



## A Look at the Future of Lightweighting

*Challenges, and how tapes and adhesives can help meet them*

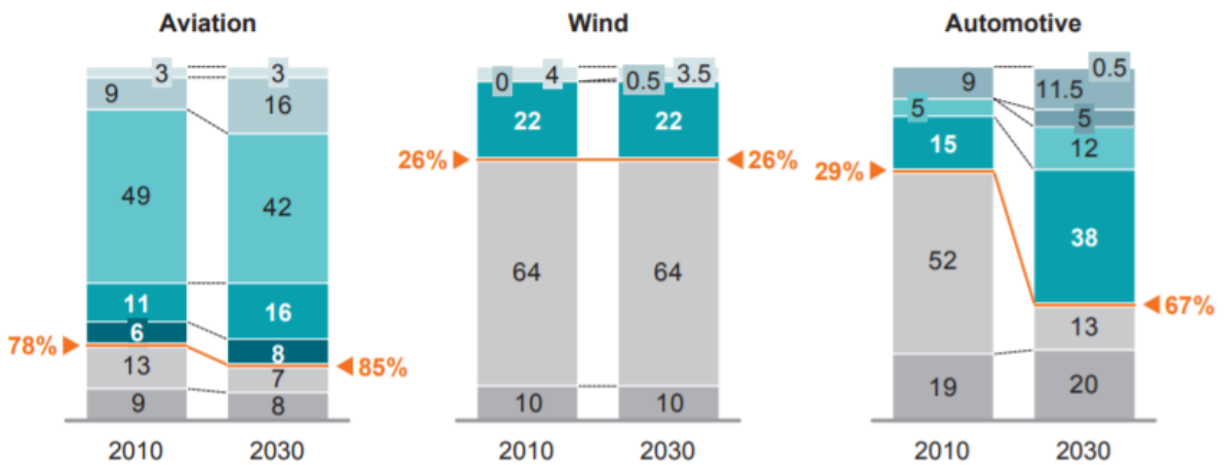
Lightweighting is no longer optional. All over the world, the goal of material and design engineers is to design and build multi-material lightweight automotive vehicles in high volume while providing the same or greater levels of safety and durability. OEMs are exploring materials such as anodized aluminum, plastics, carbon fibers and others for reducing vehicle weight while expanding their design possibilities.

### Aviation currently uses the most lightweight materials in terms of share, but automotive will catch up

**Material split**  
Percent

xx% ▶ Lightweight share<sup>1</sup>

■ Glass fiber    ■ Magnesium    ■ Other light metals  
■ Carbon fiber    ■ Aluminum    ■ Steel (< 550 MPa)  
■ Plastics    ■ HSS<sup>2</sup>    ■ Other nonlightweight<sup>3</sup>



<sup>1</sup> HSS, aluminum, magnesium, plastics (beyond current use), glass/carbon fiber  
<sup>2</sup> High-strength steel (> 550 MPa)  
<sup>3</sup> Mainly other metals, glass, fluids, interior parts for automotive, etc.

SOURCE: McKinsey

A recent [study by McKinsey](#) shows that by 2030, the use of lightweight materials in automotive production will approach the levels currently used in aviation.

## The Challenge for the Heaviest Parts of the Automotive Interior

Seating in particular is a focus for lightweighting in automotive interiors. As OEMs look to suppliers to create solutions, many are taking the challenge to heart. Faurecia, for example, has been working with a Chinese automotive foundry to develop seat structures made from magnesium alloys. According to [Automotive IQ](#) the company estimates the material could result in a 25% weight reduction compared to previous steel seating structures.

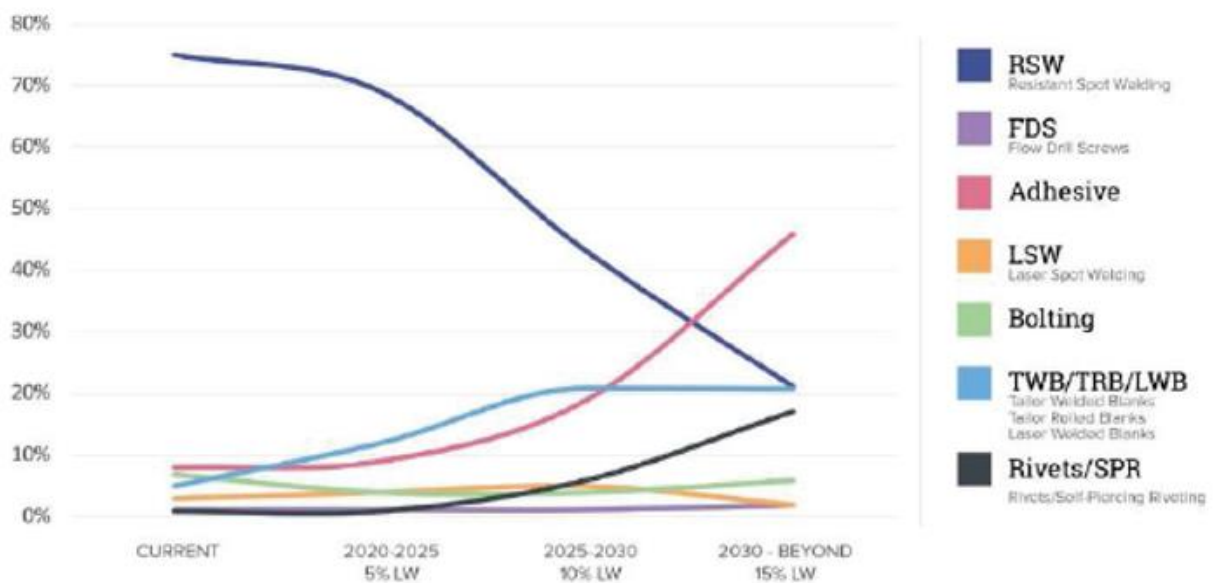
Meanwhile, [Adient](#) recently unveiled several multi-material seating concepts including die-cast magnesium seat structures, glass fiber–reinforced plastic front seat backrests, and aluminum and high tensile steel back seats with a goal of reducing standard seat structure weight by 22 pounds by 2020.

Efforts like these present some interesting questions for OEMs, tiers, converters and their suppliers. Challenges remain to cost-effectively bring lighter, multi-material solutions into production. The central question is: we can create new solutions, but how can we implement them?

## Emerging Need for Tapes and Adhesives

Part of the answer is, literally, in the nuts and bolts. As lighter materials such as [high strength steel](#), aluminum and magnesium are conceptualized and introduced in automotive designs, the need to bond them effectively becomes paramount. At the same time, OEMs are constantly looking to make the manufacturing process more efficient, often with innovative products that can reduce process time or eliminate steps. All of this creates opportunities for the development of alternatives to traditional fastening methods like spot welding, bolts, rivets and clinching.

**Figure 11: Trends in Joining Processes, Current Year to Beyond 2030**



Note: LW= Lightweighting

Source: CAR Research, Lucintel

The chart above from CAR Research/Lucintel shows what's likely to happen in the coming years. The expected growth in automotive adhesives is unmistakable. According to Lucintel, the overall automotive adhesives market [has been forecast to grow](#) at a CAGR of 9% from 2015 to 2020.

Tapes and structural adhesives can provide lightweight solutions along with – or in place of – traditional fasteners such as rivets, bolts or screws. In a recent white paper, [Adhesives.org and Sealants.org](#) point out that structural adhesives in particular can help stiffen structures when added to weld lines and seams, as well as seal gaps which can reduce NVH. The organization also says it expects the average structural adhesive bond length per vehicle to increase 60% over the next five years (approx. 2020) to an average of nearly 90 linear feet per vehicle.

It's always important to consider whether an adhesive is appropriate for certain applications. For example, many panel bonding adhesives are intended for use in outer body, non-structural panel attachment applications, including such applications where they are used in conjunction with welding and/or riveting. There are many factors that can affect the structural integrity of an individual design, so automotive engineers should always evaluate an adhesive to determine what is appropriate. Several adhesive manufacturers offer what are called impact-resistant structural adhesives, which can also be evaluated for use by OEMs.

### **Other Materials for Lightweighting**

Plastics and fiber-reinforced composites are becoming increasingly popular for seating concepts, instrument panels and other areas. Suppliers like 3M are developing adhesives and tapes that can permanently bond a great many plastics and composites as they become increasingly practical – and even necessary. These products allow you to bond plastic to metal, low surface energy (LSE) substrates and dissimilar materials.

Additional advancements in materials for lightweighting include those for reduction of interior NVH. These materials, generally inserted into cavities in doors or headliners, are much lighter and higher performing than in past decades. 3M™ Thinsulate™ acoustic absorbers feature a blown microfiber web that yields excellent performance at a wide variety of weights and thicknesses where noise and mass reduction are major goals.

### **A Lighter World**

The automotive landscape is rapidly changing worldwide. It's imperative for OEM material and design engineers to continuously incorporate lighter, stronger materials into automotive interior designs. At the same time, other trends such as autonomous driving, electrification and ride sharing are emerging in growth markets across the globe. For bonding, joining, insulation and sound absorption, 3M delivers products and solutions to help OEMs, tier suppliers and converters meet the demand.

Sources:

[https://www.mckinsey.com/~media/mckinsey/dotcom/client\\_service/automotive%20and%20assembly/pdfs/lightweight\\_heavy\\_impact.ashx](https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/automotive%20and%20assembly/pdfs/lightweight_heavy_impact.ashx)

<https://www.assemblymag.com/articles/92408-new-techniques-for-joining-plastic-to-metal>

<https://www.compositesworld.com/articles/camismas-car-seat-back-hybrid-composite-for-high-volume>

<http://www.lucintel.com/adhesives-in-automotive-market-2020.aspx>

<http://www.adhesives.org/docs/pdfs/adhesives-sealants-org-white-paper-adhesive-opportunity-and-outlook-in-light-vehicles.pdf?sfvrsn=0>

<http://supplierinsight.ihsmarkit.com/news/5243691/editorial-automakers-expected-to-increase-use-of-high-strength-steel-to-achieve-lightweighting-goals>

<http://www.iqpc.com/media/1000611/38664.pdf>

**Product Selection and Use:** Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

**Warranty, Limited Remedy, and Disclaimer:** Unless a different warranty is specifically stated on the applicable 3M product packaging or product literature (in which case such warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

**Limitation of Liability:** Except for the limited remedy stated above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability.