Masterbatch Compounding. First class technology from Coperion for a very demanding compounding process.

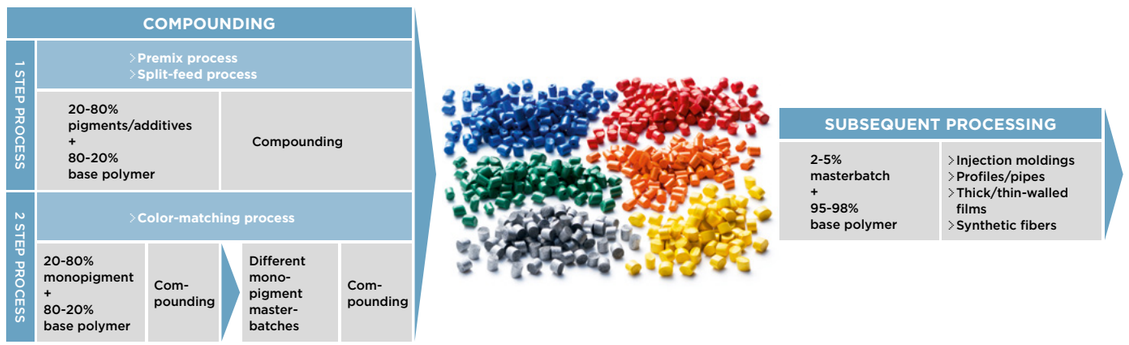
coperion

Quality is our benchmark. The processing of masterbatch puts high demands on the compounding process: After all, the pigment and additive components must be incorporated into the polymer matrix absolutely homogeneously. Because of its excellent mixing properties and the gentle product handling, the co-rotating twin screw extruders from Coperion are particularly suitable for this compounding task.

The twin screw compounders from Coperion have proven themselves in the processing of masterbatch for many years. Both the ZSK Mc[18] and the ZSK Mv PLUS series as well as the STS Mc[11] twin screw extruders are used for this compounding process. We design – depending on the masterbatch recipe – all processing steps exactly to your requirements. Metering, feeding, conveying, melting, dispersing, homogenizing, devolatilizing, pressurizing, filtering and pelletizing. This gives you exactly what you can expect: a compounding system that is optimally tailored to your process needs.

From laboratory extruder to production scale machine with high throughput rates, the Coperion twin screw extruders all operate with maximum productivity. Special developed features such as the feed hopper with quick-release clamps, the masterbatch die head or the easy-to-clean side feeder ZS-B ensure fast, easy cleaning of the extruders and therefore economical recipe and color changes.

Compounding and subsequent processing of pigment and additive masterbatch



Compounding of masterbatch. The term masterbatch includes concentrates of pigments or additives in a polymer matrix. Masterbatch is mainly available in the form of standard pellets but also in the form of mini-pellets. A distinction is made between white, black and colored masterbatch depending on the pigment type. The premix, split-feed and color-matching processes are available for compounding masterbatch.

PREMIX PROCESS

In the premix process all masterbatch raw material components are first mixed homogeneously in a mixer. Then, normally via a volumetric feeder, this mixture is fed into the twin screw extruder where it is processed.

Advantages of Coperion extruders

- Excellent dispersion at high throughput rates
- High pigment and additive loading levels are possible
- Very simple machine operation
- Long lifetime of screw and barrel parts due to specially developed screw elements
- Fast and therefore economical color changes

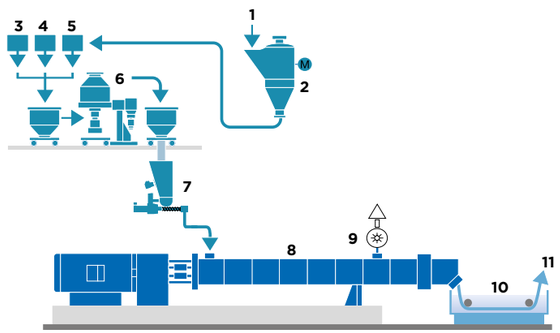
Recipe ingredients

Base polymers: PE, PP, PS, EVA, PET, PA, PC, SAN, PMMA, ABS, TPE, POM, PEEK, etc.

Pigments/additives

Organic pigments	20-40%
Inorganic pigments	40-60%
Carbon black	15-40%
TiO_2	50-70%
Synthetic SiO_2	10-30%
Natural SiO_2	30-50%
Low melt substances such as additives (UV, antifog, antistat, etc.)	10-20%

Typical set-up for the premix process



1 Polymer pellets
2 Pellet mill
3 Wax
4 Pigments
5 Polymer powder
6 Mixer, e.g. heating-cooling mixer
7 Feeder
8 Twin screw extruder
9 Vacuum pump
10 Water bath
11 To the pelletizer

SPLIT-FEED PROCESS

The split-feed process is used especially for producing mono-pigment and additive masterbatch. In this process, the polymer is fed into the feed barrel of the extruder in form of pellets. The pigments are then fed gently into the extruder by a twin screw side feeder downstream of the melting zone. The components are metered separately by individual gravimetric feeders.

Advantages of Coperion extruders

- Very high pigment and additive loading levels are possible
- Extremely gentle wetting of the pigments thus avoiding agglomerations
- Excellent dispersion of the pigments, e.g. for fiber applications
- Fast and therefore economical color changes
- High throughput rates for maximum productivity

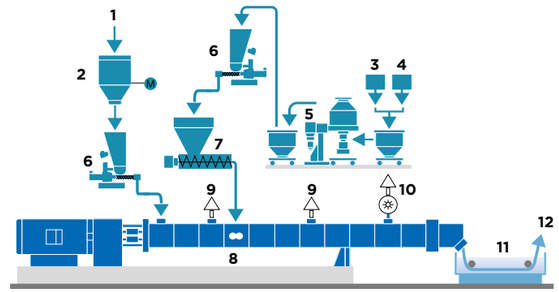
Recipe ingredients

Base polymers: PE, PP, PS, EVA, PET, PA, PC, SAN, PMMA, ABS, TPE, POM, PEEK, etc.

Pigments/additives

Organic pigments	40-60%
Inorganic pigments	50-80%
Carbon black	20-50%
TiO_2	60-80%
Synthetic SiO_2	20-50%
Natural SiO_2	40-60%
Low melt substances such as additives (UV, antifog, antistat, etc.)	30-60%

Typical set-up for the split-feed process

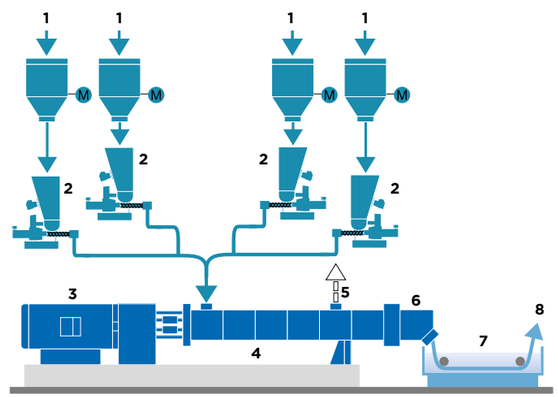


1 Polymer pellets
2 Pellet mill
3 Wax
4 Pigments
5 Mixer
6 Gravimetric feeder
7 Twin screw side feeder
8 Twin screw extruder
9 Degassing
10 Vacuum pump
11 Water bath
12 To the pelletizer

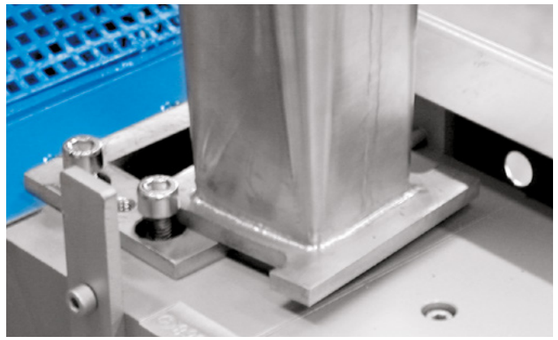
COLOR-MATCHING PROCESS

The color-matching process is used for high-end applications such as dyeing of fibers. Different monobatch pellets are fed into the extruder pre-mixed or separately. The extruder plasticizes and homogenizes them so that a masterbatch in the desired color shade is produced. Masterbatch based on the common base polymers PE, PP but also PA is used in this process.

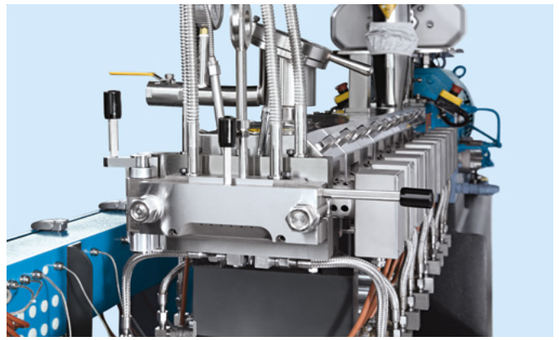
Typical set-up for the color-matching process



1 Preload hoppers for masterbatch
2 Pneumatic conveying to gravimetric feeders
3 Extruder motor and gearbox
4 Twin screw extruder
5 Degassing (vacuum pump)
6 Die head
7 Water bath
8 To Pelletizer



›QUICK-RELEASE FEED HOPPER WITH QUICK-RELEASE INSERT FOR ZSK



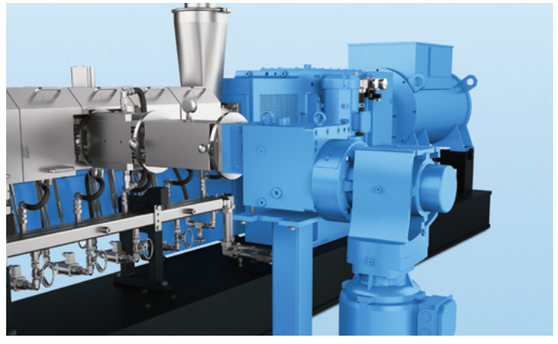
›EXTRUDER DIE HEAD OF A STS 35 Mc[11]

Feed hopper with quick-release clamps for ZSK and STS

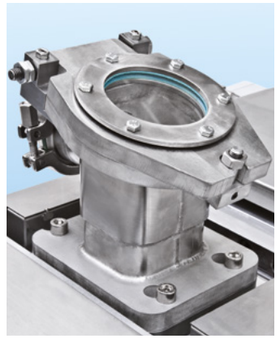
The feed hopper is only clamped to the process section by bolts. It can be removed very quickly by simply loosening these bolts. The quick-release insert which protects the barrel wall from contamination can then be changed very easily.

Extruder die head for STS

The STS extruder die head can be swiveled aside quickly and easily by loosening just a few bolts. This ensures very good, very quick cleaning when changing colors. The optimum flow geometry of the die head enables homogeneous discharge even with highly-filled products.



›QUICK-RELEASE OF THE SIDE FEEDER FROM THE PROCESS SECTION



›QUICK CLOSURE ON THE DEGASSING DOME

›C-CLAMP AT THE CONNECTION OF THE DEGASSING DOME

Easy-clean side feeder for ZSK and STS

The twin screw side feeder enables side feeding of additives in powder or pellet form into the process section of the twin screw extruder. The side feeder can be released from the process section with a few steps for fast, effective cleaning.

Degassing dome and atmospheric venting of the ZSK Mc[18] with quick closure clamps

For fast, easy cleaning both the degassing dome and the atmospheric stack of the ZSK Mc[18] series are fitted with quick-release clamps. The units can be removed by loosening just four bolts. In addition, the connection of the vacuum line on the degassing dome is equipped with a quick-release c-clamp.

ZSK Mv PLUS FOR CARBON BLACK AND EFFECT PIGMENT MASTERBATCH

Due to the deep cut screw flights of the ZSK Mv PLUS with a diameter ratio D_o/D_i of 1.8 there is a very large, free screw volume. This is a big advantage especially in the production of carbon black and special effect pigment masterbatch:

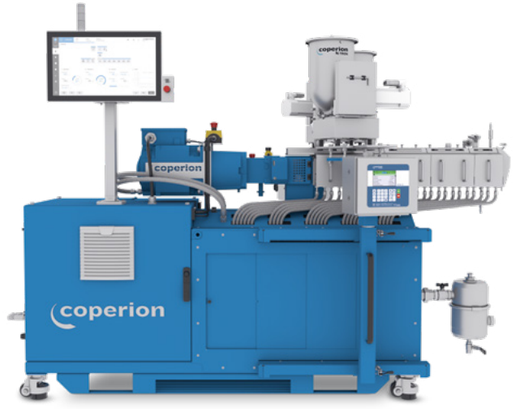
- Improved feeding of high-volume ingredients such as carbon black and pearlescent pigments
- Very gentle handling of all recipe ingredients such as shear-sensitive pearlescent pigments
- Low specific energy input for low melt temperatures
- Maximum product quality

ZSK 18 MEGAlab – MAXIMUM PERFORMANCE FOR SMALL BATCH SIZES

The ZSK 18 MEGAlab laboratory extruder is based on the successful ZSK technology. It was developed especially for processing small quantities. The reliable scale-up to larger ZSK extruders make it the ideal compounding system for formulation development and basic research and development work.

Other features:

- Throughput rates of up to 40 kg/h
- Preparation quantities from 200 g
- Specific torque Md/a^3 = 11.3 Nm/cm^3
- D_o/D_i = 1.55
- Max. drive speed of 1,200 min^{-1}



›LABORATORY EXTRUDER ZSK 18 MEGAlab

Throughput rates [kg/h]

ZSK Mc[18]	**18***	**26***	**32**	**45**	**58**	**70**	**82**	**92**
Premix	3-15	10-50	20-100	50-250	120-600	200-1,100	300-1,700	400-2,000
Split-feed	5-30	25-100	50-200	150-550	300-1,100	500-2,000	800-3,200	1,000-4,500
Color-matching	20-40	75-250	150-400	400-1,100	900-2,500			
ZSK Mv PLUS	**34**	**43**	**54**	**62**	**76**	**98**		
Split-feed	100-200	200-350	400-700	600-1,000	1,100-2,000	2,300-3,500		
STS Mc[11]	**35**	**50**	**65**					
	50-220	150-600	300-1,100					

* Laboratory extruders ZSK 18 MEGAlab and ZSK 26 Mc[18]

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Headquarters

Coperion GmbH

Theodorstrasse 10
70469 Stuttgart, Germany
Tel.: +49 711 897-0
Fax: +49 711 897-3999

info@coperion.com
www.coperion.com

Find your nearest Coperion location

coperion