

## Joint Statement: Collaboration between the Advanced Materials 2030 Initiative and the 2D Materials Initiative for a European Partnership in the field of advanced materials

### 1. Preamble

Advanced materials, i.e. materials specifically designed to exhibit novel and outstanding functional or structural properties, are a cornerstone to master the green and digital transitions in a wide range of sectors, such as energy, mobility, buildings, electronics, health and food, to name but a few. By providing alternative solutions to substitute or reduce the use of Critical Raw Materials (CRMs), advanced materials play an important role in reinforcing Europe's resilience and strategic autonomy<sup>1</sup>.

Urgent action is needed to tackle the main challenges Europe is facing to develop increasingly complex advanced materials at an ever-faster pace, without compromising safety and sustainability. Confronted with a fragmented landscape of stakeholders, competences, resources, initiatives and programmes, as well as a lack of resilience and sustainability of advanced materials' value chains, Europe's leadership in materials innovation is at risk, ultimately threatening our industrial competitiveness in strategic markets.

As a coherent response to these challenges, the **Advanced Materials 2030 Initiative** (AMi2030) was launched to faster develop and scale advanced materials in a more efficient way, for the benefit of our common environment, our societies and the European economy. Instrumental to this will be the creation of a **pan-European multi-sectorial accelerator for design, development, and uptake of safe and sustainable advanced materials towards a circular economy**. This accelerator will transform the European advanced materials sector via a single framework for all stakeholders to interact in an open and inclusive forum, from upstream developers and manufacturers to downstream users and citizens, covering the complete advanced materials lifecycle and innovation cycle. This will be achieved, among others, through an ambitious Research and Innovation Agenda mobilising resources and actors to leverage the interplay between advanced materials, digital technologies and circular economy strategies collaboratively in order to accelerate the development and reduce the cost and complexity of developing tomorrow's solutions for the twin green and digital transitions. Working towards a climate-neutral by 2050, more resilient EU, the Advanced Materials 2030 Initiative aims to accelerate the development of safe and sustainable advanced materials as the backbone of the green and digital transition and a source of prosperity and sovereignty in Europe.

The **2D Materials Initiative** has its basis in the Graphene Flagship community. The Graphene Flagship was launched in 2013, supported by EU and national funding, and is Europe's biggest ever research initiative aimed at bringing graphene and related 2D materials from the realm of academic laboratories into European society for the benefit of its citizens. The flagship has brought together over 1,300 researchers representing 170 academic and industrial partners across Europe. It covers the entire value chain from materials to components and system integration in a wide range of fields from

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<sup>1</sup> COM (2023): *A secure and sustainable supply of critical raw materials in support of the twin transition*, Brussels.

electronics, photonics, composites, energy generation and storage to medical and environmental technologies. It also extends over knowledge exchange, competences and skills from basic materials research to applied research and high-TRL spearhead projects. During its first ten years the Graphene Flagship partners have been granted over 80 patents, launched more than 100 products to the market, and established 17 spin-off companies that have received over 130 M€ private funding. In the academic domain, flagship researchers have published well over 5,000 articles that have been cited more than a quarter of a million times.

The achievements mentioned above illustrate the extent to which the activities carried out by the Graphene Flagship programme over the last ten years fits in the broader scope of advanced materials set in AMI2030. Consequently, **the two initiatives now jointly call for a European partnership under Horizon Europe and its successor FP10 in the field of advanced materials, including 2D materials.** We seek to establish a long-term cooperative relationship between public institutions and private-side stakeholders in these areas (Industry, Research & Technology Organisations, Academics,...). Advanced materials, incl. 2D materials, being developed, produced, processed, incorporated into products, placed on the market, and recovered at the end of product life by industry, the co-programmed instrument is favoured in order to secure efficient and high-scale transformation of knowledge into economic value.

## 2. The partnership proposal

The AMI2030 and 2D Materials initiatives joining forces will have manifold benefits for the whole European advanced materials ecosystem, such as:

- The scientific basis of AMI2030 can build upon the community brought together over the last 10 years by the Graphene Flagship, a large majority of this community being not exclusively focused on 2D materials
- Closer collaboration with all technological sectors (production, processing/transformation, manufacturing, digital) linked to advanced materials as part of AMI2030 will be beneficial for 2D materials.
- The 2D-EPL project (see below) of the Graphene Flagship can be used as model for the development of other experimental stage prototyping services to academics, SMEs and enterprises alike.
- With AMI2030's holistic view, new fields of application for 2D materials can be unlocked in several materials innovation markets.
- Conversely, 2D materials will bring strong cases to AMI2030, especially in terms of 'resource-efficient' and 'frontier' materials solutions.
- The Graphene Flagship has an established route to push materials from low TRL research all the way to the market, while AMI2030 brings a wider advanced materials perspective alongside strong bonds to new large industry stakeholders, with a focus on mid-range TRL and upwards.

For a long-lasting successful transformation of the European Advanced Materials sector, AMI2030 covers the entire Advanced Materials lifecycle and innovation cycle, crossing different Materials Innovation Markets (MIMs) of strategic importance for Europe. Digital, production, processing and characterization technologies as well as appropriate policy and regulatory frameworks are foreseen as enablers to this transformation, as illustrated on Figure 1.

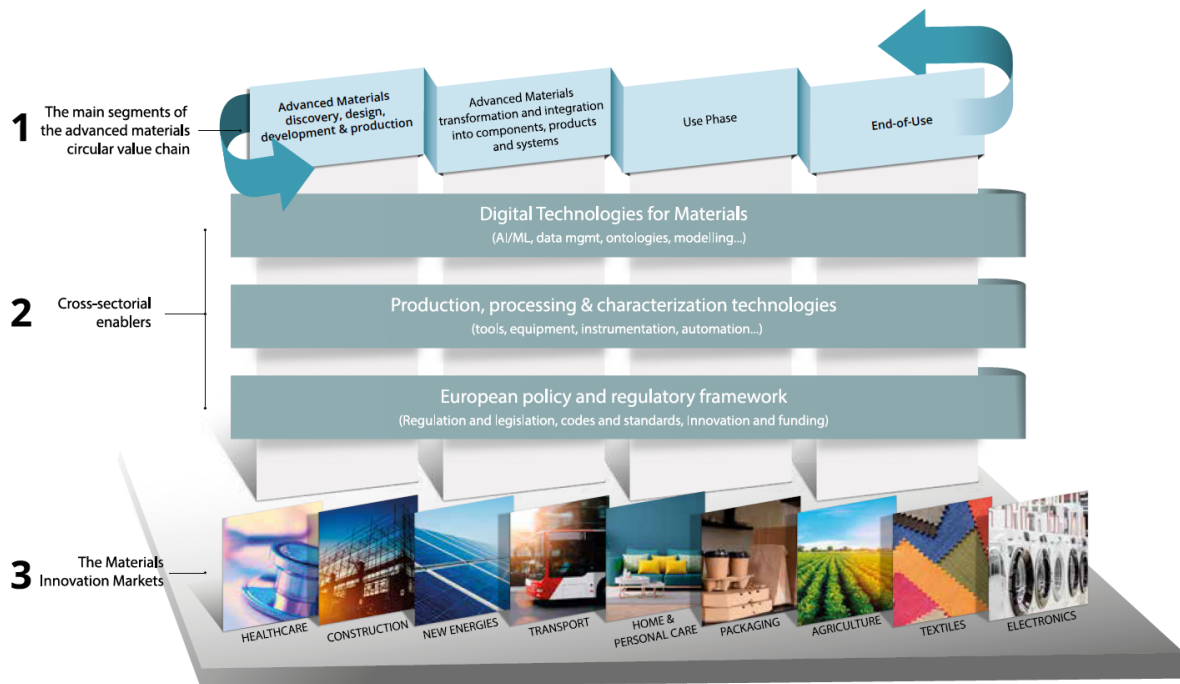


Figure 1: AMI2030 Areas of Intervention.

Furthermore, a close link between fundamental research upstream and the MIMs downstream will be established, combining technology push and market pull approaches.

General objectives encompass the four pillars initially highlighted in the AMI2030 manifesto:

- Reinforce EU Sovereignty through global leadership and strategic autonomy in key areas, ensuring compatibility with EU values.
- Establish and strengthen sustainable, resilient and circular Advanced Materials value chains, supporting the Green Deal.
- Contribute to the Digital Age through smarter Advanced Materials and data.
- Boost industrial competitiveness through interdisciplinary technology innovations.

As illustrated on Figure 2, AMI2030 will focus its activities on Advanced Materials X-cutting needs<sup>2</sup> shared across the strategic MIMs<sup>3</sup> and associated technological needs<sup>4</sup>.

<sup>2</sup> Safe and Sustainable; Resilient; Resource-efficient; Renewable; Circular; Frontier Materials

<sup>3</sup>Healthcare, Construction, Energy, Mobility, Home & Personal Care, Packaging, Agriculture, Textiles, Electronics

<sup>4</sup> Production, Processing, Characterisation, Digitalisation

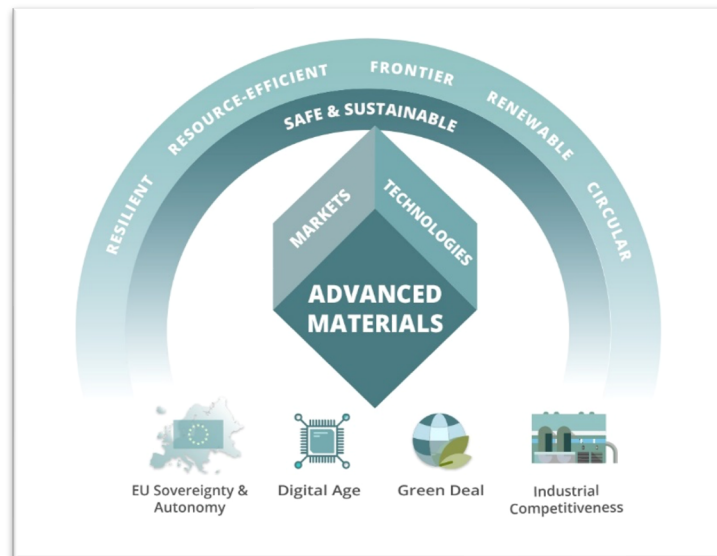


Figure 2: AMI2030 coverage and main objectives.

The general objectives will be supported through a set of actions, covering Advanced Materials lifecycle and value chains across various Materials Innovation Markets (MIMs), while addressing critical challenges and needs along the materials innovation cycle:

- Leverage on game-changing technologies for the fast development of scalable Advanced Materials solutions.
- Develop Advanced Materials technologies with low environmental footprint and circular business models.
- Support innovation uptake and access to infrastructures and services.
- Promote the outreach, dissemination and further exploitation of results.
- Contribute to an efficient implementation of key regulations, norms and standards supporting the design, development and uptake of Advanced Materials.
- Education & Skills (Knowledge management).
- Paving the way towards a European Advanced Materials Innovation Ecosystem.
- International cooperation.

The specific actions are described inside the recently released Strategic Research Agenda and will feed the upcoming SRIA to be built in close coordination with other relevant programmes and initiatives already in place on Advanced Materials and related areas.

Different classes of advanced materials provide different opportunities and face multiple challenges when it comes to their industrial use. For instance, there are about 6,000 layered materials that can exist in a 2D form. Of these, fewer than 100 have been experimentally realized, and only a small number have been studied in any detail. Even for the most widely studied 2D materials, graphene and graphene oxide, large scale industrial application has only been reached in a few markets.

The challenges ahead include, in addition to materials science, the development of processes that render these new materials compatible with mainstream manufacturing technologies. The reproducibility and reliability required for industrial applications is a major challenge that is being addressed, by building on the lessons learned from the 2D Experimental Pilot Line (2D-EPL) of the

Graphene Flagship. The 2D-EPL, which was launched in October 2020 with a budget of 20 M€, aims at establishing an ecosystem for integrating 2D materials in the semiconductor industry.

**By joining forces and integrating 2D materials into advanced materials, the two initiatives will more efficiently tackle the main challenges Europe is facing on advanced materials and be more impactful in reaching the objectives set on EU sovereignty & autonomy, innovation leadership & industrial competitiveness and making the green & digital transitions a reality.** We are ready to bring together the multiple stakeholders across the advanced materials value chain and implementing the open and systemic approach will synergize skills, resources, initiatives and programmes, for the benefit of the European advanced materials sector and all downstream markets.