

ENERGY-EFFICIENT SUSTAINABLE CONSTRUCTIONS

Building & Construction Solutions

The building sector is not only the largest single user of raw materials worldwide, but also the greatest producer of waste. Armacell is following the growing demand for high-performance insulating materials in the construction market, and offers a foam core that combines structural integrity and thermal insulation with process versatility, design flexibility and outstanding sustainability.

www.armacell.com/about-armapet



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

LONG-TERM RELIABILITY AND ENERGY EFFICIENCY

ArmaPET Eco50 is our latest product solution for the structural insulation of building envelopes, roofs, floors and internal partitions, or load bearing applications such as under-slab insulation. ArmaPET Eco50 can be used on its own and/or as part of a prefabricated system in new building construction and renovation projects.

Thermal conductivity is a central technical property, but it should not be the only one taken into account when selecting an insulation material. Mechanical stability, low maintenance and standard-compliant fire behaviour are further obvious requirements that insulation materials must meet.

But what about ease of installation? After all, what use is a technically superior insulation material if it cannot be installed securely, cleanly and quickly, even under difficult conditions on the building site?

ArmaPET Eco50 meets all of these material requirements while standing out to be the most sustainable solution in the market. All these characteristics are vital for innovative and sustainable construction, with a lower lifecycle cost:

// Long-term stability of the insulation properties and low thermal conductivity secure lifetime insulation performance.

// Excellent water resistance guarantees stable thermal conductivity even after many years of operation.

// The closed-cell structure minimises moisture penetration to avoid mildew and rot, and ensures long-term corrosion protection and has minimal maintenance requirements.

// Easy to use due to low weight and full compatibility with most production methods (e.g. adhesive bonding and plastering) and all common 2-component or hot-melt adhesives.

// Solvent stability provides resistance to most acids, salts and fuels.

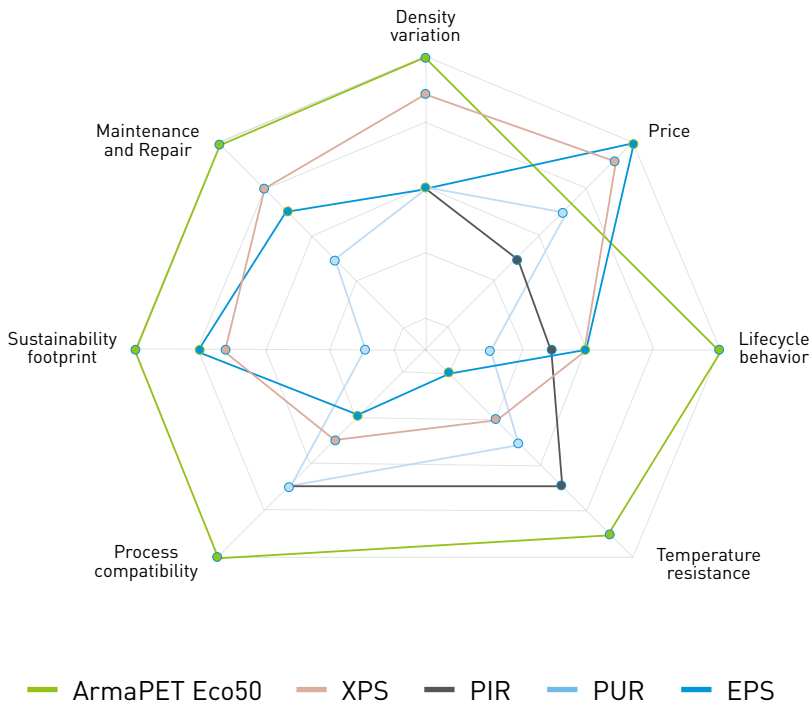
// Thermoforming and thermal welding allow for the most challenging contemporary architectural designs.

**BEST
IN CLASS
CARBON
FOOTPRINT**

λ -value
as low as

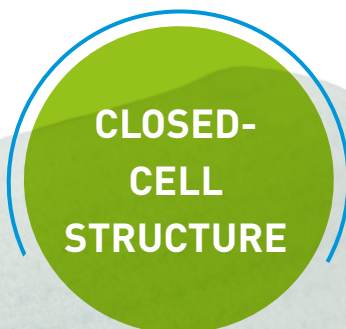
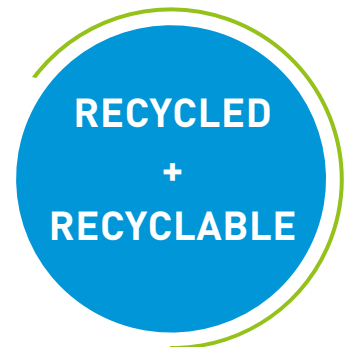
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DESIGN FREEDOM



The thermoplastic nature of ArmaPET Eco50 makes it well-suited to thermoforming by heating to its softening point. 3D-shaped or double-curved insulation boards are possible without cutting the material. It also allows the use of almost any type of decorative surface finish, such as glossy gel coatings, mosaic tiles, aluminium and stone. The exceptional design flexibility of ArmaPET Eco50 is unprecedented in its combination of an outstanding environmental profile and the technical and mechanical properties required of today's insulating building materials.

ArmaPET Eco50 makes it possible to meet contemporary architectural demands that would be impossible to realise with traditional insulating materials.



FROM THE EMPTY BOTTLE TO INSULATING FOAM

ArmaPET Eco50 is made using Armacell's unique and patented process technology, which enables the production of PET foam materials based on 100% recycled PET.

This is how the conversion takes place: After collection (1), the PET bottles are sorted and then crushed into flakes (2). This is followed by a granulation process (3) and, finally, by production of the ArmaPET Eco50 foam boards (4). In this way, single-use plastic bottles are converted into a sustainable building material. After its service phase, spanning several decades, ArmaPET Eco50 can again be fully recycled (6).

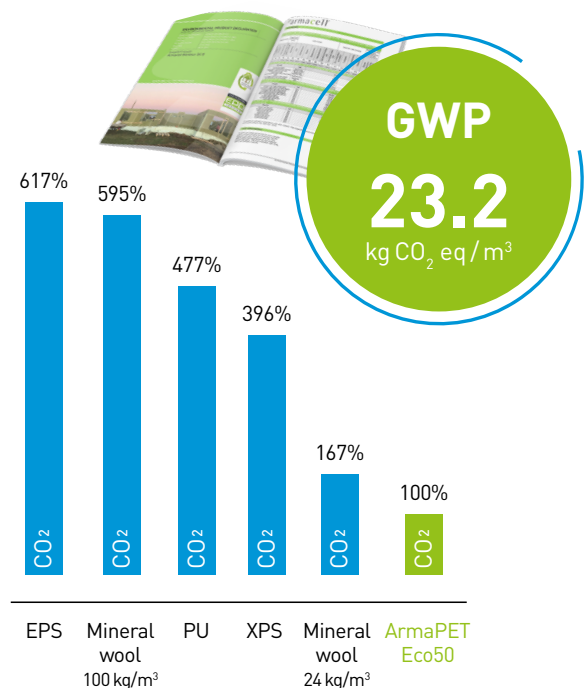


Instead of having a service life of just a few weeks, single-use plastic bottles become a long-lifetime, high-value material in the economy.

FOR ECO-CONCIOUS BUILDINGS

Armacell published the **first ever environmental product declaration (EPD) for a PET-based insulating foam**. Certified by the Institut Bauen und Umwelt e.V. (IBU), this EPD provides transparent, independent and reproducible analysis of the environmental impact of ArmaPET Eco50. It gives detailed information on the extent to which the product contributes to the greenhouse effect, acidification, over-fertilisation, smog and depletion of the ozone layer. The information provided is based on the international ISO 14025 standard and the European EN 15804 standard for construction products. The declaration is a cradle-to-gate EPD and registered on the IBU database system.

Choosing Armapet Eco50 insulating foam will improve the environmental footprint of your construction and is a big step towards keeping our environment cleaner. Each and every step along the way helps us move towards a more sustainable society.

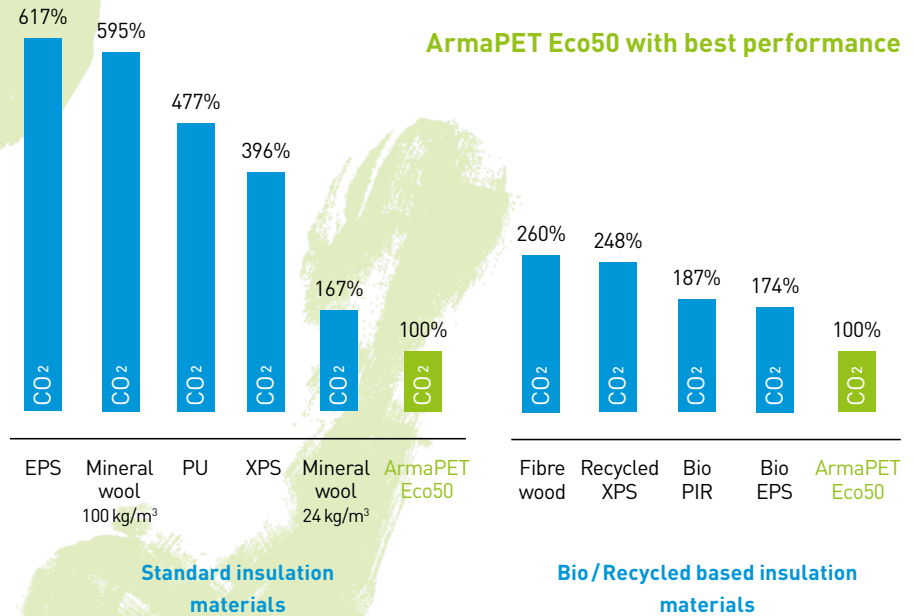


The GWP (Global Warming Potential) gives detailed information on the extent to which the product contributes to the greenhouse effect, acidification, over-fertilisation, smog and depletion of the ozone layer.

FOR A BETTER CARBON FOOTPRINT

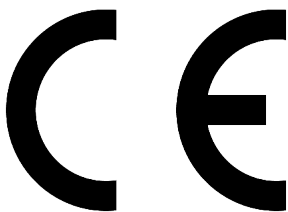
Using 100% recycled PET plastic as the raw material base for ArmaPET Eco50 results in a much lower level of CO₂ emissions than that of other polymeric insulating foams. In addition, it is 100% recyclable. In plastic waste terms, this is probably its greatest benefit. Installation waste and demolition scrap management is easier than for the main rival materials. And it does not contain any halogenated compounds or CFCs/ HFCs that could negatively impact its disposal or recycling scenarios.

Weighted GWP times lambda for all different insulation materials.



Data comes from EPD (calculated based on LCA modules A to D) and certified by the Institut Bauen und Umwelt e.V. (IBU). CE marking under ETA-21/0623

PIONEER IN FOAM TECHNOLOGIES



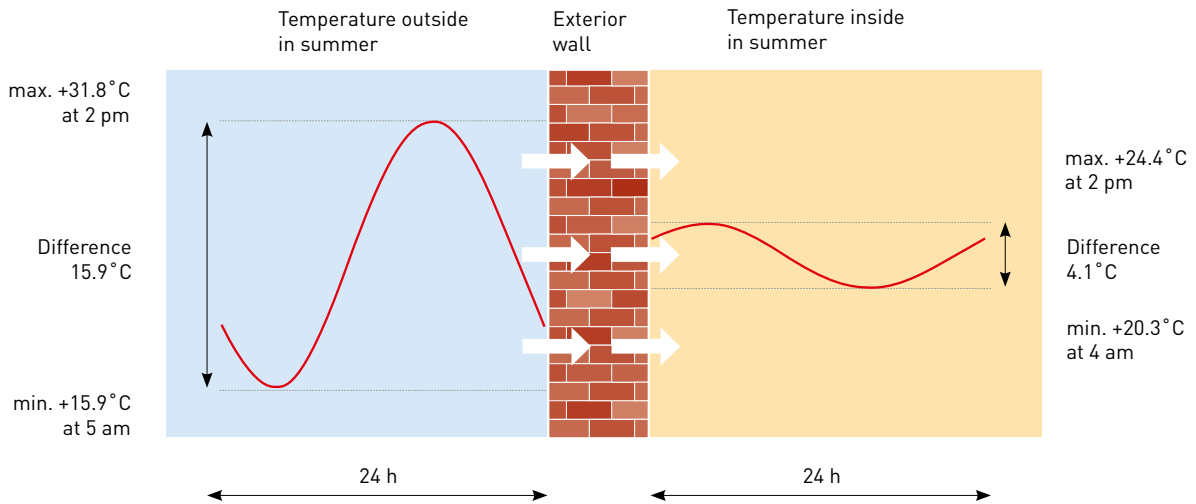
At Armacell, we see ourselves as a pioneering provider of industry-leading solutions in insulation technology. Armacell is the **inventor of ArmaFlex®**, the world's best-known brand for rubber-based technical insulation. It is the first and reliable choice for professional installation worldwide.

We are a pioneer in the field of PET foaming technology and the inventor of the patented rPET processing technology, using 100% recycled PET as the raw material base for our ArmaPET foam solutions.

With ArmaPET Eco50 we introduced the **world's first polymeric insulation based on 100% recycled PET with CE certification**. With this CE marking, we have achieved a unique degree of transparency for our new ArmaPET Eco50 product. For architects, design engineers, builders and property owners, it proves that the product conforms to the safety, health and environmental requirements for insulation materials required by ETA-21/0623.



THERMAL PERFORMANCE



PHASE SHIFT COMPARISON

The phase shift is important for evaluating how long a building can store energy in the walls and at what pace the energy travels through the walls. A slow pace and good ability to store energy prevents the inside of the house from getting warm too quickly when it is hot outside and ensures that, when the temperature drops, the walls store the energy for as long as possible to keep the temperature warm inside.

The phase shift of building materials increases with the material thickness. For the phase shift, the full wall assembly should also be taken into consideration. The target value for phase shift is described as > 12 hours. Below is a table of the different materials and related phase shift in minutes per cm of material.

When comparing a 200 mm insulation board of XPS against a 200 mm insulation board of ArmaPET on a concrete wall of 200 mm, this would result in the following phase shift of the wall: Phase shift of wall x thickness + phase shift of insulation x thickness.

Wall with ArmaPET Eco50 =
 $20 \times 17 + 20 \times 22 = 340 + 440 = 780 \text{ min} = 13 \text{ hours}$

Wall with XPS* insulation =
 $20 \times 17 + 20 \times 18 = 340 + 360 = 700 \text{ min} = 11.6 \text{ hours}$
 → In this case the insulation thickness should be further increased to meet the 12 hours for thermal shift.

Amplitude reduction factors:
 XPS $1/\text{TAV} = 2.3$ ArmaPET Eco50: $1/\text{TAV} = 3$

*Density 35 kg/m³, 0.03 W/m·K

MATERIAL	APPROX. PHASE SHIFT IN MIN. /CM OF MATERIAL
OSB (Oriented Standard Board)	43
Wood	40
Aerated concrete	24
ArmaPET Eco50	22
Solid brick	20
XPS	18
Concrete	17
Mineral wool	15
EPS	13

INSULATION MATERIALS UNDER WET CONDITIONS

Working together with the FIW Institute (Forschungsinstitut für Wärmeschutz e.V München), we have evaluated the long-term thermal performance of PET, PU and XPS boards. The purpose of the test was to compare the thermal performance of PET with that of PU and XPS under the condition of high water contents due to absorption and adsorption as a result of water vapour diffusion to replicate real-use case performance.

MATERIALS USED FOR TESTING

For PET, ArmaPET Eco50 was used. It has a nominal density of 50 kg/m³ and is based on 100% recycled polyethylene terephthalate (PET) foam in accordance with EAD 040179-00-1201.

For the PU Reference, a **CE-certified polyurethane** (PUR) foam with a nominal density of **30 kg/m³** was used. The manufacturer is known to Armacell.

For the XPS Reference, a CE-certified extruded polystyrene (XPS) foam with a nominal density of 30 kg/m³ was used. The manufacturer is known to Armacell. All samples had a thickness of 50 mm and were provided in a dimension of 500 x 500 (length x width).

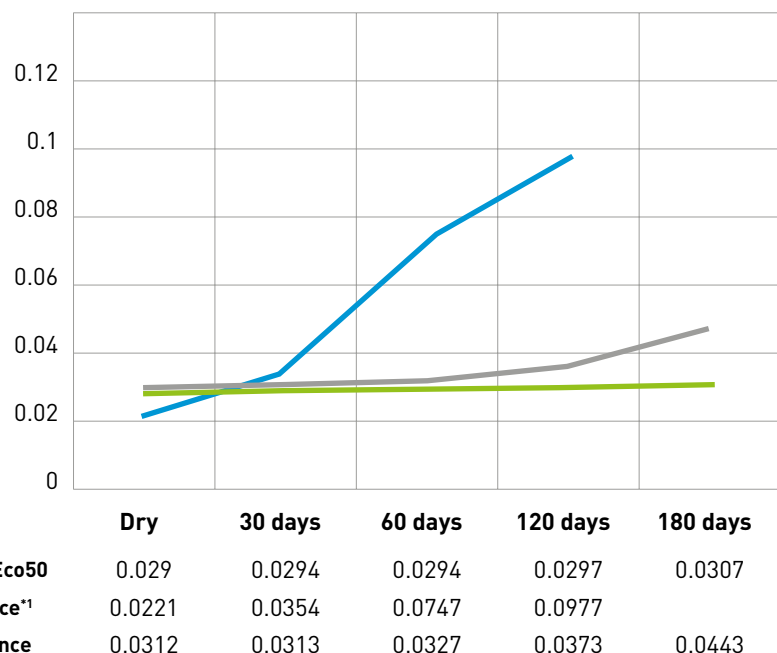
RESULTS & FINDINGS

Thermal conductivity (λ) [W/(m*k)] at 10°C in dry conditions and hygrothermal transmission (λ) [W/(m*k)] at 10°C until 180 days under water vapour absorption as per EN 12088.

Based on report L1-22-042a from FIW

*The PU reference was stopped after 81 days of water absorption because water content reached a level at which the product was starting to be incapable of keeping all adsorbed/absorbed water inside its body.

Regarding the PU results at 60 and 180 days: Due to high water content, it can't be excluded that latent heat fluxes contributed to the thermal transmission. Therefore, the test results represent the "transfer factor of a specimen" T.



ARMAPET CHEMICAL STABILITY

INTRODUCTION

The resistance of plastic materials against chemicals, solvents and other contact substances is an important criterion of selection for many applications. When contacting such substances, different properties of polymer-based products, including PET foams, can be affected. Chemicals can impact strength, flexibility, surface appearance, colour, dimensions or weight of products made of polymers.

The basic modes of interaction which cause these changes are:

- // **Chemical attack on the polymer chain, with reaction of functional groups in the chain and/or depolymerisation.**
- // **Physical change, including absorption and permeation of solvent through the plastic, resulting in softening and swelling of the plastic.**
- // **Stress cracking from the interaction of simultaneous presence of three factors: Tensile stress, a stress cracking agent and the inherent susceptibility of the plastic to stress cracking.**

Additionally, mixing and/or dilution of certain chemicals can be potentially dangerous. The substances which on their own have been proven safe may negatively influence the product's performance when mixed. The reactive combination of different chemicals may cause an increased temperature, which can affect chemical resistance.

As temperature raises, material's resistance to attack decreases. Other factors affecting chemical resistance include pressure and internal or external stresses (e.g. centrifugation), length of exposure, or concentration of the chemical.

This document provides a survey on the behaviour of ArmaPET towards common contact substances. The test conditions simulate direct exposure, which is rather rare for PET-based core, which in a final application is covered by external reinforcing (and protective) layers to form a sandwich.

Therefore, this information should be considered as a general guide. Moreover, multiple factors may affect the chemical resistance of a polyester-based product, it is recommended to test the core foam in a final application, and under the specific conditions of application.

TEST CONDITIONS

The evaluation is made based on the DIN 534282 standard ("Determination of the behaviour of cellular plastics when exposed to fluids, vapours and solids"). The samples have been exposed to vapours of respective contact substances and fluids (by direct immersion). Their stability has been examined in terms of compressive properties evolution (compressive strength and modulus) after 7, 14 and 28 days of direct exposure at room temperature.

The symbols in the results table reflect the properties change:

- +** Negligible effect - good resistance, no reduction in physical properties → **Property change in a range of 0-5%**
- 0** Limited absorption or attack - suitable for most applications, little reduction in physical properties → **Property change in a range of 5-10%**
- Extensive attack - material is damaged or significant changes in physical properties occur after exposure to the substance → **Property change in a range >10%**

All data and technical information are based on results achieved under the specific conditions defined according to the testing standards referenced. Despite taking every precaution to ensure that said data and technical information are up to date, Armacell does not make any representation or warranty, express or implied, as to the accuracy, content or completeness of said data and technical information. Armacell also does not assume any liability towards any person resulting from the use of said data or technical information. Armacell reserves the right to revoke, modify or amend this document at any moment. 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. This document does not constitute nor is part of a legal offer to sell or to contract.

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ABOUT ARMACELL

As the inventor of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal 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 3,300 employees and 25 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 acoustic and lightweight applications, recycled PET products, next-generation aerogel technology and passive fire protection systems.

For more company information, please visit:
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