ReziProK

Resource-efficient Circular Economy – Innovative Product Cycles

All Polymer

Fibre reinforcement to increase the resource efficiency of high-quality, fully recyclable plastic products

In "All-Polymer", fibre-reinforced composites (KFVW) are used to upgrade recycled plastics. The cooperation of sustainability researchers, polymers, recycling and fibre composite experts from different industries, aims to establish closed loop recycling management systems that lead to a considerable reduction in CO_2 emissions and plastic waste

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More recycled plastics

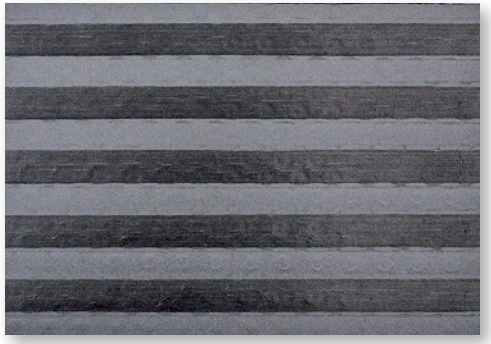
In view of major sustainability problems, the recyclability of plastics is currently at the forefront of many companies' innovation efforts. The need to increase the resource efficiency of plastics and, in particular, to help recyclable plastics become more widely used is correspondingly great.

The "All-Polymer" project, in which three companies and two research institutes are participating, is pursuing this goal. Five other companies are involved as associated partners. The participating companies will produce typical components from the three largest sectors of the plastics industry – the automotive, packaging and construction industries – from recycled plastics and upgrade them by KFVW. By dispensing with energy- and cost-intensive, not fully recyclable carbon and glass fibres, CO_2 emissions in production will be reduced. The same is achieved by energy-efficient production and further processing by KFVW.

New potential for fibres

The project aims at increasing the performance of recycled plastics in lightweight construction. As a result, the proportion of recycled material in existing products can be increased and new product segments for recycled plastics can be opened up. As the KFVWs are singlesorts and are therefore 100 percent recyclable, a complete recycling cycle can be established. The higher performance also ensures energy savings during the product life cycle.

To maintain the mechanical properties defined in advance, the components are fibre-reinforced. For this purpose, existing as well as new processes such as additive tape laying – the automated laying of polyethylene-



Section of a recycled panel with tape reinforcement.

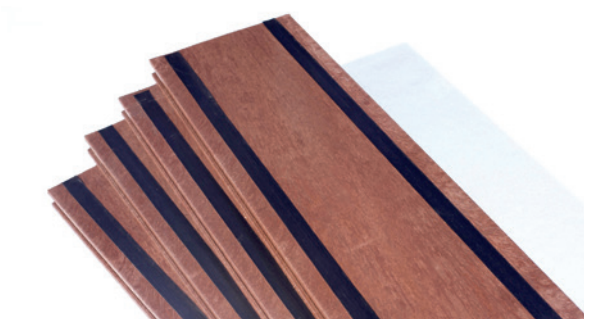
fibre-reinforced tapes on flat structures – are used. The fibre-reinforced components made of recycled plastic are analysed for their mechanical properties and fed into the process at the respective recycling companies. In addition, the influence of the fibres on the properties of the recycled material is being investigated.

The recycled fibre-reinforced components are to be used again as starting material to create a cycle. Even the use of a small proportion of fibre-reinforced material leads to a considerable improvement in the mechanical properties of the component, so that this approach is already worthwhile for products in the low-price segment due to process simplifications, material savings and increased use of secondary plastics.

First results

The adhesion and performance of UD tapes on various test specimens was investigated. Potential improvements in design, process design and material composition were identified and implemented in development loops. During process development, it became clear that welding the tapes to the components is far superior to bonding, since bonding does not provide sufficient adhesion for long-term use under typical conditions of use, according to the current state of knowledge.

The status of circularity at the companies involved was determined and priorities set in order to exploit identified opportunities for improvement.



Prototypes reinforced with tapes.

Project team from industry and science

In All-Polymer, the project participants from industry and science are working in a division of labour in order to achieve their recycling goals. The companies HAHN Kunststoffe and BSB Recycling deal with the investigation of existing recycling materials from various sources as well as the recycling of the fibre-reinforced components. Infinex Kunststofftechnik, HAHN Kunststoffe und Röchling define the prototypes and, if necessary, develop new processes for the use of the polyethylene-fibre-reinforcedtapes. A+ Composites and DSM investigate the production of the fibre-reinforced tapes and their modification for use with secondary plastics. The process integration and process development of the other partners is accompanied by A+ Composites.

The tasks of the materials physics group at the University of Koblenz Landau are the improvement of the fibre adhesion with the matrix as well as the characterisation of the components, materials and tapes and the development of the recycling process. The Chair of Sustainability Management at the TU Kaiserslautern will deal with government incentive systems, the development of business models and the investigation of ecological implications.

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Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

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The circular economy – efficient use of raw materials, avoiding waste

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All Polymer – Fibre reinforcement to increase the resource efficiency of high-quality, fully recyclable plastic products

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CONTACT
Dr.-Ing. Markus Brzeski
A+ Composites GmbH
Rudolf-Diesel-Straße 7
66919 Weselberg
Phone: +49 6333 9999060
E-mail: m.brzeski@aplus-composites.de

PROJECT PARTNERS
Infinex Kunststofftechnik GmbH
HAHN Kunststoffe GmbH
Universität Koblenz-Landau
Technische Universität Kaiserslautern