Challenge

In 2017, the German plastics industry processed about 14.7 million tons of plastics, corresponding to a turnover of 63.7 billion euros. The dominant processing machine is the screw machine. In these screw machines (single-screw extruders, twin-screw extruders, and plastification units of injection molding machines) inhomogeneities of the melt flow occur in the process. In order to reduce these inhomogeneities, the screw tip is often equipped with dynamic mixing elements. Due to its simplicity, the design of the rhomboid mixing part is widely adopted in industry, despite its negligible radial mass transfer. The low radial transfer results in a less-than-optimal temperature and additive distribution across the outlet of the screw machine. This inevitably leads to quality deficiencies in the plastic products produced, which results in production waste and increased environmental pollution.

Solution

The invention represents a variation of the rhomboid mixing element in which the radial mass transfer (and thus also the heat transfer) is noticeably increased by adjusting the geometry. The adjustment is carried out by means of computer-assisted shape optimization along predetermined degrees of freedom. The novel design is a combination of a specially designed top surface, a special cross-sectional profile and a twist of the outer contour. A mixing element shaped in this way achieves significant radial mass transfer with low shear and thus with low pressure requirements as well as low shear heating. The resulting flow pattern displaces the melt located between the barrel and the screw core like a regular rhomboid mixing element but additionally transports melt from the barrel wall of the screw machine towards the screw core.

Advantages

- Improved radial mixing
- Decreased degradation due to reduced temperature
- Reduced production waste
- Increased energy and resource efficiency

Status

- Patent application at the German Patent and Trade Mark Office. Patent application not yet disclosed. RWTH Aachen University cannot derive any rights against third parties from the patent application that has not yet been disclosed.
- Exists as prototype
RWTH Aachen University is looking for partners for patent exploitation.