COMPOSITES – a sustainable solution

Statement of Composites Germany on the new Directive 2000/53/EC on end-of-life vehicles

Abstract

Composites (fibre reinforced polymer composite materials) are durable, engineered materials, which provide longevity, strength, excellent chemical and heat resistance, and freedom of design. Demand for composites has been growing over past decades as key industry sectors seek new material solutions to enable a climate-neutral economy.
Composites Germany welcomes the new ELV directive to improve the circularity in the automotive industry. We recommend the following adaptations/improvements to ensure that fibre composites, with their advantageous properties, can continue to support the desired climate neutrality in the automotive industry in the future:

1. *For the regulatory evaluation of material applicability in the automotive industry, Composites Germany promotes a holistic approach: use phase AND end-of-life are both important and need to be taken into account.*
2. *Contrary to the assumption that composites are not/poorly recyclable, numerous industrially available recycling options already exist today. This needs to be considered and the document needs to be corrected accordingly.*
3. *The "closed loop" regulation leads to an unnecessary restriction and limitation of the industry and, with regard to fibre composites, hinders their use as high-performance lightweight construction materials. We recommend allowing and promoting cross-industry cycles for composite materials if the material can be reused for a high-quality application in another industry. Suggesting a financial penalty for car manufacturers that use composite parts is highly counterproductive and threatens the goal of a circular economy for composite materials.*
4. *Battery housings in electric cars are a new core application for composite materials. Cost-effective composite materials with a low CO2 footprint offer enormous advantages. These materials can be cost-effective recycled to new high performance composite materials, also for next use in the same automotive applications. But to do so, these structure parts must be dismantled, such that the battery cells or modules are taken out, the cells or modules to be treated according to the battery regulation, while the casing materials would then be treated according to the automotive end-of-life directive.*

Introduction

Composites Germany, run by the two organizations AVK – Industrievereinigung Verstärkte Kunststoffe e. V. and Composites United e. V., welcomes the new ELV Directive to improve circularity in the automotive industry. A responsible and sustainable handling of resources is crucial to reaching the objectives of the EU Green Deal, ensuring an ecologically as well as economically sustainable future. We strongly believe that composite materials play a crucial role in fulfilling the EU Green Deal objectives and are thus essential for key industries in Europe including the automotive industry. The new ELV directive can become an important instrument for promoting the development of circular value chains for composite materials in Europe. Next the ELV should ensure that the good circular use of composite materials will be made possible.

The importance of composite materials for Europe

Fibre reinforced polymer composites or fibre reinforced polymers (FRP) consist of a fibre reinforcement (typically glass or carbon fibres) and a polymer matrix (a thermoset or thermoplastic polymer). The role model for such a combination of materials (composite materials) is nature, where almost all materials are composites (e.g., wood, bones etc.). By combining materials and their advantages, a superior composite can be created. In the case of FRP, exceptional weight-specific mechanical properties can be reached, among other important properties like a high resistance to corrosion as well as a long durability and longevity.

Based on these properties, FRP are essential for the European industry. No modern wind turbine or aircraft can be developed without composite materials. Composite materials will also play a crucial role in the transition to a green hydrogen economy for Europe, e.g., for hydrogen tanks. As a consequence, the achievement of the EU Green Deal objectives as well as the energy transition are not possible without composite materials. Also, for the automotive industry, the benefits are clear. With the use of composite materials, vehicle weights and thus fuel consumption and CO2 emissions can be reduced. Furthermore, composites reduce maintenance efforts and cost and allow for optimized design freedom as well as functional integration. Especially with the ongoing transition to battery electric vehicles (BEV) and the resulting increased car weights, lightweight design with composite materials becomes more important.

The status quo of composites recycling

In addition to the advantages that the use of composites brings to the design and use phase of vehicles, the end-of-life for these parts must also be considered. For more than 15 years, Composites Germany with its running organisations AVK and Composites United has been active on the topic of composite recycling. As a result, several industrialized recycling processes exist for glass fibre reinforced plastics (GFRP) as well as carbon fibre reinforced plastics (CFRP) today. For example: With the pyrolysis process (GFRP & CFRP), mechanical recycling (GFRP & CFRP) as well as cement co-processing (GFRP), different recycling options are available and industrialized[1]. Consequently, the repeatedly mentioned statement and implication that “composite materials cannot currently be recycled easily” is inaccurate. When dismantled and separated properly, composite materials from ELVs can be reused or recycled to new value-adding applications. Meanwhile several companies work actively on the recycling of composites materials. [2] The cross-industry/application-oriented recycling of composites offers several opportunities to save natural resources and produce high performance products. The current recycling options (especially for thermoplastics within the automotive industry) are to be welcomed and should be further expanded.

[1] See (examples)

- AVK Composites-Recycling study https://www.avk-tv.de/news.php?id=505
- Composites United information brochure “Recycling and recovery of CFRP” https://composites-united.com/en/cu-launches-new-information-series-cu-knowledge/
- EuCIA Document on composites circular economy: https://eucia.eu/wp-content/uploads/2023/05/221031-EuCIA-Background-Document-Composites-Circularity-Final-002.pdf
- EuCIA Background documents on cement co-processing: https://eucia.eu/wp-content/uploads/2023/05/Position-paper-co-processing-of-composites-CEMbureau-EuCIA-for-JRC-study-final.pdf and https://eucia.eu/wp-content/uploads/2023/07/230623-Joint-position-Co-processing-Composites.pdf

[2] https://eucia.eu/wp-content/uploads/2023/07/EUROPEAN-COMPOSITES-RECYCLING-SOLUTIONS-2.pdf

Challenges on the way towards composites circularity

The challenges that still exist today on the path towards a circular economy for composites are mainly related to a limitation of scale. Compared to waste amounts in the steel or aluminium industry, the composites numbers are marginal[3].

The transition to a circular economy starts already at the design phase. "Design for Circularity" is currently a very prominent subject in the composites industry as well as in many R&D projects. Based on their longevity and superior durability, composite materials can ideally be reused or re-manufactured and then directly be utilized for a new application again.

When a recycling process is necessary, waste streams need to be collected in an unmixed way and then combined in order to reach economically viable sizes. Only then, recycling companies are empowered and have the securities to invest in recycling technology and the development of new competitive materials from recyclates which are attractive and competitive to be utilized as resource for new products again. Legislators can support this development through EU-wide new waste codes for composites as well as recycling targets in the different industries including the automotive industry.

Recommended Implications for the new ELV directive

As a consequence of these statements and explanations, Composites Germany recommends the following adaptions/improvements to the European Commission proposal:

1) **Focus on a holistic view:** In the current proposal, a focus of the current ELV directive on the use phase of the vehicles is seen as a "regulatory failure" with the argument that the end-of-life scenarios are not well considered with respect to composite materials. Composites Germany promotes a holistic approach: **use phase AND end-of-life are both important and need to be taken into account**. It is not right to exclude new (composite) materials per se or to penalise them simply because closed cycles have not yet been established due to small quantities and the associated economic challenges. Consequently, exceptions or grace periods should be provided for materials/material groups that promise high (ecological) added value **from a holistic perspective**. Otherwise, material innovations and thus the competitiveness in the automotive sector in Europe may be hindered.

2) **Correction of statements "challenging and costly to recycle":** In the current proposal, composite materials are often described as challenging or costly to recycle with the implication that they are subsequently an obstacle to improving the circularity for ELVs. **These statements are inaccurate.** Three industrialized recycling technologies are available for FRP. When dismantled and separated properly, composite materials from ELVs can be reused or recycled to new value-adding applications. Rather, the ELV directive should focus on addressing the challenges towards a circular economy for composites, namely promoting reuse scenarios and ensuring the separate dismantling, single-variety sorting of composite parts as well as the combination of composite waste steams to allow for an economically viable recycling.

[3] https://eucia.eu/wp-content/uploads/2023/05/221031-EuCIA-Background-Document-Composites-Circularity-Final-002.pdf

3) **No closed-loop recycling content target for composite materials:** The current proposal recommends “mandatory recycled content targets for plastics in newly type-approved vehicles of 25%, **of which 25% from closed loop**”. As explained above, prescribing a mandatory recycling rate can be a sensible way of increasing the need for recycled materials and thus boosting the circular economy by increasing demand. The prerequisite is that the corresponding quantities of recycled material can also be made available. However, the "closed loop" regulation leads to an unnecessary restriction and limitation of the industry and, with regard to fibre composites, hinders their use as high-performance lightweight construction materials. Nevertheless, it must of course be ensured that materials are reused or recycled to a high standard. As a result, **we recommend allowing and promoting cross-industry cycles for composite materials** if the material can be reused for a high-quality application in another industry.
   Example: A wind rotor blade will probably never become a new wind rotor blade again due to a technically induced fibre shortening during recycling. This does not make technical or economic sense. For a high-quality automotive application, however, using the recycled material can make ecological and economic sense. Opening up to cross-sector cycles therefore leads to significantly fewer restrictions and more flexibility for industry, which significantly improves its competitiveness in the necessary transformation process towards a climate-neutral economy. Furthermore, with a cross-industrial approach, composite waste streams can be more easily combined to reach economically viable sizes. In addition, cross-industry cycles also lead to increased resilience of the European economy, as materials can be reused across sectors depending on demand and dependencies, which improves the flexibility and agility of the European economy and can compensate for potential shortages.

4) **Remove from the Extended Producer Responsibility (EPR) (Article 21, Point 1 e) the reference to “composite plastics”:** In the described article of the current proposal, composite plastics are falsely utilized to describe materials which prevent a high-quality recycling, see statement 2). **Suggesting a financial penalty for car manufacturers that use composite parts is highly counterproductive and threatens the goal of a circular economy for composite materials** as it will limit the use of these materials in cars and thus reduce the waste volumes that are required for an economically viable composites circular economy.

5) **Comment on the design for removal and treatment of electric vehicle batteries**
   In chapter II, article 7, paragraph 1 and 2, and referring to Annex VII, part C and F, it is stated that the design should allow for the easy removal of a list of components, which e.g., includes plastic parts, heavier than 10kg, and also electric vehicle batteries.
   For the batteries it is also stated that "The batteries shall be separately removed from end-of-life vehicles and stored in a designated area for further treatment in accordance with Article 70(3) of Regulation (EU) 2023/ [OP: Batteries Regulation]".
   However, that battery regulation only states what percentages should be recovered from metals in the battery cells and disregards that for future electric vehicles the load carrying structure or casing could be made lighter, and with lower CO2 footprint, from composite materials. Note that such solutions already exist in series production, and that many suppliers are investigating this option for future battery packs.

A typical battery for an electric vehicle would have a weight of roughly 500 kg, whereby the casing structure would weigh 100 kg when made form steel, 80 when made from aluminium, or 70 kg, when using low cost and low CO2 foot-print composite materials.[4]
These materials can be cost-effectively recycled to new high performance composite materials, also for next use in even the same automotive applications. But to do so, these structure parts must be dismantled, such that the battery cells or modules are taken out, the cells or modules to be treated according to the battery regulation, while the casing materials would then be treated according to the automotive end-of-life directive. In contrast, if the casing would be treated as just "battery recycling" according to the battery regulation, as it is done today, the whole pack will go in a shredder, after which the highly needed battery cell metals can be recovered, but the then resulting composite waste is hardly useable anymore. And that would then lead to the impression that composite materials are difficult to recycle, which is not true when they are treated properly, by removal, so separation, before the battery cell recycling process.

Recommendation:
It is recommended that the list of mandatory removal of parts and components from end-of-life vehicles is modified to include: Electric vehicle battery encasement structures or housings.

Then to further add these notes:
"The electric vehicle battery encasement structure or housing may be removed either during the dismantling from the vehicle, or at a battery recycling facility".
Exception to this separate removal is allowed when complete packs are shredded into small segments or powder, when the shredded casing materials in that mix can still be reprocessed to similar quality new materials for automotive applications."

We are at your disposal for any questions and further explanations:

Dr. Elmar Witten
AVK – Industrievereinigung Verstärkte Kunststoffe
Am Hauptbahnhof 12
D-60329 Frankfurt am Main
Phone: +49 69 2710770
E-Mail: elmar.witten@avk-tv.de

Dr. Bastian Brenken
Composites United
Ottenbecker Damm 12
D-21684 Stade
Phone: +49 4141 40740 15
E-Mail: bastian.brenken@composites-united.com

[4] AZL-Aachen-GmbH joint partner study "Concept Study & Development of Cell-to-Pack Battery Casings", 2023, on material alternatives for future electric vehicle battery layouts, and evaluation on weights, cost, CO2-footprint and recyclability.