Advanced solvent-based technology for the closed-loop recycling of engineering plastics

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Engineering plastics (e.g., ABS, PC and PMMA) have superior mechanical properties, such as strength and gloss. Therefore, they are primarily used in high-end products, such as electrical and electronic (E&E) devices and passenger cars. When it comes to end-of-life solutions, closed-loop recycling is the only sustainable option for this group of plastics. This is mainly due to a lack of alternative product applications to absorb lower-grade recycled material in quantity. In turn, closed-loop recycling implies very high quality requirements on the recycled material to replace virgin resins.
Closed-loop recycling of engineering plastics, especially from post-use sources, is still in its infancy. This is mainly due to the complexity of numerous engineering plastics as a material (often representing blends of different polymer types, such as PC/ABS) and that of the waste streams where they mostly occur, e.g. E-waste. An additional difficulty is the presence of legacy additives, such as certain types of flame retardants in E-waste, the use of which is banned by EU law. Since mechanical recycling has no technological capabilities to remove flame retardants or other additives, plastic waste containing such additives is currently incinerated of landfilled.

Current recycling solutions largely rely on mechanical recycling that offers a partial solution for engineering plastic waste only. As a result, the recycled content of plastic parts in E&E devices and automobiles is currently less than 2%. On the other hand, the EU target is 24% to be achieved by 2030. We believe that this goal can only be achieved with the aid of advanced recycling techniques, such as solvent-based and chemical methods. In our view, the best results can be achieved by a proper combination with mechanical recycling methods. This paper discusses the opportunities of combining mechanical and solvent-based techniques for the recycling of complex waste streams, such as E-waste.