

Autoneum – making sustainable acoustic and thermal management of cars a reality

The automotive manufacturing industry has reached a point of no return. Advancing electrification and increasing sustainability standards have forced manufacturers to change strategic tack and design vehicles that are more environmentally responsible in every phase of their lifespan. Swiss company Autoneum is at the cutting edge of acoustic and thermal management solutions for automobiles – an increasingly important component to the design and construction of electrified cars, boasting an extra layer of specialisation: sustainability.

The last few years have seen a confluence of events and forces put pressure on vehicle manufacturers to make drastic strategic changes. Countries, especially in Europe, have put in place ever-stricter emission regulations to meet global CO₂ reduction targets. The groundswell of public understanding of and concern about environmental issues is demanding manufacturers act more responsibly in materials sourcing and manufacturing. At the same time, big tech is pushing the vision that the cars of tomorrow will be connected, autonomous, shared, and electric; they've even introduced a catchy acronym – CASE. All this has brought to the fore an important component to vehicle design and construction: acoustic and thermal management.

Swiss company Autoneum is the global market and technology leader in acoustic and thermal management solutions for vehicles. Headquartered in

Winterthur, it has a huge international presence with more than fifty plants around the world and works with almost every car manufacturer. The company's engineers are masters in acoustic and thermal management, which is an increasingly important element for CASE-sensitive vehicle design and construction. However, while Autoneum recognises CASE as a genuinely disruptive concept for innovation in the automotive industry, its in-house experts agree that it omits one critical factor: sustainability. Taking innovation a step further, the company has developed sustainable textile solutions, which are the basis of its wide range of interior and exterior products that deliver tangible sustainable benefits.

REDUCING NOISE, CONTROLLING TEMPERATURE

Car interiors contain all manner of noise-reduction and insulation features, typically built into exterior parts such as the underbody and wheel hubs, hidden from view in panelling around the engine, behind the dashboard, inside the doors and underfoot. Strip all this away, and the cabin would soon become unbearably noisy and hot. As for electric vehicles (EVs), replacing an internal combustion engine (ICE) with a battery pack won't remove all the noise: as long as a vehicle is moving, considerable noise – from the tyres on the road or the air rushing over the body, from heating and ventilation, and the tonal noise of the e-motor itself – can affect the sound quality inside the

cabin. Consequently, reducing noise and optimising temperature control are critical goals in vehicle design.

Autoneum has turned this aspect of vehicle design into both a science and an art. Every component the company manufactures – from floor carpet systems to underfloor panels, and engine or e-motor encapsulations, to name but a few – is designed to be not only multifunctional and lightweight, but also more sustainable. Dedicated to sustainable solutions, Autoneum has established the Autoneum Pure label. Setting industry standards, the label determines technologies with especially high standards of environmental performance.

Autoneum's innovation process is driven by its Advance Sustainability Strategy, which aims to reduce emissions, energy and water consumption and waste, but also outperform international compliance requirements. For example, Autoneum focuses on constantly increasing the recycled content of new products and their recyclability to reclaim production cut-offs. All four phases of a vehicle's life are taken into account: the procurement and production of the raw materials, the actual manufacturing of the vehicle, its use phase, and end of life. Consequently, Autoneum products are designed to have low environmental impact at source, produce little CO₂ during manufacture, serve multiple functions to avoid redundancy, be lightweight to reduce fuel consumption and save battery power, and be easily recyclable. That's no easy task: how is it achieved?

SUSTAINABLE ACOUSTIC AND THERMAL MANAGEMENT

The floor of a typical vehicle features face carpet visible to the occupants, a backing layer, and a decoupler to fill the gap to the vehicle body. Acoustic components located close to the wheels in the interior, for example in the trunk area, and the car exterior such as textile mud guards, reduce the rolling noise. This is especially important in EVs where there is no running engine to distract from road noise. Additionally, electric cars usually have broader and stiffer tyres which means that occupants experience almost as much exterior



Top: Ultra-Silent front trunk (frunk).

Left: E-motor encapsulation with more than 50% recycled content.

Below: Floor insulator/inner dash from recycled cotton.

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noise at a driving speed of between 40 and 50km/h as they would in a car powered by an ICE at city-driving range. While Autoneum engineers therefore place great importance on optimising the acoustic performance of the company's various noise-reducing products, they give equal attention to their environmental performance.

Autoneum reuses fibres from textile waste, such as cotton clothing or

recycled PET, to produce its acoustic-management components. The fibres are converted into felt matting, which are used to create a lightweight acoustic material that can be moulded to customer specifications. The cut-offs are reclaimed, processed, and reused, thereby ensuring a closed material loop. The end product is then integrated as a single unit into the vehicle, significantly facilitating removal and recycling at the end of



vehicle life. Autoneum thus improves the overall recyclability of non-metal vehicle parts, which are traditionally shredded together with the vehicles resulting in automotive shredder residue (ASR), a complex mixture of materials for which there is no economical recycling stream, and usually end up as landfill. Assuming a car has a 15-year life span, parts designed today will be recycled in 20 years, by which time the automotive industry will have embraced the circular economy and will recycle the whole car, part by part.

This is why part recyclability is mandatory today, even if the benefits won't be realised for several years: the future is written today.

For its sustainable carpet systems, the company uses recycled and highly durable PET plastic, which can provide carpets 20% lighter than alternative fibres. 'Identifying recycled materials like PET bottle flakes, which meet the highest standards in terms of performance, economic efficiency, and supply chain, is a key factor for success,' explains Philippe Godano, Global Product Manager Interior at Autoneum. 'Personal commitment from top managers of original equipment manufacturers and their suppliers is equally important,' he continues, 'and cascades down to the procurement organisation by quantified metrics.' By having sustainability in its DNA, Autoneum can fully anticipate the environmental challenges carmakers are facing, as well as support customers in fulfilling and exceeding the

requirements of new emissions and circular-economy legislation.

As for the thermal management of vehicles, only around 30% of the energy produced by an ICE goes to moving the vehicle – the rest is given off as heat. Though undesirable in other respects, this surplus of thermal energy makes heating the passenger compartment relatively straightforward. By contrast, the 90% efficiency and lower operating temperature of an electric powertrain leaves little energy for managing cabin

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thermal comfort and every joule or Watt hour calorie diverted to heating or cooling significantly reduces range. To increase the energy efficiency of electric vehicles, Autoneum's innovations focus on reducing heat loss by optimising cabin insulation – without increasing vehicle weight.

WEIGHT-SAVING SIMULATION

It may seem inconsequential compared to overall design and passenger comfort, but weight is critical in vehicle design. Weight affects fuel consumption and, for ICE and hybrid cars, fuel consumption is linked to CO₂ production. New European emission regulations and the introduction of penalties for vehicle manufacturers exceeding the fleet emission limit have given an economic value to every kilogram of weight saved, and a proportional reduction in penalties manufacturers will have to pay.

EVs don't escape the weight dilemma: batteries are heavy and weight affects range – perhaps one of the biggest concerns of potential EV buyers. Every kilogram saved on the weight of a component thus translates to greater efficiency, and therefore extended driving range.

Autoneum uses computer-aided engineering to run simulations when designing and improving products. Because most of the company's components serve two functions – to minimise noise and manage temperature – thermal and mechanical simulations can identify the optimal material quality and amount. The simulation is then fine-tuned to find the combination that will lead to the lowest weight for each part.

EVALUATING SUSTAINABILITY

Any potential improvement of a current, or innovation of a new product must also pass Autoneum's Innovation Sustainability Evaluation. This internal assessment and rating process

encourages the research and development engineers to evaluate the sustainability improvement potential of the product at early stages of development. The evaluation comprises a series

of specific questions that address its impact in the four stages of the vehicle and component life cycle. In parallel to the internally developed evaluation system for agile adjustments, Autoneum performs full Life Cycle Analysis following ISO 14040/14044, to identify the main emission drivers at each life stage of an automotive component. This helps to develop the company's environmental strategy to reduce its CO₂ footprint systematically and efficiently.

Such a high standard of assessment is a bold quest, but manufacturers are having to develop ambitious sustainability strategies without compromising performance. Core to achieving both is innovation in lightweight acoustic and heat-management systems and sustainable textile solutions. One ambitious company is proving that high performance and sustainability are well within our grasp.



Behind the Research

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Research Objectives

The team at Autoneum are experts in designing acoustic and thermal management systems for vehicles with sustainability built in from the source to end of life.

Detail

Address

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Bio

Swiss company Autoneum specialises in sustainable acoustic and thermal management for cars. It develops and produces multifunctional, lightweight components and systems for interior floor and engine bay as well as the underbody. Customers include almost all light vehicle manufacturers in Europe, North and South America, Asia, and Africa.

Collaborators

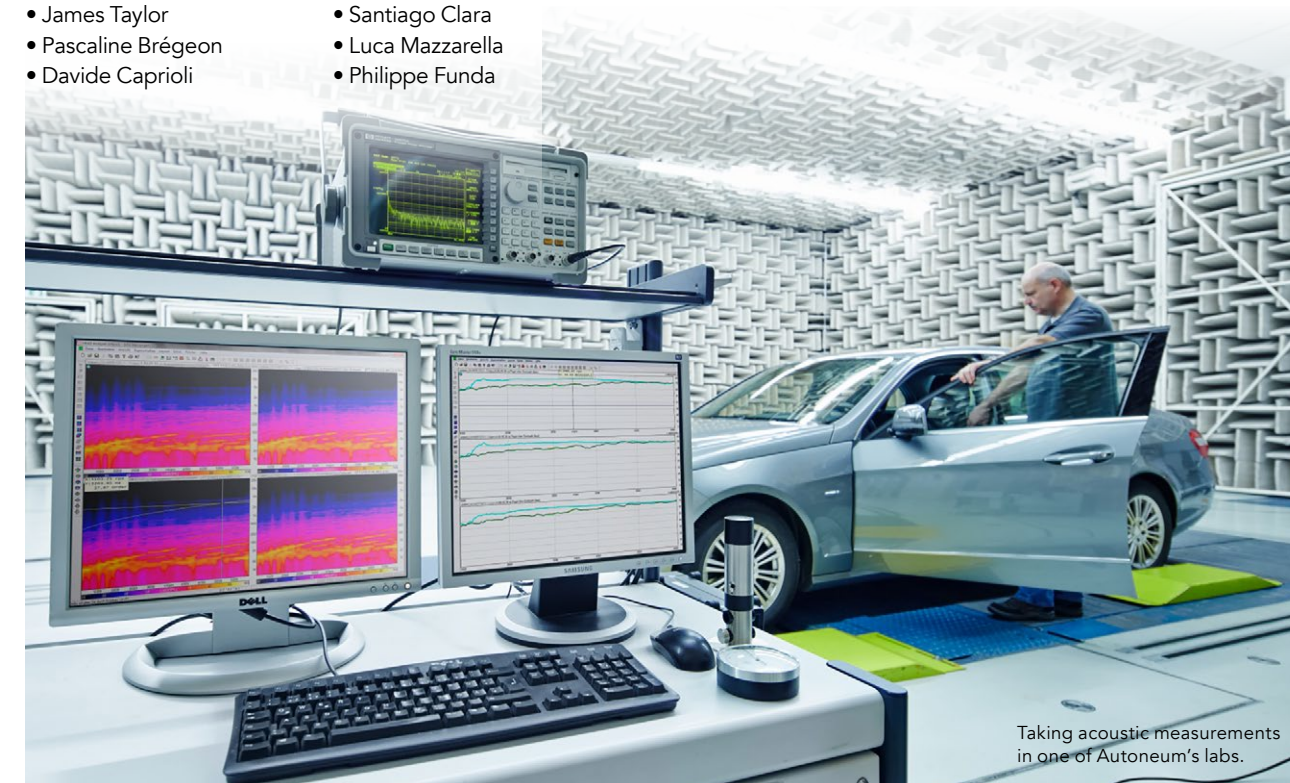
- Philippe Godano
- James Taylor
- Pascaline Brégeon
- Davide Caprioli
- Stefano Schnappenberger
- Laura Gottardo
- Santiago Clara
- Luca Mazzarella
- Philippe Funda

Personal Response

What materials excite you the most when it comes to designing and manufacturing acoustic and thermal management products, and why?

“ Polyester is the material for the future of interior thermo-acoustic components. It can be used in many forms (fibre, film, foam, powder, adhesive), is available in vast quantities in recycled form, has low volatile organic compounds emissions and odour, and is affordable. Combined with state-of-the-art simulation methods and manufacturing processes, polyester-based parts are the benchmark in terms of performance and sustainability today. ”

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Taking acoustic measurements in one of Autoneum's labs.