ECOCOMPOSITES

Developing bio-based and recyclable composites

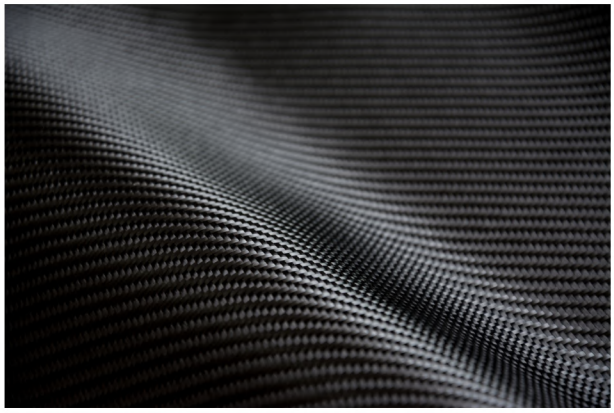
TRANSITION TO SUSTAINABLE AND RECYCLABLE COMPOSITES

THE ROLE OF BIO-BASED MATERIALS

Composite materials are crucial in various industries due to their lightweight nature and low environmental impact during use.

Bio-based composites, made from renewable resources, provide better recyclability and align with EU climate goals and circular economy efforts.

This summary advocates for transitioning to bio-based multifunctional composites, supporting the European Green Deal and the Circular Economy Action Plan by reducing environmental impacts, improving recyclability, and benefiting local economies.



PROJECT OVERVIEW

Composite materials are valued in various industries for their unique properties and can be found in almost all areas of daily life: from car structures to construction applications over to aircraft components. Their main advantage lies in the high strength-to-weight ratio, which allows for lightweight yet durable structures, allowing manufacturers to adapt these materials to specific application requirements.

Traditional composites, primarily derived from fossil fuels, pose significant sustainability challenges, contributing to greenhouse gas emissions and pollution during both production and disposal and complicating recycling processes while generating considerable waste. It is estimated that 40-70% of composites waste today is still ending in landfill or is incinerated without energy recovery (EUCIA, POSITION PAPER: CIRCULARITY OF COMPOSITE MATERIALS, November 2022).

Moreover, their production is energy-intensive and costly. As Europe aims for climate neutrality and a circular economy, transitioning from fossil-fuel-based composites to sustainable, bio-based composites becomes crucial.

Supporting the research, development, and deployment of bio-based composites will enable European industries to achieve sustainability goals, in line with EU sustainability policies, and bolster economic resilience.

Additionally, the possibility to integrate multiple functions within composite materials allows to reduce lead times during manufacturing and enable predictive maintenance, thus improving the efficiency of production processes and lowering costs and energy requirements.

This brief addresses the challenges associated with traditional composites and underscores the necessity of bio-based alternatives for a greener, more sustainable future.

POLICY RECOMMENDATIONS

To advance the adoption of sustainable bio-based composites and address the sustainability challenges posed by traditional composites, the following policy recommendations are proposed:

PRIORITISE RESEARCH AND DEVELOPMENT

Focus research and development on specific applications to address technological and economic barriers, such as high material and production costs, by exploring renewable materials, optimising production processes, and enhancing recycling techniques.

PROMOTE SYNERGIES BETWEEN ACADEMIA, INDUSTRY, AND GOVERNMENT

Encourage collaboration between industry, academia, and government to establish common policy goals, relevant regulatory mechanisms, stimulate innovation and drive progress in this critical field.

PROMOTE INCENTIVES FOR SUSTAINABLE PRACTICES

Introduce incentives for all actors of the composite value chain to offset potential cost increases from transitioning to sustainable bio-based composites. This include grants for businesses adopting eco-friendly technologies and processes that reduce waste and energy consumption.

INTEGRATE BIO-BASED COMPOSITES INTO PUBLIC PROCUREMENT

The EU should prioritise bio-based composites in public procurement, especially in construction, transportation, and infrastructure. This will boost market demand and incentivise manufacturers to invest in sustainable materials.

ESTABLISH STANDARDS AND CERTIFICATIONS

Clear standards and certification processes for sustainable bio-based composites will ensure quality and facilitate market acceptance. Industry-wide benchmarks will build trust among manufacturers and consumers, promoting broader adoption.

FOSTER LOCAL SOURCING AND SUPPLY CHAINS

Encourage use of locally-sourced raw materials for bio-based composites to reduce dependency on imported materials, strengthen local economies, and mitigate global supply chain risks.

PROMOTE PUBLIC AWARENESS AND EDUCATION

Launch campaigns to raise awareness of sustainable bio-based composites among manufacturers, consumers, and policymakers, highlighting the advantages of transitioning to these materials and their economic and environmental benefits.

MONITOR AND EVALUATE PROGRESS

Establish mechanisms to monitor the environmental impact of transitioning to sustainable bio-based composites. Regular assessments will inform policy effectiveness and allow for adjustments to promote a more sustainable future.

POLICY IMPLICATIONS

Composites, made from a matrix (like polymer or metal) and reinforced with fibres or particles, offer benefits such as increased strength, reduced weight, and durability.

Widely used in aviation, automotive, wind energy, and construction, they excel in strength-to-weight ratio and corrosion resistance.

However, many composites are fossil fuel-based, generate significant waste, and are hard to recycle, posing sustainability challenges. **In Europe, 683,000 tonnes of composite waste are expected by 2025** *(ETIP Wind, 2020: How Wind is Going Circular)*.

Technological advancements in bio-based, multifunctional composites and recycling processes provide promising solutions to these issues. **These innovative materials can enhance sustainability by reducing environmental impacts, lowering energy consumption, and cutting greenhouse gas emissions,** thereby supporting the EU's industrial base.

The global bio-composite market is expected to grow at a CAGR of **11.8%**, from approximately **€4.5 billion in 2016 to €10.9 billion by 2024** *(T. Gurunathan et al. (2015), 77)*.

ENVIRONMENTAL IMPACT AND SUSTAINABILITY

Traditional composites, mainly based on finite fossil fuels, are not sustainable and contribute to greenhouse gas emissions. This reliance on petroleum harms the environment and hinders the shift to a bio- based and circular economy. In contrast, bio-based composites use renewable resources, lowering carbon emissions and offering a sustainable and eco-friendlier option.

RECYCLABILITY

Recycling traditional composite materials is challenging because separating fibres from the matrix without degrading quality is difficult. This leads to material waste and limits reuse in high-performance applications. Bio-based composites offer a solution, making recycling easier. Innovative techniques, like chemical recycling, can enhance recovery and reuse, ensuring energy-efficient processes and high-quality secondary raw materials. By improving recycling methods that preserve composite properties, the industry can reduce waste, maximise value at the end of life, and support the EU's goals for a sustainable, circular economy.

WASTE GENERATION AND LANDFILL

Traditional composite manufacturing produces significant waste, with up to 70% of composite waste currently ending up in landfills or being incinerated. In contrast, bio-based composites, made from renewable resources and easier to recycle, can help reduce waste. This, combined with the adoption of energy-efficient recycling methods, aligns with EU sustainability policies, including the European Green Deal, Circular Economy Action Plan, and the EU Plastics Strategy.

COST-EFFECTIVENESS

Bio-based composites use renewable resources, which are often cheaper than traditional materials made from fossil fuels. Investments in R&I and upscale are strongly necessary to favour scale-up and process optimisation of the bio-based industry, and allow for cost decrease, making these sustainable composites a more affordable choice for both manufacturers and consumers.

HIGH ENERGY CONSUMPTION

Manufacturing conventional composite materials is highly energy-intensive. Implementing energy-efficient production methods is crucial to reducing the environmental impact of composite manufacturing and aligns with the objectives of the European Green Deal.

DEPENDENCY ON IMPORTED RAW MATERIALS

The EU is highly dependent on imported raw materials for composite production, which poses risks to supply security and economic stability. This dependency makes industries vulnerable to supply chain disruptions and fluctuating global market prices. By shifting to bio-based, locally sourced raw materials, the EU can reduce its reliance on imports, strengthen supply chains, and support local economies.

ECOCOMPOSITES

The cluster is composed of

r-LightBioCom

r-lightbiocom.eu

MC4

mc4-project.eu

FOREST

forest-project.eu

furhy
fully recyclable hybrid bio-composite for transport application

furhy-project.eu

repoxyble
BIO-BASED MULTIFUNCTIONAL RECYCLABLE COMPOSITES

repoxyble.eu

SUSPENS
Design sustainable composites

suspens-project.eu

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