

# Single market for defence: policy asks from the European carbon and graphite industry

The European Carbon and Graphite Advanced Materials Association (ECGA) welcomes the opportunity to contribute to the European Commission's consultation on the single market for defence. Our association represents producers and innovators within the carbon and graphite advanced materials sector, which is a foundational element of strategic value chains such as battery manufacturing, semiconductors, aerospace, and defence systems.

We commend the Commission's focus on building a resilient European Defence Technological and Industrial Base (EDTIB). This paper outlines the strategic importance of carbon and graphite materials, the readiness of European producers to scale capacity, and our recommendations for a procurement framework that strengthens European sovereignty from the raw materials level up.

**Our core message:** European carbon and graphite producers stand ready to invest in expanded defence-grade capacity. We seek a policy framework that provides the market certainty necessary to justify these investments, ensuring that critical defence materials are produced on European soil by European companies.

## A The Strategic Importance of Carbon and Graphite in Defence Systems

Carbon and graphite materials, including carbon fibres, carbon composites, and high-purity graphite grades, are indispensable to modern defence systems. Their unique combination of properties (high thermal resistance, electrical conductivity, lightweight strength, electromagnetic absorption, and chemical stability) makes them irreplaceable across critical applications.

## A.1 Missile, Torpedo, and Aerospace Propulsion

The most strategically significant application of high-purity graphite lies in propulsion systems for missiles and torpedoes. Graphite is the most refractory material known, with a sublimation temperature of 3,825°C—far exceeding all metals and ceramics. This makes it the only material capable of surviving rocket motor nozzle throats, where temperatures routinely exceed 3,000°C, and the thermal environments encountered during ballistic missile re-entry and hypersonic flight.

In these applications, graphite and carbon-carbon composites function through controlled ablation, absorbing enormous quantities of thermal energy by sacrificing their surface layer to protect guidance systems, warheads, and other sensitive components. The physics of ablative thermal protection cannot be replicated with any other material at comparable weight and cost. European deterrence capabilities, including submarine-launched ballistic missiles, cruise missiles, torpedo propulsion systems, and future hypersonic platforms, fundamentally depend on access to defence-grade graphite.

## A.2 Aerospace Structures and Unmanned Systems

Carbon fibre composites have become essential structural materials in military aerospace. Planes like the F-35 or the Rafale use carbon composites for more than 40% of their load-bearing structure. Unmanned aerial vehicles rely even more heavily on carbon fibre, as weight reduction directly extends flight endurance and payload capacity.

Rotorcraft applications include rotor systems and structural components where carbon composites reduce weight while providing necessary fatigue resistance. As unmanned systems become increasingly central to military operations, demand for aerospace-grade carbon fibres will continue to grow.

## A.3 Protection, Survivability, and Signature Management

Silicon carbide, a compound of silicon and carbon, ranks among the hardest materials known and has become essential to modern armour systems, fragmenting incoming projectiles while providing protection at significantly reduced weight compared to steel. Carbon fibre composites serve as backing layers that catch spall and debris, ensuring multi-hit capability. This combination is now standard in body armour, tactical vehicle protection, and aircraft armour.

Graphite's electrical conductivity also enables signature management applications. Graphite-based coatings absorb radar waves and convert them to heat rather than reflecting them, reducing the radar

signatures of aircraft and naval vessels. Graphite-based flares and smokescreens provide similar protection against sensor systems.

## **A.4 Energy Storage and Strategic Power**

Graphite serves as the essential anode material in lithium-ion batteries powering military communications, navigation, sensors, and unmanned systems, with no commercially viable alternative at scale. Drone operations in Ukraine alone consumed an estimated 50,000 tonnes of battery-grade graphite in 2024.

Graphite-based lubricants and seals enable military systems to operate across temperature ranges from cryogenic conditions to 3,000°C in vacuum, resisting corrosion and environmental contamination where conventional materials fail. High-purity graphite also serves as a neutron moderator in nuclear reactor designs, including small modular reactors under development for naval and forward operating base applications.

## **B European Industry: Ready to Scale with the Right Framework**

Our members possess decades of accumulated expertise in defence-grade material specifications and qualification processes. They have established track records of supplying materials that meet the exacting standards required for aerospace and defence applications, encompassing not only material production but also the application engineering necessary to optimise material integration for specific defence requirements.

Our members also maintain active research and development programmes at the technological frontier. Their proximity to European defence primes enables rapid iteration, customisation, and technical support that distant suppliers cannot match.

Moreover, our members operate under the world's most stringent environmental, health, and safety regulations, positioning European materials as the responsible choice for defence programmes with environmental, social, and governance commitments.

However, the capital-intensive nature of carbon and graphite production, particularly graphitisation processes requiring sustained temperatures exceeding 2,500°C, means that facilities must operate at high utilisation rates to achieve economic viability. Competitors in other regions benefit from state

support that de-risks industrial investments; European producers require comparable policy frameworks to justify expansion investments that would strengthen European sovereignty.

## C Our Policy Recommendations

ECGA proposes three complementary policy measures that would address the barriers identified above and create conditions for a functioning Defence Single Market that extends to strategic raw materials.

### C.1 European Content Requirements with Physical Origin Criteria

The Commission should establish European content requirements for defence procurement that include specific provisions for strategic raw materials, using **physical transformation criteria to verify European origin**. For carbon and graphite materials, appropriate criteria would include "**graphitised in Europe**" for synthetic graphite products and "**carbonised in Europe**" for carbon fibre and carbon-carbon composites. These criteria identify the high-temperature transformation processes that constitute the essential value-adding steps in carbon and graphite production, analogous to "melted and poured" requirements used in the steel sector.

Physical origin criteria provide verifiable markers of genuine European production, distinguishing materials that are merely traded through European intermediaries from materials that are actually manufactured in European facilities using European technology and labour. This distinction is essential to achieving the security of supply objectives that motivate European content requirements.

Moreover, for the most strategically sensitive applications, including missile propulsion systems, hypersonic thermal protection, and nuclear reactor components, **European content requirements should mandate ITAR-free supply chains**. Materials in these categories should be required to originate entirely within European jurisdiction, eliminating the export control vulnerabilities and technology transfer concerns associated with ITAR-controlled materials.

### C.2 Supply Chain Transparency to Tier Three

The Commission should mandate that defence prime contractors identify and verify strategic material suppliers throughout their supply chains, with visibility extending to at least Tier 3 for materials deemed critical to defence readiness. Carbon and graphite materials, given their irreplaceable role in multiple

priority capability areas, should be explicitly included in the categories subject to this transparency requirement.

**Annual updates and verification would ensure that supply chain information remains current as programmes evolve and supplier relationships change.** This supply chain mapping would use existing defence supply chain security frameworks, protecting commercially sensitive information through appropriate classification while providing competent authorities with the visibility necessary to identify vulnerabilities and make informed procurement decisions.

**Early detection of supply chain vulnerabilities for graphite and other critical materials would enable proactive measures to address dependencies before they create programme risks.** Currently, supply chain issues often surface only when disruptions occur, leaving insufficient time to qualify alternative suppliers. Systematic mapping would shift the approach from reactive crisis management to proactive supply chain resilience.

### C.3 Harmonised European Qualification Framework

The Commission should establish a harmonised European defence supplier qualification system for strategic raw materials producers, addressing the fragmentation that currently prevents European suppliers from serving the defence market efficiently.

The core element of this framework should be **mutual recognition of qualification across Member States**. A supplier qualified by one Member State's competent authority should be recognised as qualified throughout the European Union, eliminating the requirement to repeat qualification processes for each national market. This mutual recognition should be based on common technical standards aligned with established defence specifications, including NATO standards where applicable.

The framework should establish **defined timelines for qualification decisions, with a maximum of twelve months for initial qualification and a six-month fast-track pathway for suppliers already qualified in another Member State**. Current qualification timelines of three to five years are incompatible with the urgent capability requirements identified by the European Council. Accelerated qualification is essential to enable European suppliers to respond to defence needs within relevant programme timescales.

To enable market access during the qualification process, the framework should provide for provisional qualification status. Provisional qualification would allow suppliers to begin serving defence customers while final certification processes are completed, subject to appropriate quality assurance measures.

The framework should include **financial support mechanisms to reduce qualification barriers for small and medium-sized European producers**. Support for low-volume qualification runs, testing costs, and engineering resources required for ITAR substitution programmes would enable smaller suppliers to enter the defence market and contribute to supply chain diversification. Reduced fees for SMEs and technical assistance during qualification processes would further improve accessibility.

## D Conclusion

**The European carbon and graphite industry possesses the technical capabilities, innovation capacity, and production expertise necessary to serve as the foundation of a sovereign European defence supply chain.** Our members operate facilities that meet the world's most demanding environmental and quality standards. We are prepared to invest in expanded capacity to meet the needs of a strengthened European defence posture.

What we seek is a policy framework that provides the market certainty necessary to justify these investments. The Commission has correctly identified that the current fragmented approach, with ITAR dependencies, redundant qualification processes, and inconsistent supply chain practices across Member States, prevents European materials producers from serving the defence market effectively, regardless of their technical capabilities.

The upcoming Communication on the Defence Single Market represents an opportunity to establish the policy direction necessary to address these barriers. By implementing **European content requirements with physical origin criteria, mandating supply chain transparency for critical materials, and harmonising qualification processes across Member States**, the Commission can create conditions for a genuine Defence Single Market that extends from raw materials to finished systems.