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NOTE

From:	General Secretariat of the Council
To:	Permanent Representatives Committee/Council
Subject:	*Preparation of the Council (Competitiveness (Internal Market, Industry, Research and Space)) on 23-24 May 2024* Research and Innovation for Advanced Materials for Industrial Leadership - Policy debate

Delegations will find attached a Presidency note on "Research and Innovation for Advanced Materials for Industrial Leadership" with a view to the policy debate at the Competitiveness Council on 23 May 2024.

ANNEX

BACKGROUND PAPER – 'RESEARCH AND INNOVATION FOR ADVANCED MATERIALS FOR INDUSTRIAL LEADERSHIP' (COMPET, 23 MAY 2024)

Advanced materials are **new materials with enhanced properties** that are intentionally designed for superior performance. Innovations in the last decade, including artificial intelligence, allow scientists to create new, purpose-built materials that strongly outperform naturally occurring materials. Advanced materials are beginning to **transform every aspect of life** as they are enabling the invention of entirely new products and devices. They are essential in a wide range of sectors, including space, defence, agrifood and healthcare. In the next twenty years, we will likely see a massive leap forward in research and innovation on advanced materials in Europe.

Advanced materials are on the list of critical technology areas for the Union's economic security[1] and are key for its competitiveness and for the green & digital transitions. They promise a wealth of solutions for a successful implementation of the Green Deal Industrial Plan as they drive innovations in new clean energy technologies provided for in the Net-Zero Industry Act[2] and have the potential to substitute certain critical raw materials, thereby contributing to the objectives of the Critical Raw Materials Act[3], but also the Chips Act[4]. Policy actions that enhance Europe's technological base on advanced materials are thus **crucial building blocks for the EU's resilience, competitiveness, and open strategic autonomy,** contributing to a European competitiveness deal as requested by the European Council in April 2024.

1 13892/23 AD1
2 6269/24
3 PE 78 2023 REV 1
4 OJ L 229, 18.9.2023, p. 1–53

The **demand for advanced materials is expected to significantly increase** in the coming years and should be matched by growing innovation and production in the Union. Europe can ensure it has the necessary capacities and resources to lead innovation and deployment in advanced materials, in line with its green & digital transition, industrial policies, sustainability, circularity and value chains' resilience. End of life management of advanced materials in the aim of circularity is a particularly important innovation challenge. Capability of recovering and recycling complex materials and technologies for separating materials is crucial for the European industry.

Research and innovation (R&I) on advanced materials is a **complex topic that covers a high variety of fields and applications**. The advancement of **digital technology in advanced materials in R&I** – including the use of data infrastructures, digital modelling tools, common data analytics and artificial intelligence – holds promise for expediting the identification of novel and groundbreaking materials but requires deliberate and comprehensive strategies to foster success.

The Union's industrial ecosystem in advanced materials has a high potential. It can rely on a **significant share of innovation leaders in the field** and a strong technology specialisation in certain sectors[5]. However, our leading position is eroding. The Union's corporate patenting output in advanced materials falls behind the US and Japan and remains stable over time while other world regions report rising patent trends. In addition, there is a persisting gap between innovative research and uptake in industrial applications and processes, an issue that is linked to i.a. the lack of testing and experimentation facilities and the lack of entrepreneurial dynamism, exhibiting a relatively low share of capital raised by start-ups active in advanced materials.

[5] Industrial R&D&I investments and market analysis in advanced materials, Commission study (Nov. 2023).

Increasing the pool of well-educated researchers and professionals and skilled entrepreneurs is crucial. Indeed, R&I on new advanced materials for industrial applications is **intrinsically multi-disciplinary** and needs to draw on expertise and skills in fields such as chemistry, physics, nanotechnology, ceramics, metallurgy, and biomaterials. These challenges call for the development, implementation and coordination of regional, national and Union policies to strengthen the entire value chain in advanced materials in the Member States, encourage intersectoral collaboration and integration, accelerate the uptake of advanced materials and maximise the impact of R&I investments in this field.

Today, the Union and its Member States have the unique **opportunity to develop a joint and comprehensive strategic approach** to **safeguard the Union's economic security and increase its industrial competitiveness.** Advanced materials are envisaged to: (i) strengthen the European multi-disciplinary scientific base; (ii) foster innovation and industry capacity; (iii) reduce dependency on critical raw materials and other critical resources; (iv) build synergies and cross-fertilisation across sectors; (v) increase overall investment in knowledge creation and valorisation.

In its Communication[6], the Commission suggests the following **preliminary R&I priorities** for joint action in advanced materials for a successful Union green & digital transition: Energy[7], Mobility[8], Construction[9], Electronics[10].

6 Commission communication on Advanced Materials for Industrial Leadership (27 Febr. 2024),

7 Energy: Materials needed for conversion and generation of renewable and low carbon energy, energy storage and increased energy efficiency.

8 Mobility: Materials for energy storage and use, robust, lightweight materials for transport means and assets, protection and durability, circularity and environmental performance, ability to perform in harsh environments

9 Construction: Materials for more energy efficient buildings, more robust building structures and structural integrity monitoring, enhanced wellbeing in buildings, materials increasing circularity and improved environmental performance.

10 Electronics: Materials for improved performance and new functionalities of electronic components, sensors, novel computing concepts, chips production, greater efficiency in the next generation of communication technologies and ability to perform in harsh environment.

In light of the above, ministers are invited to give their views on following questions:

1. COORDINATION: How can the Union and its Member States best coordinate research and innovation on advanced materials to reduce fragmentation in the Union and improve competitiveness of advanced materials companies and value chains?

2. PRIORITISATION: Which application areas should be prioritised? Do the four priority areas the Commission proposes to start with in 2024 sufficiently take into account socio-economic, scientific, or technological developments, and the potential common needs for joint action? Which other priority areas should be considered in the next stage?

3. SHARING PRACTICES: Are there successful models or best practices in your country from which the EU can draw inspiration?