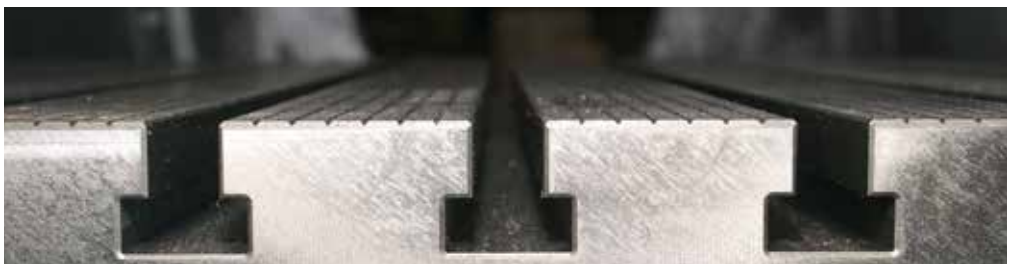
PROCESSING GUIDELINES

ArmaPET® Shape H

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

// Zero-waste production: no milling or cutting needed
// Foaming directly inside the mould
// Integrated functions: built-in concept with skins and inserts possible
// Superior production efficiency thanks to reduced complexity
// Outstanding thermal stability

www.armacell-core-foams.com



armacell®
ArmaPET®

ARMAPET SHAPE H

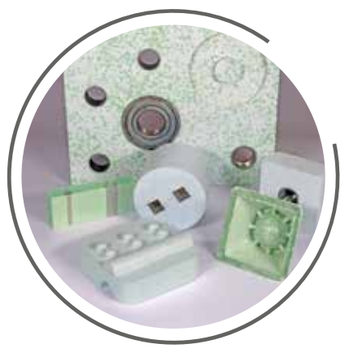
Particle foam based on 100% recycled PET for **easy moulding** of **lightweight**, yet strong, three-dimensional foam parts which can be produced in nearly **any shape**.

This fully recyclable mouldable particle foam is the first to be made entirely of recycled plastics and is Armacell's solution for the cost-effective production of ready-to-use 3D shaped structural foam parts. Starting from recycled PET beverage bottles (rPET), the rPET-based flakes are further processed using Armacell's patented technology to produce ArmaPET Shape H that can be used for waste-free 3D part moulding.

ArmaPET Shape H has been developed to improve fusion, cycle times and adhesion performance. It guarantees excellent adhesion to different skins and inserts made from aluminium, steel, wood, polymeric layers including prepregs, glass fibres, carbon fibres and basalt or natural fibres, without adding additional resin. This opens up a broad range of material combinations and allows for hybrid designs adjusted to the customer's needs.

ArmaPET Shape H allows for an easy moulding process at temperature between +160 to +200 °C. In addition, metallic or plastic inserts can be included directly in the moulding step.

From artists using the beads for creative projects, DIY or prototyping, up to industrial scale applications and mass production, the application possibilities are unlimited. ArmaPET Shape H is dedicated to realising complex shape parts requiring high mechanical integrity and superior temperature stability.



EASE OF MOULDING

- ✓ **Enhanced moulding process at lower temperatures**
- ✓ **One-step moulding of sandwich and hybrid setup without additional resin**
- ✓ **Easy bonding to glass fibre, carbon fibre and metal/ aluminium skins**
- ✓ **Integration of plastic or metal inserts during moulding**

OFFERING

	Unit	ArmaPET Shape H
Bulk Density*	g/l	200
Bead Size	mm	3
Final Part Density**	kg/m³	⩾ 200
Application		For moulding in oven or hot press with temperatures between +160 °C and +200 °C. For hybrid designs.
Packaging size		• 50 L (10 kg) • Big bags (200 kg) On special request: 25 L (5 kg)

* The bulk density describes the initial density of the loose beads before moulding.

** With overfilling adding around 10% to the bulk density.

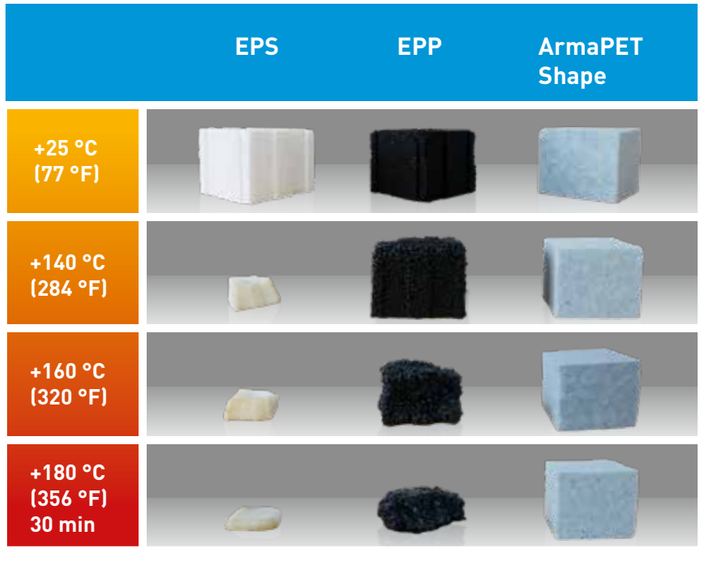
ArmaPET Shape H has to be stored in closed packaging in a cool and dry place. We recommend using the original packaging and closing it tightly after every use to prevent moisture ingress. The temperature during storage and transport should not exceed +25 °C. Exposure at higher temperatures and excessive moisture can lead to an agglomeration of beads. This effect is reversible and moulding quality will not be impacted in most cases, but as this can impact the handling and processing, it is not recommended.

MECHANICAL PERFORMANCE

Reference values
These mechanical test results are based on an ArmaPET Shape H moulded 400 x 400 x 25mm reference part. The properties will vary depending on the geometry of the final foam part and the moulding process parameters.

Density (moulded part)	**ISO845**	[kg/m³]	220
Density variance in the part		[kg/m³]	±15
Compression strength (10% deformation, RT)	**ISO844**	[MPa]	2.1
Compression modulus	**ISO844**	[MPa]	> 45
Shear strength	**ISO1922**	[MPa]	1.25
Shear modulus	**ISO1922**	[MPa]	> 20
Shear elongation	**ISO1922**	[%]	> 5.0
Compression modulus (+150 °C)	**ISO844**	MPa	5.5

TEMPERATURE STABILITY

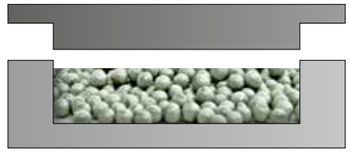


Moulded ArmaPET Shape H has an excellent thermal stability for further processing at elevated temperatures, such as infusion and RTM. It is extremely tolerant to high-peak exothermic reactions and shows no degradation of material properties even in the case of hot spots.

PROCESSING GUIDELINES

In general, standard moulding tools like ovens, press or variotherm processes can be used to nicely achieve ArmaPET Shape H moulded parts with superior surface structures.

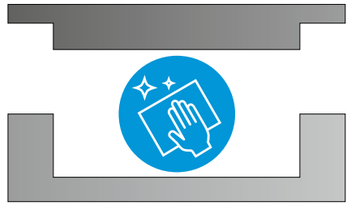
In this brochure we provide guidance on the processing parameters, preparation and process steps required to achieve good moulding results. Of course, the process might require small adjustments and fine-tuning based on the available equipment and the expected final results. Final process parameters with existing equipment, as well as compatibility with material used in the same process, should be verified.



SUITABLE MOULD
The mould should be able to withstand pressure properly. In this context we recommend moulds made from metal, like steel or stainless steel.

For DIY projects, moulds can, for example, also be created from metal putty.

The mould should be designed in such a way that the top part allows the compression of the beads inside the mould. Therefore, the upper part of the mould needs to fit into the bottom part as shown in the illustration. The top part can also be designed with a ribbing structure that ensures the required compression and would leave a pattern on the final part.

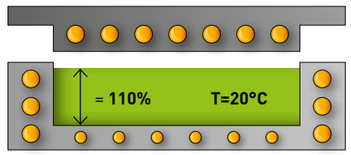


MOULDING PROCESS
1. CLEAN THE MOULD.
After cleaning, treat the mould with **a semi-permanent release agent** (e.g., XTEND 838, Marbocote HP7 or Frekote 770 NC, or the equivalent). Alternatively, cover the mould with PTFE or a similar coating inside. This is recommended for high cycle tooling and will eliminate the need of using a release agent.

Optional: Depending on your final part, put any prepregs or other skin materials into the mould.

Optional: If required, lay any profiles or inserts into the mould at the desired position. compression of the beads inside the mould. Therefore, the upper part of the mould needs to fit into the bottom part as shown in the illustration. The top part can also be designed with a ribbing structure that ensures the required compression and would leave a pattern on the final part.

PROCESSING GUIDELINES



2. FILL THE MOULD WITH ARMAPET SHAPE H LOOSE BEADS.

Filling shall be done at room temperature. We do recommend **ten per cent overfilling** with potential inserts to be considered.

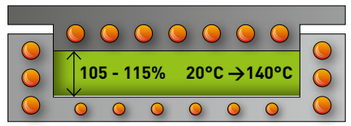
Distribute and compress the beads which will not distribute themselves evenly, especially not in the edges of the mould. Vibration or pulsation supports the homogeneous filling which is of importance as it will impact the expansion and final part density.

A slight compression will happen while overfilling, but do not actively crush the beads too much.

Pay attention that ArmaPET Shape H starts to expand as of +70 °C.

Optional: Install sensors to measure the temperature.

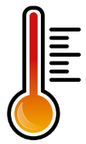
Optional: Depending on your final part, optionally put any prepregs or other skin materials into the mould.



3. CLOSE AND CLAMP THE MOULD.

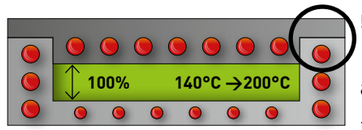
Close and clamp the mould to a **starting volume of 105% to 115%** of the final volume.

Do not crush the beads too much.



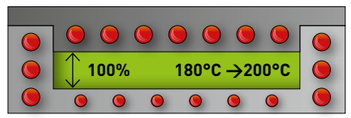
4. START THE HEATING PROCESS.

Depending on the part and moulding process, we recommend a **stepwise heating process**. Please refer also to the graphs below. High heat rates are acceptable.



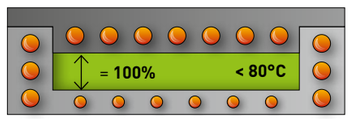
5. COMPRESS THE MOULD.

Fully close the mould so that there are **no more gaps between the lower and upper part**. Hold it until you reach the final process temperature of +180 to +200 °C. **A first short plateau is recommended at +120 to +160 °C**, which supports degassing and allows for full expansion of the beads before curing.



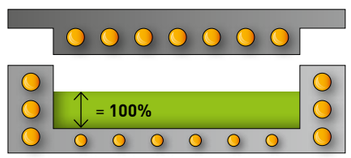
6. FUSING AND CURING.

At temperatures between +180 to +200 °C, the beads fully expand, fuse and cure. The graphs on the next pages provide an indication of how long the curing process takes.



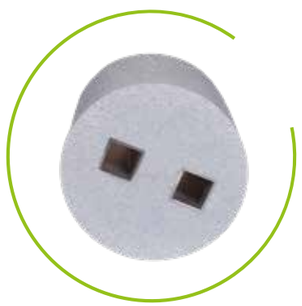
7. COOLING.

Keep the mould closed while **cooling down below +80 °C**. The final fusion strength develops after the completed cooling. Fast cooling to below +120 °C is necessary to prevent crystallization effects.

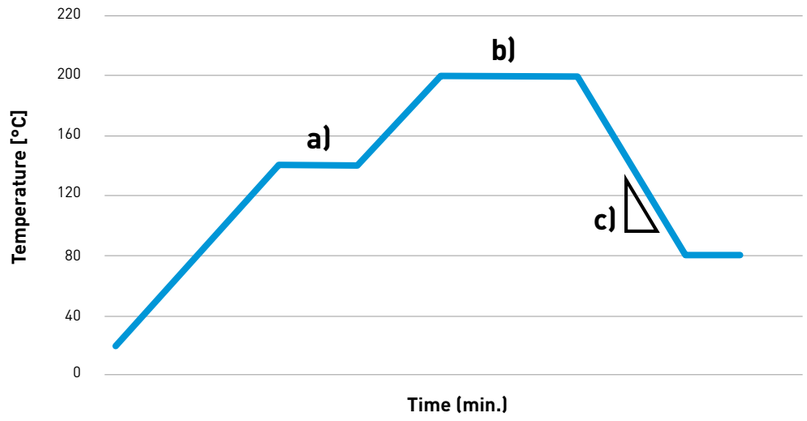


8. OPEN AND DEMOULD.

General guidance for either variothermal press or oven heating process is given on the next page.



VARIOTHERMAL PRESS:

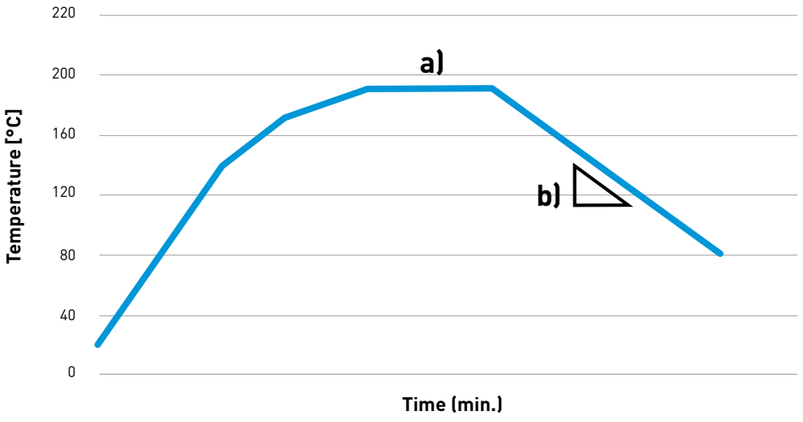


a) A plateau is recommended between +120 and +160 °C > one minute.

b) Curing temperatures between +170 and +210 °C. For curing time see the graph for reference.

c) High cooling rates are recommended (e.g. > -20 °C/min.), fast cooling to below +120 °C is necessary to prevent crystallization effects.

OVEN PRESS:

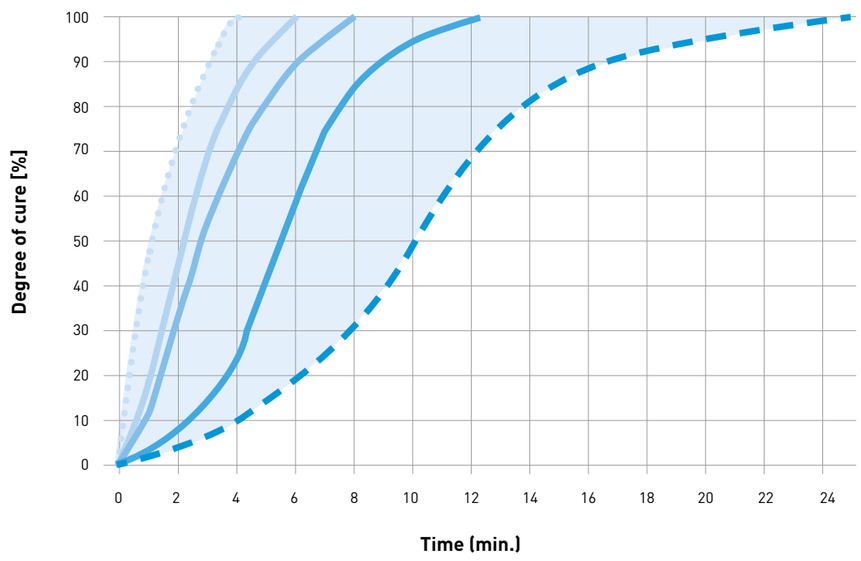


We recommend preheating the oven.

a) Curing temperatures between +170 and +210 °C. For curing times see the graph for reference.

b) High cooling rates are recommended (e.g. > -20 °C/min. with active cooling), fast cooling to below +120 °C is necessary to prevent the crystallization effect.

CURING:



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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 24 production plants in 16 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.

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