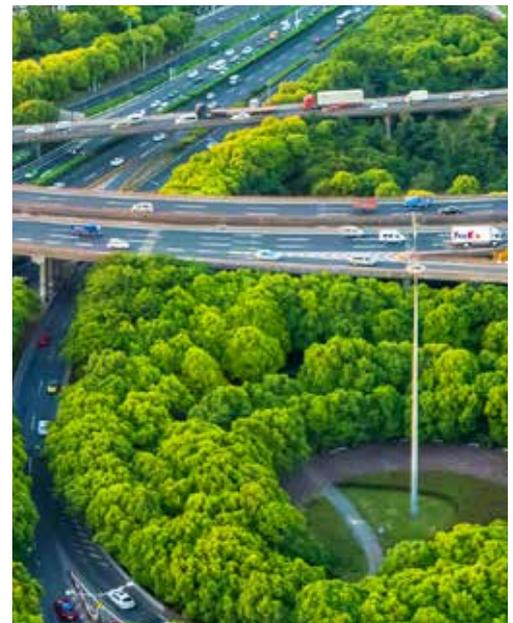


CONTRIBUTING TO CLEANER TRANSPORTATION

AUTOMOTIVE SOLUTIONS

Reducing vehicle weight, enhancing vehicle performance and integrating recycled and recyclable materials are among the key challenges in designing the car of the future. Armacell's innovative PET foam material solutions are engineered to master those challenges and for structural car parts offer the advantages of being both sustainable and lightweight without compromising safety, comfort and durability.

www.armacell-core-foams.com



 **armacell**[®]
MAKING A DIFFERENCE AROUND THE WORLD

OUR SOLUTIONS FOR THE AUTOMOTIVE INDUSTRY

For some time now, the automotive sector has been going through a transformation of enormous significance. The driving factors are the need to reduce fuel consumption and CO₂ emissions, the growing popularity of electric vehicles (EVs) and the recent shift to a more sustainable circular model.

Whatever the vehicle – conventional, hybrid or fully electric – increasingly stringent regulations on CO₂ emissions and high fuel costs for consumers are driving the need for lightweight car design.

As awareness of climate change grows, the pace of EV technology development is accelerating significantly and new materials are being developed to meet the growing demand for efficient transportation. As batteries become more and more powerful, reducing vehicle weight will be the key challenge to overcome range limitations.

Consumers are increasingly questioning the impact of the products they are using, and the automotive industry is no exception. Besides, it also faces the challenge of the mandatory integration of recycled and recyclable plastic materials into its vehicles.

Lightweight design is driving the change towards forward-looking conservation of natural resources, efficient vehicle performance and achieving net-zero emissions targets by the middle of the century.

At Armacell, we are helping the automotive industry achieve these goals with innovations and developments that deliver the value-enhancing solutions to effectively meet changing consumer and industry demands. Our diverse range of fit-for-purpose products and innovative, made-to-measure thermal, acoustic and mechanical solutions helps to enhance the weight-to-performance ratio and durability of exterior and interior automotive parts, thus reducing a vehicle's environmental impact while improving driver safety and the in-vehicle experience.

Innovative automotive solutions to reduce weight, improve safety and enhance the in-vehicle experience optimise the manufacturing process and increase sustainability.

ARMACOMP

ENGINEERED FOR AUTOMAKERS

Our elastomeric Component Foams made of EPDM rubber and various formulations are used to seal out air, dust or moisture.

Found in the seals around headlights, taillights, dashboard electronics, EV battery enclosures and electronic control modules, these materials help to protect sensitive circuits. Doing double duty to damp vibration and unwanted noise, seals are often found around doors, mirrors and sunroof openings.

Component Foams products from the EnsoLite® and Monarch® lines are on the approved source lists of Ford, General Motors, Fiat Chrysler and Toyota.



ARMACOMFORT

ENJOY THE COMFORT OF SILENCE

Based on a unique EVA/EPM blend, our flexible, high-performance sound attenuation solutions are designed to reduce noise from equipment, as well as airborne and structural noise.

Optimising acoustic comfort is one of the most important factors in improving the overall in-vehicle experience. Our ArmaComfort® products provide superior acoustic transmission reduction at a minimum space requirement.

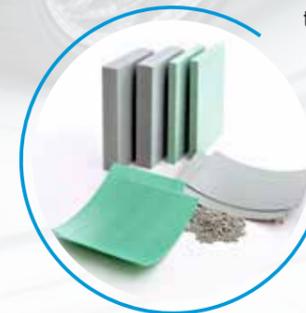


ARMAPET

THE CIRCULAR ECONOMY IN PRACTICE

Our pioneering PET technology, which enables high-tech foam to be manufactured from recycled PET bottles, puts the circular economy into practice and supports the automotive industry's lightweighting efforts to significantly improve its sustainability.

ArmaPET® material solutions are helping to reduce CO₂ emissions, meeting recycling targets and facilitating the integration of recycled and renewable plastic materials into newly designed vehicles.



ARMAGEL

INSULATION JUST GOT BETTER

ArmaGel® is an aerogel product that offers superior thermal insulation in ultra-thin thicknesses.

As one of the world's lightest and thinnest insulation materials, ArmaGel protects mechanical equipment against heat loss and supports its long-term cost-efficient performance.





ARMAPET - RECYCLING PLASTICS INTO HIGH-TECH FOAM CORES

ArmaPET lightweight cores based on 100% post-consumer bottles enhance sustainability and recyclability in automotive car applications while ensuring flexibility and efficiency in production.

Automotive engineers are constantly working to design even lighter, more energy-efficient and environmentally friendly internal combustion and electric vehicles. But how can they make these vehicles lighter without compromising on safety and durability?

At Armacell, we offer the automotive industry powerful and innovative material solutions that deliver the value-enhancing answers the global market is demanding. Our comprehensive offering of innovative eco-friendly PET foam product solutions includes structural and insulating foam cores, thin flexible sheets for thermoformable micro-sandwich solutions and particle foams to produce 3D foam parts.

These differing lightweight solutions provide specific performance benefits with regards to structural strength and formability and help enhance the weight-to-performance ratio and durability of exterior and interior automotive parts. This reduces a vehicle's environmental impact while improving driver safety and the in-vehicle experience.

As a core material for a wide range of automotive sandwich applications, ArmaPET makes many things possible in terms of design flexibility, durability and thermal management. But it is more than a simple lightweight substitute, because ArmaPET is a resource-saving, thermoplastic material based on 100% recycled PET plastic and is fully recyclable at the end of its service life.

TURNING POST-CONSUMER RECYCLED PLASTIC INTO NEW MATERIAL SOLUTIONS FOR TOMORROW'S VEHICLES

ArmaPET is a versatile, lightweight, safe and sustainable material that is suitable for a wide range of structural, semi-structural and interior automotive applications.

ARMAPET CURVE

THERMOFORMABLE FLEXIBLE SHEETS

ArmaPET Curve is designed for recyclable, thermoformable micro-sandwich solutions produced in continuous manufacturing processes.



ARMAPET STRUCT

STRUCTURAL FOAM CORE

ArmaPET Struct is the versatile and durable solution for structural sandwich applications with a more environmentally responsible approach.



ARMAPET SHAPE

PARTICLE FOAM

ArmaPET Shape particle foam offers maximum design flexibility to produce lightweight, rigid 3D foam parts using innovative fusion technology.



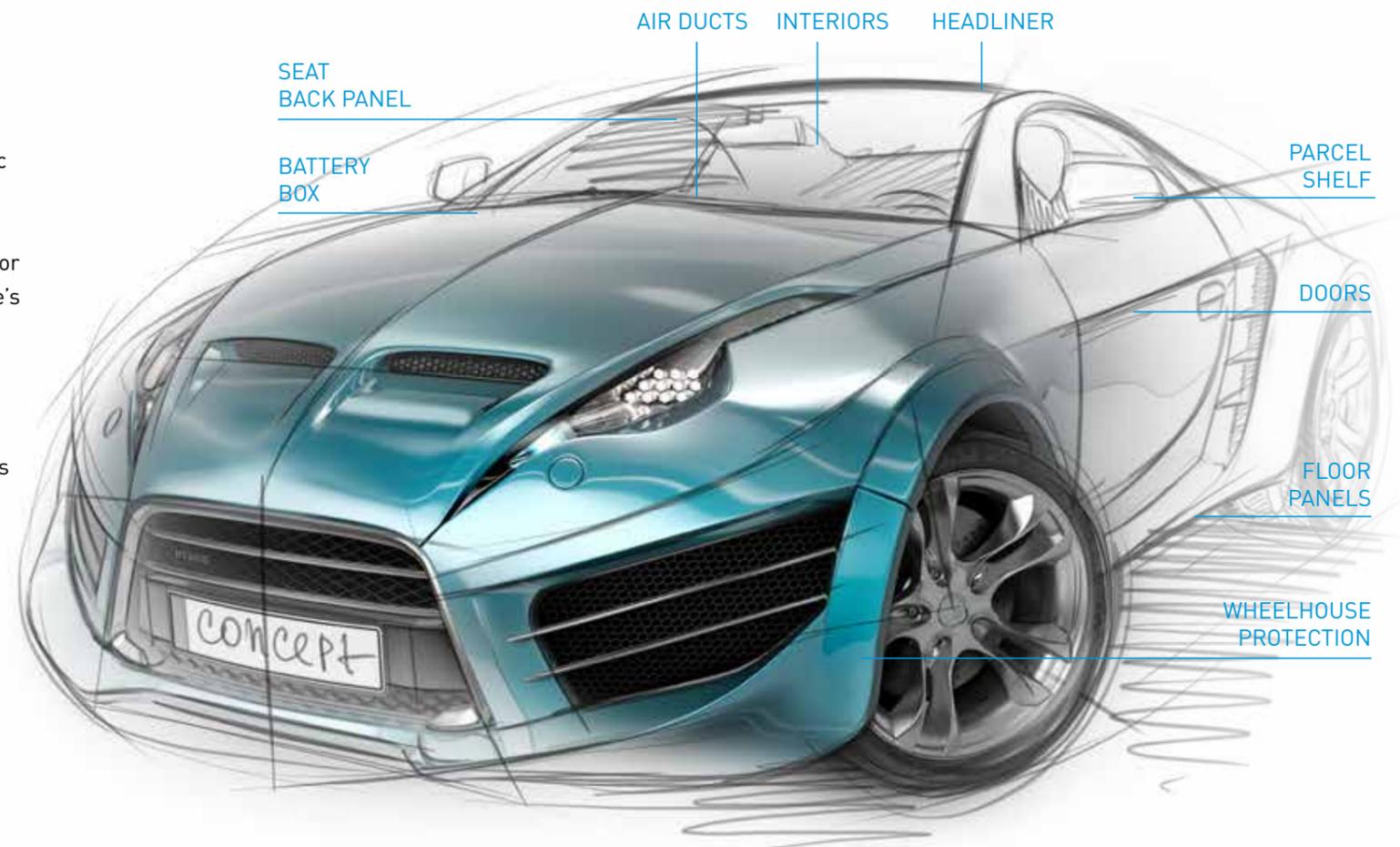
ARMAPET ECO

INSULATING FOAM CORE

ArmaPET Eco combines insulation and structural integrity, ensuring energy and emissions efficiency for decades of use.



Download technical data



ARMAPET - ENABLING NEW MATERIAL SOLUTIONS FOR GREENER TRANSPORTATION

The global automotive industry is being transformed, a process largely driven by emissions and environmental footprint targets. Especially in Europe but also elsewhere in the world, mandatory targets to reduce CO₂ emissions and tighten up fuel economy standards are forcing today's automakers to look for new technologies and material solutions to help them meet these challenging regulations and market expectations.

Whatever the vehicle, conventional, hybrid, electric or hydrogen-powered, lightweight vehicle design is driving the transformation towards sustainable transportation. The replacement of heavier metal car parts with plastic ones has been an ongoing trend for a long time and has contributed significantly to lightweight designs and energy and emissions savings. At present, most of this plastic comes from virgin sources.

Society's ever-growing environmental awareness and the demand for resource-saving and environmentally friendly products are also forcing engineers to think about the environmental impact of the materials used in car manufacturing. Green mobility also implies considerations of how the vehicles and their materials are designed, constructed and handled at the end of their service life.

In view of the increasing consumer demand for more sustainable vehicles, some OEMs have set ambitious roadmaps to improve the circularity of their

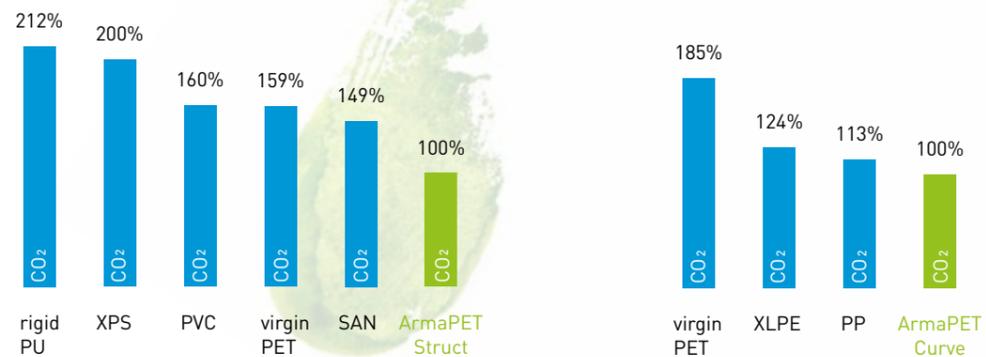
operations over the next few decades, including some initiatives specifically related to integrating more recycled and recyclable plastic materials into their cars. Volvo announced that from 2025 at least 25% of plastic materials in its cars will come from recycled sources. General Motors is aiming for at least 50% of the materials in its vehicles to be sustainable by 2030. And Ford has established an interim target of 20% recyclable and recycled plastics by 2025.

Our disruptive, 100% recycled rPET technology - helping to make more sustainable transportation possible.

In the post-consumer life cycle of a plastic bottle Armacell's reprocessing technology creates a virtuous eco cycle. After the plastic bottles have been collected, they are sorted and then crushed into flakes, which Armacell buys as a raw material. This is followed by an in-house granulation process and, finally, extrusion foaming.

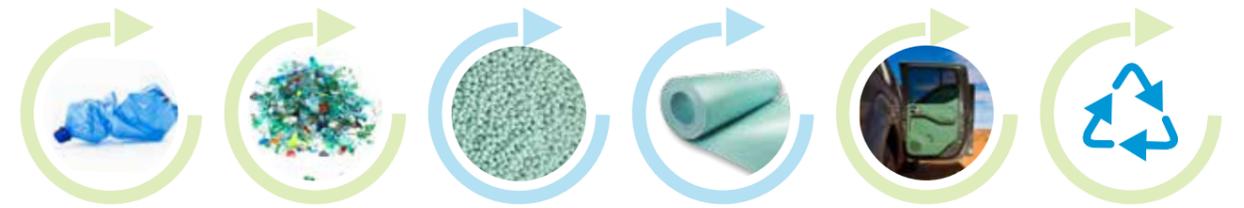
Through the use of recycled raw materials and internal scrap re-use, our ArmaPET product portfolio generates significantly less CO₂ than a standard process using virgin PET resin.

The diagrams below detail the CO₂ emissions caused by the manufacturing of different ArmaPET products compared to other foam materials ArmaPET is replacing in more and more applications.



CO₂ emissions of ArmaPET products in comparison to competitive materials. ArmaPET = 100% reference

PUTTING PLASTIC WASTE TO GOOD USE



FULLY THERMOPLASTIC SANDWICH PARTS - THE ONE-STEP RECYCLING-FRIENDLY SOLUTION.

Increasing environmental and economic demands in the engineering of automotive foam parts require innovative material designs and adjusted manufacturing techniques. In this context, fully thermoplastic sandwich solutions are becoming more and more important.



ArmaPET is a thermoplastic material based on 100% post-consumer PET. The combination of an ArmaPET core with thermoplastic skin layers, also made of r-PET in a more advanced way, is the most suitable sandwich solution in terms of improved end-of-life cycle scenarios, because it enables full recyclability of the entire sandwich structure at the end of a vehicle's life.

CASE STUDIES

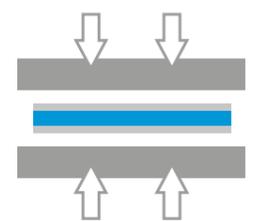
THERMOFORMING

A micro-sandwich has been produced using an ArmaPET Curve core and PET-based fleece skin material without any intermediate layer. The three layers have been consolidated in the thermoforming process. The cycle times are comparable to those of polypropylene (PP).

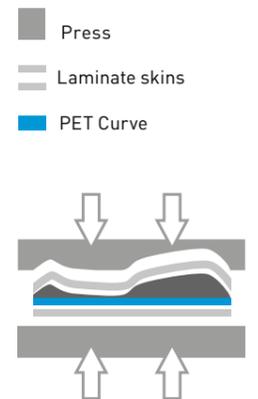
POST-EXPANSION

ArmaPET Curve can be post-expanded to a maximum thickness of 8 mm and, at the same time, consolidated with PET fleece (or thermoplastic) skins. This post-expansion can be achieved using a double-belt press laminator where ArmaPET Curve, supplied in rolls, is consolidated with the desired skins in a continuous process to create a final sandwich panel.

At temperatures of 180°-210°C ArmaPET will expand nicely to its maximum potential and the final thickness can be obtained by controlling the gap, speed and temperature. Post-expansion and consolidation can also be achieved in a two-step process with a heated plate press (image 1) and a cold mould press (image 2) to obtain the final shape of the part.



Picture 1: Heated plate press



Picture 2: Cold mould press

All data and technical information are based on results achieved under the specific conditions defined according to the testing standards referenced. It is the customer's responsibility to verify if the product is suitable for the intended application. The responsibility for professional and correct installation and compliance with relevant building regulations lies with the customer. Armacell takes every precaution to ensure the accuracy of the data provided in this document and all statements, technical information and recommendations contained within are believed to be correct at the time of publication. By ordering/receiving product you accept the **Armacell General Terms and Conditions of Sale** applicable in the region. Please request a copy if you have not received these. Microban® is a trademark of Microban Products Company and is used herein with permission.

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ABOUT ARMACELL

As the inventors of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal, acoustic and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day. With more than 3,200 employees and 27 production plants in 19 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for high-tech and lightweight applications and next generation aerogel blanket technology.

For more company information, please visit:

www.armacell.com

For product information, please visit:

www.armacell-core-foams.com