

Fluitec Documentation No. 11.130 Rev. 1

mikromakro technology for the improvement of **Extrusion Processes**

Melt pumps and melt mixers are well established and integrated in extrusion processes. They are normally installed between the extruder and the tool and complement each other in a perfect way. Reduced pulsations and improved thermic homogeneity allow a significantly improved quality of the melt and a much higher contouring accuracy of the final products. The new Fluitec mikromakro® melt mixers are dedicated for melts of high viscosities and high throughput rates. The housings are manufactured by using the proven and tested Multi-Material-Technology MMT.

Introduction

Static mixers in combination with gear pumps are used for decades for the homogenisation of polymer melts. In order to fulfil the increasing requirements of high-tech plastic products, it is essential to focus on a perfect and homogeneous structure already in the melt of the polymer. Nowadays, this demands can be met by applying the latest technology of Fluitec mikromakro® melt mixers. As a matter of fact, however, only the melt pump is able to compensate the pressure peaks caused by the extruder in an efficient way. Thus it is compulsory to use the combination of both technologies, the gear pump and the static mixing elements, to improve an extrusion process significantly. An up-to-date extrusion process can be arranged as shown below:

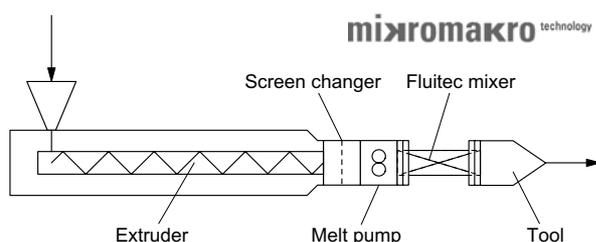


Fig. 1 Sketch of an extrusion plant

Advantages by using the Fluitec mikromakro® melt mixer:

- homogeneous temperature profile
- homogeneous viscosity profile
- improved staining quality and performance
- reduced costs for dye of up to 25%

Advantages of the melt pump:

- elimination of pressure peaks generated by the extruder
- constant flow of polymer melt
- possibility of decreased the melt temperature

The homogeneous melt, the constant flow rate and the possibility for a reduced melt temperature are leading to the following advantages:

of the extruded product:

- narrow residence time distribution
- improved quality of surface
- improved quality of mixtures of different polymers or regranulates
- products which are free of striae
- improved mechanical properties due to reduced thermal and mechanical stress
- homogeneous and uniform cell structure of foamed products

of the process:

- increased throughput-rate
- significantly extended field of applications
- optimisations of processes are reproducible
- reduced wear out of extruder
- reduced costs for energy
- reduced costs for maintenance
- possibility of increased use of regranulates



Fig. 2 mikomakro® melt mixer 185

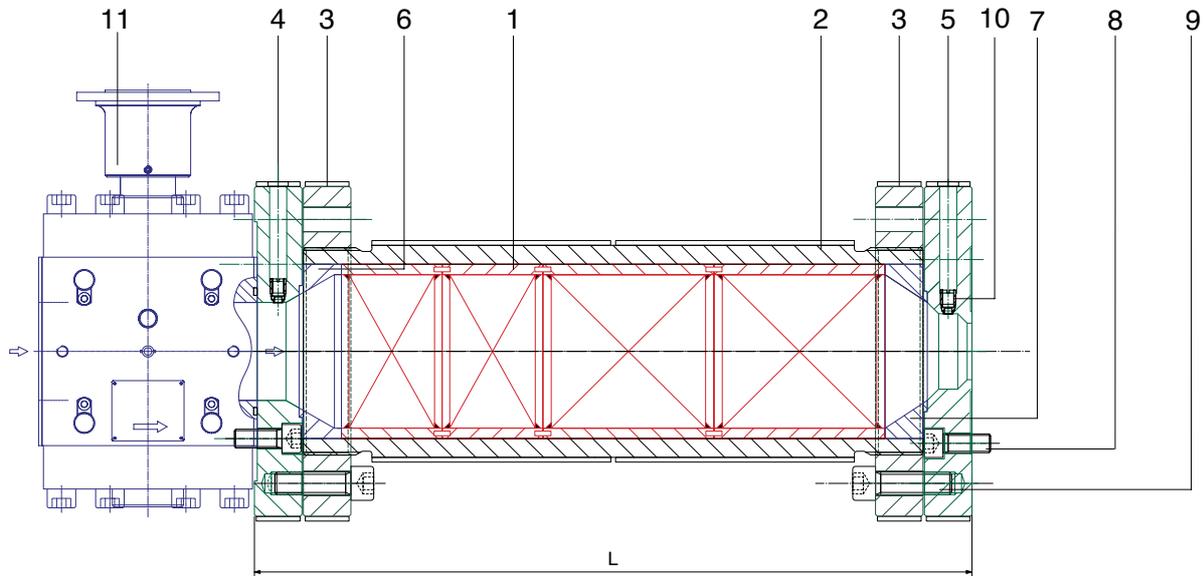


Fig. 3 Melt pump and mixer based on the **mikromakro** technology

Fluitem **mikromakro**® mixer

mikromakro® mixing means the systematic use of static mixers of different geometries and sizes. Basically, a rough but well distributed pre-homogenisation must be achieved in the makro-mixer, while a perfectly fine homogenisation is achieved in the following mikro-mixer.

The consistent application of this technology allows in most cases a significantly improved mixing efficiency and at the same time a reduced energy demand. Fig. 4 shows pictures taken of a laminar mixing process, using the **mikromakro**® technology, after an L/D ratio of 2 and of 3.

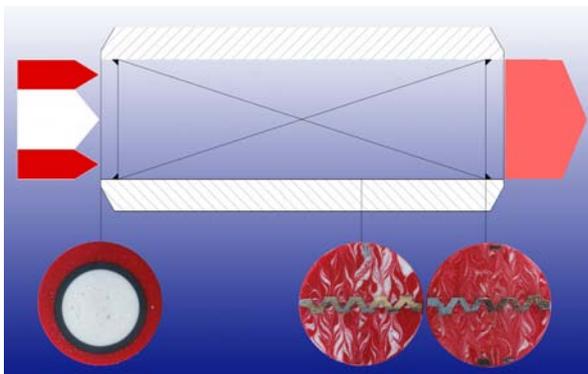


Fig. 4 Mixing performance of the **mikromakro**® melt mixer

The **mikromakro**® technology is successfully applied in extrusion processes of higher throughput rates or of very high viscosities. It is important to customize the **mikromakro**® mixer design, if the mixers diameter exceeds 60 mm. A system as shown in Fig. 3, consisting of a melt pump and a melt mixer, can be used for throughput rates of $< 500 \text{ kg h}^{-1}$ and a viscosity of 2'000 Pas to 50'000 Pas.

The housing of the melt mixer is produced with the well proved Multi-Material-Technology MMT. Alloys of different thermal expansion improve the ability for sealing, the heat transfer, the removability and the handling of the melt mixer. It is a feature of the

novel **mikromakro**® mixing concept that mixer designs with reduced lengths and at the same time of reduced pressure drops are possible.

Legend of Fig. 3

1. Fluitem **mikromakro**® melt mixer
2. Housing with multi material technology
3. Flanges to screw-on
4. Inflow of middle-flange
5. Outflow of middle-flange
6. Extension
7. Reduction
8. Hexagonal bolts
9. Hexagonal bolts
10. Fittings for pressure- and temperature probes
11. Melt pump

Due to the improved stability, melt mixers of larger dimensions are built as hollow shaft constructions. Depending on the specific application, the elements at the entry can be additionally reinforced.



Fig. 5 CSE-X® mixing elements DN250 / DN200