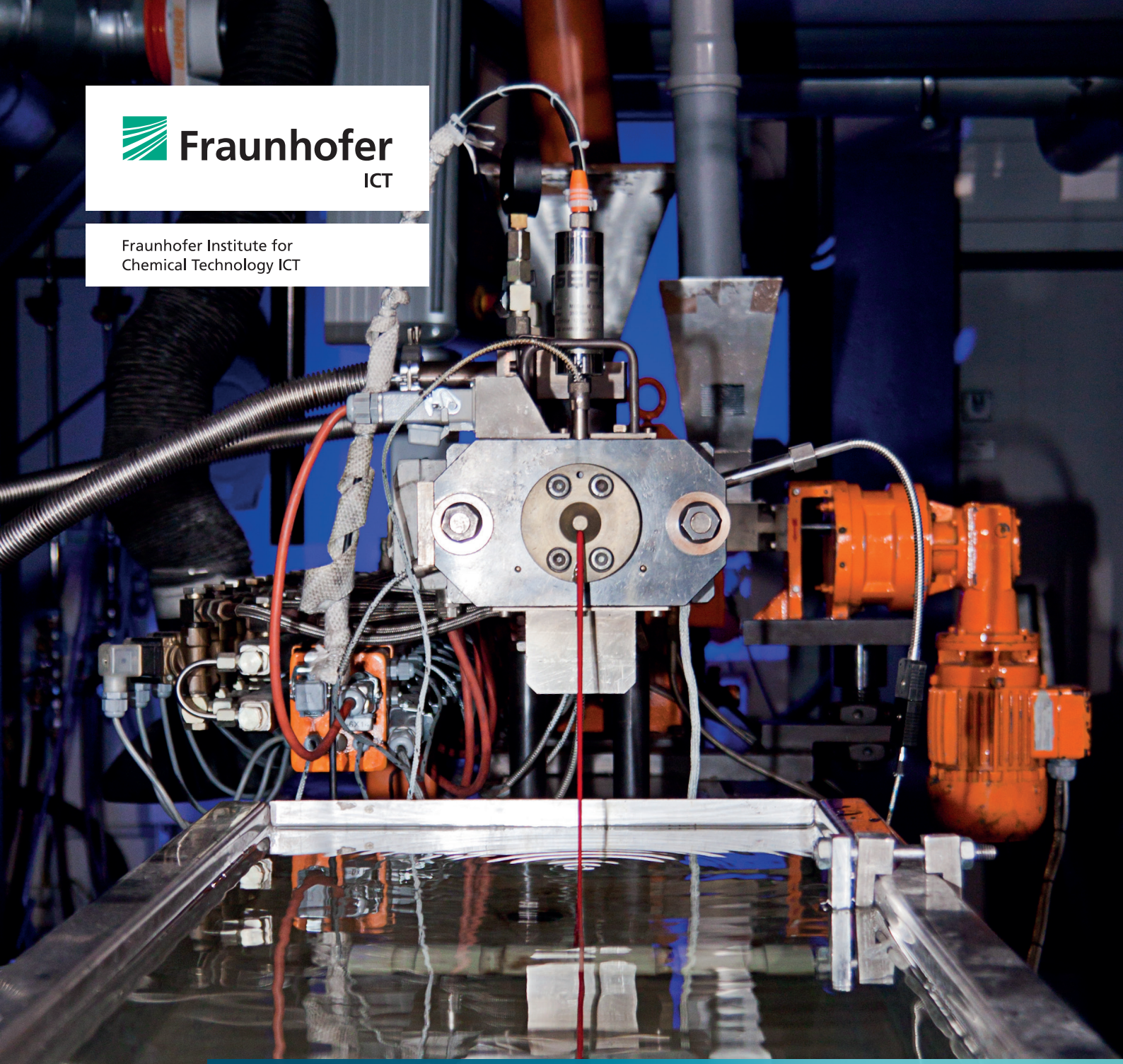


Fraunhofer ICT

Fraunhofer Institute for Chemical Technology ICT

Polymer Engineering Department

Facilities and equipment – materials and compounding technologies

Twin-screw extruders

The compounding of custom-made material compositions for almost any material requirements, together with the corresponding process development, is a core competence of Fraunhofer ICT. Comprehensive facilities and equipment are available for our development work. Various extruders, dosing technologies and downstream devices are used, as well as specialized equipment for foam extrusion or melt characterization.

Leistritz ZSE 18 MAXX

Small twin-screw extruder for material development and reactive extrusion for the production of small batches of costly or scarce materials. Equipped with safety devices to allow the processing of hazardous substances.

Technical data	
Screw diameter	18 mm
Processing length	L/D = 60
Throughput rate	0.2 to 10 kg/h
Side-feeders	3

Leistritz 27 HP

Extruder for process development: The long processing unit allows the flexible design of various processing zones and the integration of new processing techniques.

Technical data	
Screw diameter	27 mm
Processing length	L/D = 52
Throughput rate	3 to 80 kg/h
Side-feeders	2

Leistritz Micro 27

The high flexibility of the technology allows us to complete even difficult extrusion and compounding tasks quickly and effectively.

Technical data	
Screw diameter	27 mm
Processing length	L/D = 36 or 40
Throughput rate	3 to 30 kg/h
Side-feeders	1

Coperion ZSK 32 MC

Twin-screw extruder with a long processing unit, which is used for demanding compounding tasks and integrated processes with medium and high throughput rate.

Technical data	
Screw diameter	32 mm
Processing length	L/D = 48
Throughput rate	10 to 200 kg/h
Side-feeders	1

Haake Rheocord

Lab-scale extrusion line for the production of compounds and filaments. For specialized applications a melt pump is available.

Technical data	
Screw diameter	16 mm
Processing length	L/D = 25
Throughput rate	0.1 to 2 kg/h
Melt pump	

Minilab Haake Rheomex CTW 5

Microcompounder for the compounding of very small sample quantities. The processing time can be controlled through an integrated bypass flow channel.

Technical data	
Conical twin-screws	
Screw diameter	14 to 15 mm
Processing lenght	109.5 mm
Sample size	5 g

Haake Polylab

Used for lab-scale extrusion and material characterization. Different attachments allow twin-screw, single-screw and kneading processes.

Technical data	
Single-screw	
Twin-screw	
Kneading chamber	70 ml
Kneading chamber	220 ml

Cincinnati CMT 35

Complete line for the extrusion of profiles. Counter-rotating twin-screw extruder including downstream devices (calibrating table, cooling bath, caterpillar haul-off, saw, and tilting table) and profile tools (e.g. 3-chamber window profile).

Technical data	
Conical screws	35 / 75 mm
Screw length	665 mm
Max. throughput rate	80 kg/h
Total torque	1.7 kNm

Dosing technology and downstream processing devices

Fraunhofer ICT is equipped with numerous dosing and downstream processing devices, which can be freely combined with many of the extruders listed above. Dosing devices and pelletizing technologies can be selected and combined to obtain optimal processing technologies for specific material formulations and tasks.

Dosing technology

Solids: Gravimetric feeders using single-screw, twin-screw, rotary or vibrational conveyance, for flexible application.

Technical data	
Dosing rate	0.02 to 150 kg/h
Powder, pellet and fiber dosing	

Liquids: Depending on viscosity, pressure and required throughput capacity, we offer a large number of flexible dosing systems for liquids. Gear-, piston-, annular- and eccentric screws, membranes and hose pumps for dosing a variety of liquids up to suspensions with fillers.

Technical data	
Dosing rate	0.02 to 10 kg/h
Low-, medium- and high viscosity liquids	

Gases: Gravimetric dosing stations for CO_2 and N_2. Used in foam extrusion, reactive extrusion and melt purification.

Technical data	
Dosing rate	0.085 to 9.0 kg/h CO_2
	0.05 to 5.3 kg/h N_2
Maximum pressure	300 bar

Strand pelletizers

Technical data	
Strand speed	15 to 80 m/min
Strands	up to 20
Adjustable pellet length	2 to 15 mm

Hot face pelletizer LHLG

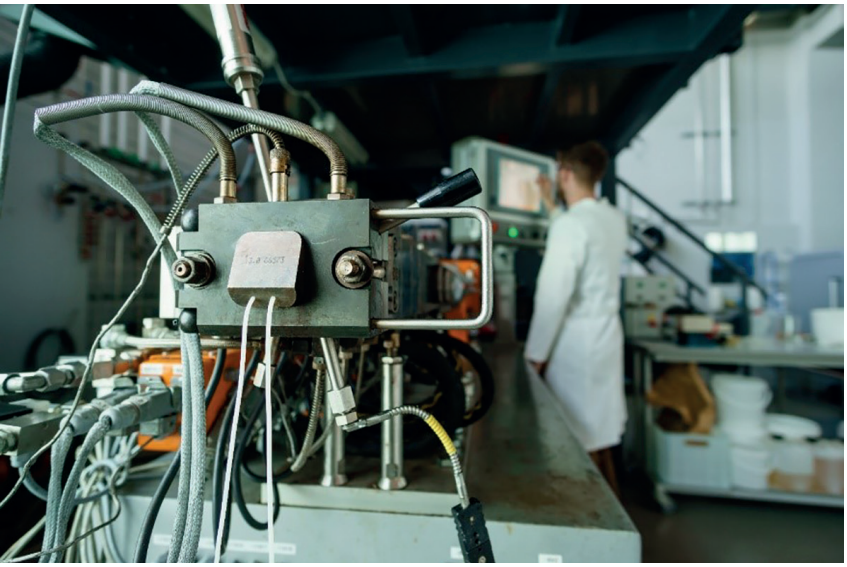
Pelletizing system with a rotating knife directly after the outlet nozzle. Very robust pelletizing system for a variety of material systems and process settings (highly filled compounds, natural fiber reinforced compounds, low throughputs).

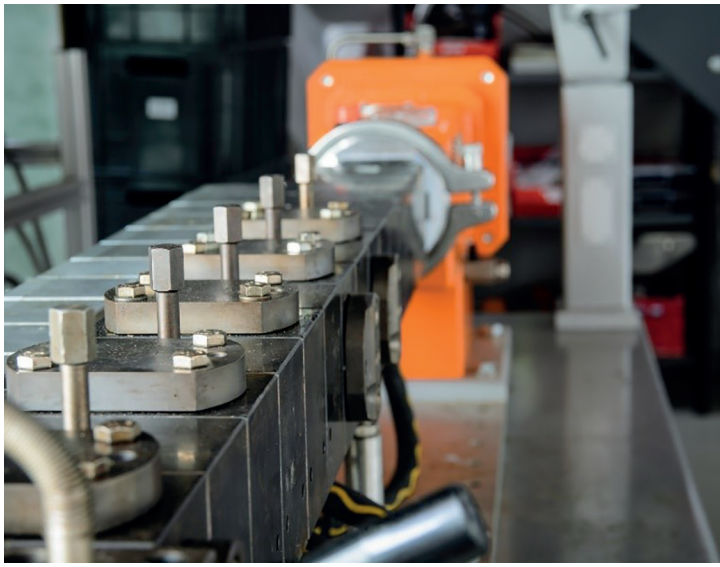
Technical data	
Cutting plate	2 × ∅ 3 mm
With cooling air flow	

Gala LPU Standard and EPS

Flexible underwater pelletizer. For the pelletizing of highly-filled compounds, and the production of gas-loaded particles and micro-pellets.

Technical data	
Perforated plate diameter	1.6 to 5 mm | 0.3 to 0.8 mm
Throughput rate	2 to 100 kg/h
Water pressure (EPS)	10 bar





Hrubal winder

Two-station winder with controlled winding tension for the winding of thin, flexible tubes and strands.

Technical data	
Winding diameter	max. 70 cm

Sihi water ring vacuum pump

Single-stage displacement pump, transports nearly all gases and vapors as entrained liquids. Mainly used for the extraction of water, gases and low molecular impurities from polymer melts.

Technical data	
Pressure	down to 33 mbar (abs.)

ILLIG KFG 35a

Thermoforming machine for forming film material.

Technical data	
Mold size	350 × 250 mm
Mold size	approx. 90 mm
Heating field temperature	max. 590 °C
Materials	thermopl. foils and foam foils
Extra equipment:	cooling fan, compressed air polarity reversal for demolding

COLLIN Lab & Pilot Solutions

Film extrusion line that enables the production of monolayer films from various materials.

Technical data	
Throughput	2 to 20 kg/h
Processing temperature	max. 500 °C
Nozzle width	200 mm
Haul-off speed	100 m/min (calander unit)
Materials: thermoplastics	non-reinforced (PE, PP, ...), reinforced/filled (WPC, ...)
Extra equipment:	winding unit

Busch oil-lubticated rotary vane pump

Throughput vacuum pump for demanding degassing and melt purificaion processes

Technical data	
Pressure	up to 0.5 mbar (abs.)

Pellet dryer

Varoius dry-air dryers for the treatment of pellets.

Technical data	
Capacity	5 to 250 l
Temperature range	25 to 180 °C

Additive manufacturing of polymer components

Additive manufacturing enables a fast and cost-effective production of prototype components and small series. We develop optimized and functionalized polymers for additive manufacturing (pellets and filaments) and adjust the processes to the materials.

Arburg plastic freeformer

From pellets directly to final part.

Technical data	
Temperature (installation space)	100 °C
Construction volume 1-component printing	189 × 134 × 230 mm
Construction volume 2-component printing	154 × 134 × 230 mm

3devo Composer 450 Extruder

From pellets direcly to filament.

Technical data	
Single-screw	
Throughput	0.1 to 1 kg/h
Filament diameter	0.5 to 3 mm
4 heating zones	up to 450 °C
Materials	PLA, ABS, PA, PEEK, etc.

German RepRap X500

Robust 3D printer for industrial use.

Technical data	
Dimensions (X × Y × Z)	500 × 400 × 450 mm
Temperature	
Building chamber	up to 80 °C
Construction sheet	120 °C
Materials	thermoplastic filaments (1.75 mm)
Two independent discharge units	
Suitable for high-temperature materials	

Various desktop devices

From the idea directly to the prototype.

Technical data
BQ Hephestos 2
Ultimaker 2
Ultimaker 3
Hyrel 3D 30 M
Snapmaker
German RepRap X400

Specialized processes

A core competence at Fraunhofer ICT is the development of specialized processes in compounding. Foaming, purification and polymer modification processes can be carried out using a twin-screw extruder. Supercritical CO_2, for example, has been used very successfully in recycling processes. Further integrated processes successfully implemented at Fraunhofer ICT include the introduction of ultrasound into the screw area of the extruder to improve the dispersion of particles in the melt, and the incorporation of microwaves into the processing section of a twin-screw extruder.

Introduction of ultrasound into twin-screw-extruder

Ultrasound generator with an optimized sonotrode for the introduction of ultrasound into an extruder. Used in dispersion, homogenization and reactive extrusion tasks.

Technical data	
Nominal power	2 kW
Frequency	20 kHz
Amplitude	8 to 16 µm

Introduction of microwaves into twin-screw-extruder

Antenna array including tailored cylinders and screws for the introduction of microwaves into standard twin-screw extruders. Used as additional, rapidly adjustable energy source for different research tasks.

Technical data	
Nominal power	750 W
Frequency	5.8 GHz

Contact

Dr.-Ing. Kevin Moser
Phone +49 721 4640-533
kevin.moser@ict.fraunhofer.de

Dr.-Ing. Jan Diemert
Phone +49 721 4640-433
jan.diemert@ict.fraunhofer.de

Fraunhofer Institute for
Chemical Technology ICT
Joseph-von-Fraunhofer Str. 7
76327 Pfinztal
Germany

www.ict.fraunhofer.de

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