



POSITION PAPER

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CIRCULARITY OF COMPOSITE MATERIALS

Scope

This position paper has been developed by the Assocompositi Sustainability Committee to illustrate the guidelines for a circular management of composite material products. In fact, all composite material components have characteristics that are already substantially in line with a technical-economic circular approach.

Characteristics of composite materials

Composite materials differ from other structural materials because of their extraordinary combination of stiffness, strength and lightness, which makes it possible to reduce mass by facilitating transport and handling operations, assembly, installation and - in the case of moving components such as wind turbines or vehicle parts - even the energy demand associated with their operation. All these advantages, together with the superior durability of the material in the most common operating conditions, unequivocally identify the environmental advantages linked to the use of composites i.e. lower energy consumption and greenhouse gas emissions, longer component life even in the absence of maintenance, better performance and greater safety.

Circularity of composite materials

Composite materials, in addition to the unquestionable advantages listed above in terms of durability and efficiency of products in their use phase, also offer several possibilities for the circular management of the disposal phase (end-of-life). The hierarchy promoted by the European Union for the end-of-life treatment of products fosters - before getting to the actual recycling - strategies of prevention, repair and reuse that are ideal for these materials. They are in fact repairable, durable and retain their properties for a long time, even in the presence of aggressive environments.

Recycling of composite materials

If these strategies are not considered feasible or cost-effective, the market still offers several recycling options for composite materials. To date, the primary technologies for composite waste processing with the highest degree of technological maturity are co-processing in cement plants, mechanical milling and pyrolysis, while other processes currently under development.

Which are the recycling processes?

Co-processing in cement plants uses glass fiber-reinforced composite waste for the production of cement and allows an efficient use of the material by reducing the energy

consumption of the process while considerably lowering CO₂ emissions, with undoubted advantages in terms of environmental protection.

Fragmentation with controlled grinding is an energy-efficient and very flexible process for different material streams and types. In this case, a partial recovery of the intrinsic properties of the composites can be obtained. The number of applications is already quite large, ranging from furniture products to industrial applications in which the recycled material can also perform a reinforcing function with benefits in terms of costs and environmental impact.

Pyrolysis, finally, has a greater environmental impact than the first two types of process but allows the recovery of reinforcing fibers and in some cases even some organic chemical components derived from the thermal decomposition of the resin that can find application in the production of new composites.

A look at the future

There are other processes under development that, although having a lower degree of technological maturity, may open new frontiers for the high value-added recovery (upcycling) of composite materials, such as thermal processes (fluidised bed and gasification) thermochemical processes (solvolysis) or electromechanical processes (high voltage pulse fragmentation). Driven by research and innovation, new composite materials specifically designed to be more easily recycled at the end of their life are also becoming available on the market, such as composites with thermosetting "cleavage" and/or "vitrimer" matrices or thermoplastic matrix composites obtained by reactive molding.

For more information

More detailed information on this topic can be found in the technical support document "*Circularity of Composite Materials: A Beginners Guide*" available in English upon request to our Secretariat (ufficiostampa@assocompositi.it).

Founded in 2005, Assocompositi is the Industrial Association for the composite materials sector in Italy. It brings together more than 70 companies and research organizations as well as professionals distributed throughout the Country, and carries out activities to promote the culture of composites, market protection and collaboration with institutions. The Association operates in close connection with the national associations of the member countries of the European Union thanks to its membership in EuCIA (European Association of Composite Materials).



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