

Conference Minutes of “Forum Plastic Recyclates”

# Start into a Second Life for Plastics

A growing number of companies and industrial sectors would like to use recyclates for their products. However, the application is frequently still confronted with considerable difficulties. And the extension of recycling to other fields and sectors also poses new questions. An overview of the current status and associated technical solutions was provided in conference “Forum Plastic Recyclates” at the end of March.



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Recycling of plastic waste is now seen by politics as well as the industry as an important issue for environmental protection and more sustainability. Clear signals for this are regulations – e.g. of the EU Commission to increase the recycling of packaging and boost the use of recyclates – and the importance of circular economy as highlighted by industrial associations such as Plastics Europe Deutschland, an association of plastics producers. Consequently, the will is there, but implementation still proves to be difficult. There is a lack of necessary infrastructure for collecting plastic waste, adequate processing capacities, recy-

ling-compatible product design, and frequently, the quality of recyclate has room for improvement. An interesting overview of the main difficulties and possible solutions for the problems was provided during the “Forum Plastic Recyclates” hosted by the Fraunhofer Institute for Structural Durability and System Reliability (LBF) on March 24, 2022.

A good summary of the present situation was given by the forum’s chairman Professor Dr. Rudolf Pfaendner from the Fraunhofer LBF in his opening lecture. He pointed out the growing interest of consumers and therefore also of manufacturers for an increased use of

recycled materials. That is why recyclates are meanwhile being used in an increasing number of products. Simultaneously, however, there is still a need for an adequate recycling infrastructure. According to Dr. Pfaendner, the growing interest is not limited to Europe, but is a global phenomenon. Presently, two thirds of the patents in the recycling business come from China.

Ton Emans, president of the European association “Plastics Recyclers Europe”, took a clear stand for recycling-compatible design. In his view, significant advances in recycling will not be the result of innovations in recycling technol-

ogies, but mainly due to corresponding product design. He therefore also sees a commitment for producers of plastic products to focus more intensely on the recyclability of their products. "Companies must concentrate far more on design for recycling, also when selecting the polymers used", he said. Furthermore, to increase the recycling rates, better harmonization and standardization of waste collection is necessary in Europe.

### Stabilization for PP and PE

Previously, low quality was a frequent argument against a more widespread use of recyclates. But quality can be increased significantly by means of additives. Which improvements are achievable in polyolefins such as polypropylene (PP) and polyethylene (PE) was explained by Dr. Oliver Reich from BASF. The chemical company investigated how the molecular weight of the polymers changes after several recycling cycles, and which effect this has on the recyclate's properties and their processability.

Accordingly, investigations showed that PP as well as PE require stabilization by means of additives. With unstabilized PP, for example, the melt volume flow rate already increases significantly after just a few recycling cycles, whereby the material exits from the necessary processing window. However, if it is stabilized with additives, up to three times as many recycling cycles are possible before it cannot be processed further. But according to Dr. Reich, stabilization is not a cure-all. Primarily, the long-term temperature stability of the additives must be observed. Furnace aging tests by BASF had shown that also sufficiently stabilized materials degrade over time, thereby decreasing the effect of the additives. This point is particularly important if polymers are to pass through several recycling cycles. Nonetheless, as Dr. Reich pointed out, the investigations revealed a decisive point: "Without additives, a circular economy cannot be achieved."

### No Circular Economy without Additives

The significance of additives for improving recyclate quality was also underlined by Dr. Matthias Bruch, innovation and product manager for plastic additives at



Additives can solve quality problems with recycled plastics. With the IrgaCycle product range, BASF has introduced versions, with which e.g. processability and long-term thermal stability can be improved. © BASF

Brüggemann GmbH. In his view, there are mainly three points that create large problems with recycled plastics: the different additives and fillers contained, contaminations such as traces of metals, sand, and organic compounds like inks and adhesives, plus damage during processing caused by oxidation or degradation of the polymer chains. As a remedy for the latter, Brüggemann has developed a repair technology for recyclates.

The remedy involves additives that compensate the damage inflicted on polymers during processing. Currently, the company offers these additives for PE and PP. According to Dr. Bruch, analyses show that e.g. melt volume flow rate of correspondingly additivated plastics only increased slightly even after several extrusion cycles. Moreover, their tensile strength and their elastic modulus remain constant for a far longer period. Also the effects of heat aging arise much later. And compared with previous stabilizers, the new additives partially increase the performance of recyclates more than twofold, he added.

But additives are not only helpful for recycling – sometimes they also prove to be a hindrance, as explained by Dr. Andreas Mäurer from the Fraunhofer Institute for Process Engineering and Packaging (IVV), and Jörg Hamann from the plant builder EPC Engineering and Technology. This is e.g. the case with plastic products that are in use for a very long time, such as components in the automotive field and the building industry. In the past, for example, insulating panels made of expanded polystyrene (EPS) were frequently treated with hexabro-

mocyclododecane (HBCD) to ensure adequate flame proofing. However, use of this additive has been mostly banned since 2013. Therefore, plastics containing it cannot simply be returned to the recycling loop.

### Additives as Hindrance for Recycling

One possibility for removing HBCD from insulating panels involves solvent-based recycling processes. Hereby, a solvent is used to extract the required polymer from the plastic waste, subsequently cleaned and then precipitated. The plastics recovered in this way can then be reused for making new products. As the polymer is not depolymerized by the process, solvent-based processes are classified as mechanical recycling. A corresponding process has been developed by the Fraunhofer IVV and the CreaCycle company. ■

Florian Streifinger, editor

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