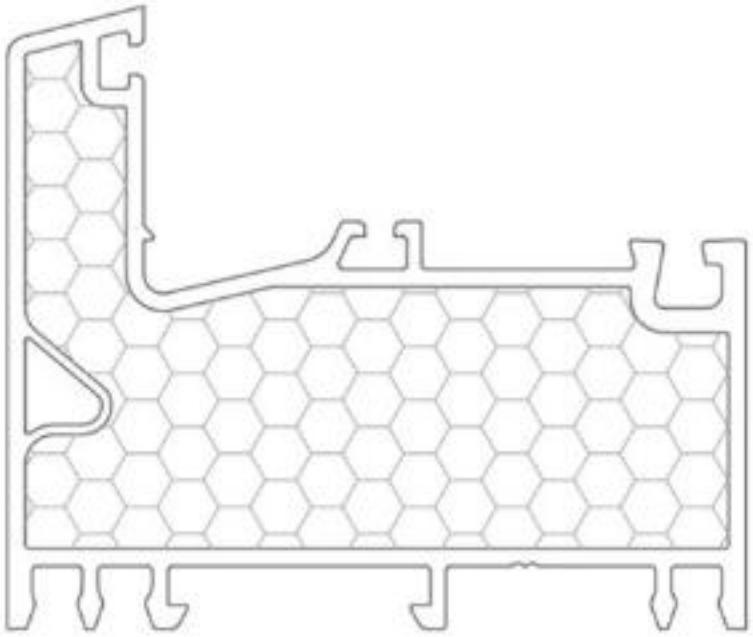
Improving insulation, replacing steel: window profiles with a core made from recycled PET

About this project



evoFrame

Improving insulation, replacing steel: window profiles with a core made from recycled PET

Markets:

Material: Thermoplastics, Others (thermoplastic composite), Closed-pore

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This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

Context

Window frames have a significant impact on the thermal insulation of buildings. To ensure the necessary structural integrity, steel reinforcements have traditionally been used in window profiles made of polyvinyl chloride, or PVC for short. However, these increase weight, material consumption and CO# emissions.

Foam cores made from recycled polyethylene terephthalate (PET) are already available and can partially replace the steel reinforcement whilst improving thermal insulation. However, their mechanical properties are often insufficient to safely design larger window sizes. Furthermore, their manufacture requires several processing and assembly steps, which increases production costs.

At the same time, demand for recyclable window profiles is rising. The combination of a PVC profile and a PET core offers good prospects in this regard, as both plastics can be separated and recycled relatively easily after use. However, there is currently a lack of solutions that combine high thermal insulation, sufficient stability, recyclability and cost-effective production in a single window profile.

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Purpose

In the evoFrame project, the project partners are developing window profiles with integral foam cores made from recycled PET, which are intended to replace the steel reinforcements in PVC window frames. To this end, they are developing foam profiles with near-final contours as well as co-extruded frame profiles with an integrated foam core. In co-extrusion, the PVC outer skin and foam core are produced in a single manufacturing step.

The project partners are developing integral foam profiles with a specifically tailored foam structure that combines high thermal insulation properties with the mechanical stability required for window frames. The profiles are intended to enable larger window dimensions whilst reducing weight and material usage.

Another key focus is on resource efficiency. By using recycled PET, eliminating steel reinforcement and reducing PVC wall thicknesses, the project partners aim to significantly lower the carbon footprint of production. At the same time, recyclability is to be maintained, as PVC and PET can be separated from one another in existing recycling processes. Furthermore, the partners are investigating the transferability of the technology to façade and technical profiles.

Procedure

The project team is first developing a process for producing integral foams from recycled PET. In doing so, the researchers are modifying the material during extrusion to enable stable and uniform foam formation. They are investigating how process parameters, additives and mould design influence the structure of the foam as well as its insulating and strength properties.

On this basis, the researchers are developing foam profiles with near-final contours that take on their final shape during production. In doing so, they create a compacted outer skin and a foamed core. This structure improves mechanical strength whilst maintaining good thermal insulation properties.

The project partners then apply these findings to window profiles. To this end, they are developing a co-extrusion process in which a PVC jacket and a PET foam core are combined in a single production step. This eliminates the need for subsequent processing and assembly steps.

In parallel, the participants are analysing the relationship between foam structure, insulating effect and mechanical strength. Finally, they will evaluate the developed profiles in terms of material usage, energy savings, manufacturability and potential applications beyond window construction.

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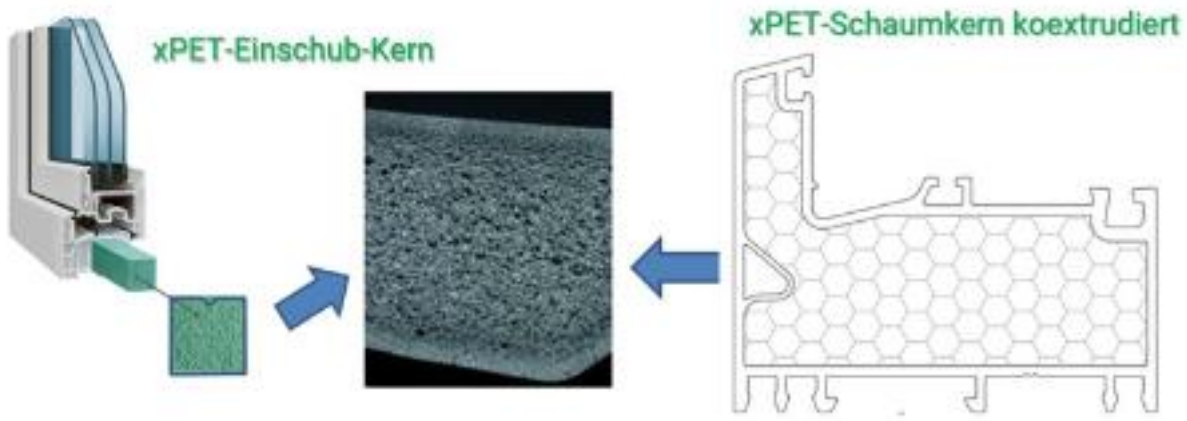

Funding duration:

Funding sign:	03LB4014	**Funding amount:**	EUR 1.5 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB4014A - evoFrame featured in the government's funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts, Machines and plants, Tools and moulds	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight manufacturing	✓
Functional integration Material functionalisation	✓
Measuring and testing technology Component and part analysis, Materials analysis	✓
Modelling and simulation Loads & stress, Optimisation, Structural mechanics, Materials	✓
Plant construction & automation Plant construction	✓
Recycling technologies Recycling	✓
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming Extrusion, Others (Co-extrusion)	✓
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials) Closed-pore	✓
Composites Others (thermoplastic composite)	✓
Fibres	
Functional materials	
Metals	
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	