FEICA The European voice of the **adhesive** and **sealant industry**

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Adhesives in the regulation of end-of-life vehicles

FEICA, the Association of the European Adhesive & Sealant Industry, is a multinational association representing the European adhesive and sealant industry. Today's membership stands at 16 National Association Members (representing 17 countries), 25 Direct Company Members and 25 Affiliate Company Members. The European market for adhesives and sealants is currently worth more than 19.9 billion euros. With the support of its national associations and several direct and affiliated members, FEICA coordinates, represents and advocates the common interests of our industry throughout Europe. In this regard, FEICA works with all relevant stakeholders to create a mutually beneficial economic and legislative environment.

Background

In July 2023, the European Commission published a proposal for a regulation on *circularity requirements for vehicle design and end-of-life vehicles* ('ELV regulation proposal', document COM(2023)451). The proposal describes various measures to increase the circularity of vehicles, including through *vehicle design* and an *extended producer responsibility* (EPR) system.

Both in the requirements on vehicle design ('circularity strategy', Article 9 and Annex IV) as well in the requirements on EPR ('fee modulation', Article 21), adhesives are mentioned explicitly as detrimental to end-of-life vehicle circularity and therefore to be considered as potential impediments in the vehicle design process and in the EPR fee setting. The text of the articles and the annex implies that adhesives are *in general* a cause of substantial challenges for the *dismantling* and for the *recycling* of end-of-life vehicles.

This paper argues that **the explicit and generalised mention of adhesives as an impediment to the circularity of end-of-life vehicles is inaccurate** and that it also misses the crucial role that adhesives play in the *overall sustainability*, the *performance*, and the *safety* of vehicles as well as in the desired large-scale transition to *electric mobility*.

Adhesives in the production and in the end-of-life of vehicles

Adhesive applications in automotive applications

Adhesives are involved in the production and assembly of most components and parts of a vehicle, including the body, the windows, the drivetrain (of both electric and internal combustion engine vehicles), the suspension, the trim and the interior, and the electrical system, including the high voltage batteries of battery electric vehicles. They serve the principal function of bonding together parts or components in an optimal way, with a view to performance, durability, longevity, and crash safety. Adhesives also are the key to combining dissimilar materials, enabling for example light-weight designs such as mixed-metal vehicle bodies and carbon fibre reinforced structural components. In electric vehicles, adhesives provide crucial bonding solutions for the battery system.

Prominent adhesive applications in vehicles include:

- Adhesives for bonding together the different components of the body, including light-metal and composite components which reduce vehicle weight
- Adhesives for the reinforcement of lightweight metal body components and for improved crash safety of the body (e.g., in bumper beams, pillar reinforcement)
- Adhesives for bonding the windscreen onto the body as a structural element, increasing rigidity, reducing vehicle weight, and improving safety
- Crash-proof bonding of the rear-view mirror to the windscreen
- Lamination of the surfaces of interior panelling, cladding, trim and dashboards including the lamination with safety-improving soft surface materials
- Adhesives for upholstery and other automotive textiles, and for the production of airbags
- Attachment of exterior decorative and functional elements with self-adhesive tapes, such as badges and aerodynamic elements
- Thread lockers, retaining compounds and other adhesives that ensure reliability and ruggedness of vehicle components, especially in the drive train and the suspension
- Various adhesive applications in the production of electrical and electronic components
- Adhesives for the production, assembly, and casing of high voltage electric batteries
- Self-adhesive protective and decorative films for vehicle bodies, preventing paint damages and reducing the need for repainting
- Various legally required stickers, such as type codes, airbag warnings, and fuel, charging and operating fluid type information

This incomplete list illustrates that the applications of adhesives in vehicles are numerous, *varied* and often *indispensable* and illustrates how the safety, reliability, and overall vehicle lifecycle emissions of modern vehicles all benefit heavily from the use of adhesives. Many adhesive applications found in this list will not have any significant influence on the dismantling of vehicles into their components or parts, nor on recycling, as is described in more detail below. In many applications, a replacement of adhesives with other technologies may lead to reductions in durability, reliability, or safety. **Adhesives therefore cannot adequately be regulated in a generalised way without potentially incurring substantial unintended consequences.**

Adhesives in the dismantling of end-of-life vehicles

Adhesives have a long history in vehicle production and assembly and have been allowing the successful dismantling of vehicles, including for repair, into components since then.

The *mechanical separation* of several types of adhesive bonds is well established and routinely practiced in repair jobs. For example, in windscreen replacement this separation is performed by cutting the adhesive bond with a wire. For protective and decorative films on the bodies of vehicles, their ready removability by hand, enabled by adhesives, is part of the value proposition, to enhance the lifespan and value of vehicles. Many other adhesive bonds, for example of aerodynamic elements and trim components can also be broken readily by application of mechanical force of no more or a lesser amount than would be required for the release of mechanical fasteners such as rivets. Dismantling by mechanical force may also often be faster than the separate removal of a multitude of mechanical fasteners such as screws that would be required to replace adhesives in such applications. Adhesives which are applied in addition to mechanical fasteners, such as thread lockers, generally do not introduce additional hurdles or steps in the dismantling of vehicles as they release with the mechanical fastener which they secure in place.

At the same time, not all adhesive bonds need to be dismantled for successful reuse or recycling. For example, structural adhesives applied in between metal components or parts of the same family of metal, e.g., structural adhesives and foams in the body of vehicles, generally do not need to be released as the entire bonded component or part may be sent to metal recycling. Adhesives behave in this sense no different to welds and rivets which are also not released during dismantling.

Adhesive bonds *within* the components of vehicles such as textile and trim lamination, stickers and the adhesives within electrical and electronic components are typically not targeted for further dismantling into their subcomponents or materials during the ELV dismantling process. In such cases, the subsequent recovery and recycling processes for these components or parts may be set up to perform a separation of the adhesive bond, where required, as described in the following.

Adhesives in the recycling of end-of-live vehicles

Without detracting from the importance of vehicle recycling, it should be noted that, in line with the EU waste hierarchy, the preferable option for components from dismantled end-of-life vehicles should be *refurbishment*, *remanufacture* and *reuse*. Adhesives support these product loops by improving the *durability* and *longevity* of vehicle components and parts as described above, enabling their reuse in the same or in another vehicle. Where reuse pathways are not viable, not economically feasible or where no suitable end market exists, recycling is the preferred alternative.

When considering the impact of adhesives on recycling operations, two principal distinctions need to be made that relate to the materials that are bonded: firstly, whether the adhesive was used to bond similar or dissimilar materials together and secondly, the nature of the target material of recycling, e.g., a certain metal, a certain plastic material or glass.

Where an adhesive bonds together similar or identical materials, the bond may not need to be released for recycling. Rather, the adhesive may be designed to be *compatible with recycling* of the materials it bonds together. For example, adhesives are known to not present any impediment to metal recycling processes, such as steel and aluminium recycling, both of which exhibit very high recycling rates from automotive applications[1], [2]. Adhesive applications are destroyed in the melt processes applied to steel and aluminium waste[3], [4]. This case includes not only structural adhesives used on metal body and drivetrain components but also the residues left by thread lockers, retaining compounds and similar products on metal components. The quality of recycled glass is also typically not substantially affected by adhesives[3], [4]. Similarly, adhesives can be designed to be compatible with recycling processes for plastic materials, for example, in the recycling of self-adhesive plastic vehicle wrapping films[5].

Where dissimilar non-metal materials are bonded by adhesives, a separation of the different parts and materials within the component may be required. Such a separation of the adhesive bond may typically occur *mechanically*, e.g., by manual separation or by shredding, followed by density-based separation, sensor-based sorting or sieving. Such cases will require a specific consideration as the successful separation and recycling will depend on the specific combination of materials and adhesive[4], none of which are representative of adhesives applications in vehicles as a whole.

Conclusion

FEICA is convinced that **the explicit and generalised mention of adhesives as an impediment to the dismantling and recycling in the ELV regulation proposal is inaccurate, as adhesives can allow for and even enable successful dismantling and recycling**. FEICA also believes that the current wording constitutes an uneven playing field as other materials and bonding technologies which may prevent dismantling and/or recycling are not mentioned. FEICA therefore strongly believes that **the mention of specific materials or technologies which are to be considered in the circular design strategies and in fee modulation for vehicles should be provided, if at all, in secondary legislation or guidance only.** Any mention of specific materials or bonding technologies should be sufficiently specific and reflective of the existing practices, successes and limitations of end-of-life vehicle dismantling and recycling. Therefore, we propose to take out adhesives and the other examples mentioned.

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[2] 'Determination of Steel Recycling Rates in the United States'. American Iron and Steel Institute and Steel Manufacturers Association, 2021.

[3] H. Onusseit, 'The influence of adhesives on recycling', *Resources, Conservation and Recycling*, vol. 46, no. 2, pp. 168–181, Feb. 2006, doi: 10.1016/j.resconrec.2005.05.009.

[4] 'Circular Economy and Adhesive Bonding Technology', Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, 2020.

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Contact

FEICA Regulatory Affairs:
Jana Cohrs (j.cohrs@feica.eu)
Dimitrios Soutzoukis (d.soutzoukis@feica.eu)

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FEICA - Association of the European Adhesive & Sealant Industry
Rue Belliard 40 box 10, 1040 Brussels, Belgium
Tel: +32 (0)2 896 96 00
info@feica.eu | www.feica.eu

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