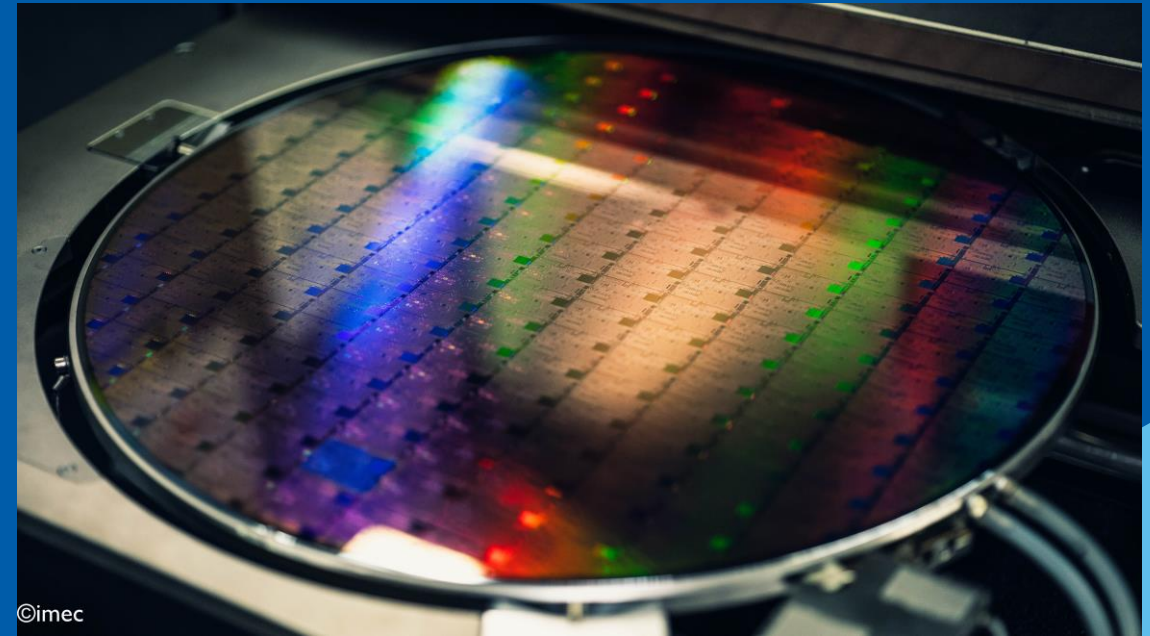
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Some highlights

Launch of experimental pilot line 2D-EPL

The 2D-EPL started on October 1, 2020, and had a digital kick-off on October 8. The 2D-EPL project involves 11 partners from Belgium, Finland, Germany, Spain and the UK.

There is already large industrial interest in the 2D-EPL as shown by its Industrial Advisory Board that today includes 10 European companies.



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Dissemination activities

Visit by EC Executive Vice President
Margarethe Vestager



"It is incredible to see how well the project is administered, coordinating even a large group of academic institutions can be a challenge, but adding industrial partners successfully into the mix is remarkable."

"the Graphene Flagship is money well spent"

Due to Covid19, most dissemination activities have moved online for the time being:

- Women in Graphene (virtual reality implementation)
- New "Graphene for" series
 - Energy storage (June)
 - Research, Innovation, Collaboration (September)
 - Health (November)
 - Standardization (January)



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Impact of Covid19



- The impact has been and continues to be quite substantial but uneven in the consortium
- In the first 6 months, the Core 3 partnership has used about 10% of its resources, which is 2/3 of the expected usage: *we will be applying for a cost neutral 6 month extension of the Core 3 project*
- At this time we do not expect that the 2D-EPL project will ask for an extension, but the situation may change if the pandemic persists
- The impact is particularly strong on our international workshops and conferences, which are all either on hold or have been converted to digital formats. This puts substantial strain on our staff working on event management, and I am impressed by how they cope with the challenging situation



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Horizon Europe



- We are convinced that the most appropriate way to implement the activities of the Graphene Flagship in Horizon Europe is to keep the coherence that has allowed us to reach remarkable results in the last 7 years, demonstrated how to cross the valley of death from academia to industry.
- Compared to the RIAs+CSA model included in the latest circulate HE work programme draft, the FPA+SGA model has several advantages. It is the most efficient way to implement large scale research actions, enables the creation of a large industrial ecosystem needed to bring new technologies to society, and it has demonstrated an ability to renewal by continuously adding new competence to the consortium.
- If legally necessary, the FPA+SGA structure may be supplemented by additional RIAs, which would naturally become Partnering Projects and benefit from many of the support functions from the FPA+SGA, if they so desire.
- We are concerned by the prolonged negotiations on the Horizon Europe budget, which delays our planning process, causes uncertainty in the consortium and leads to internal competition rather than collaboration.



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Where we are as a technology?

graphene



Plateau will be reached:

○ less than 2 years

● 2 to 5 years

● 5 to 10 years

▲ more than 10 years

⊗ obsolete before plateau

As of July 2020

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Graphene disruptive technologies - *from academic laboratories to society*