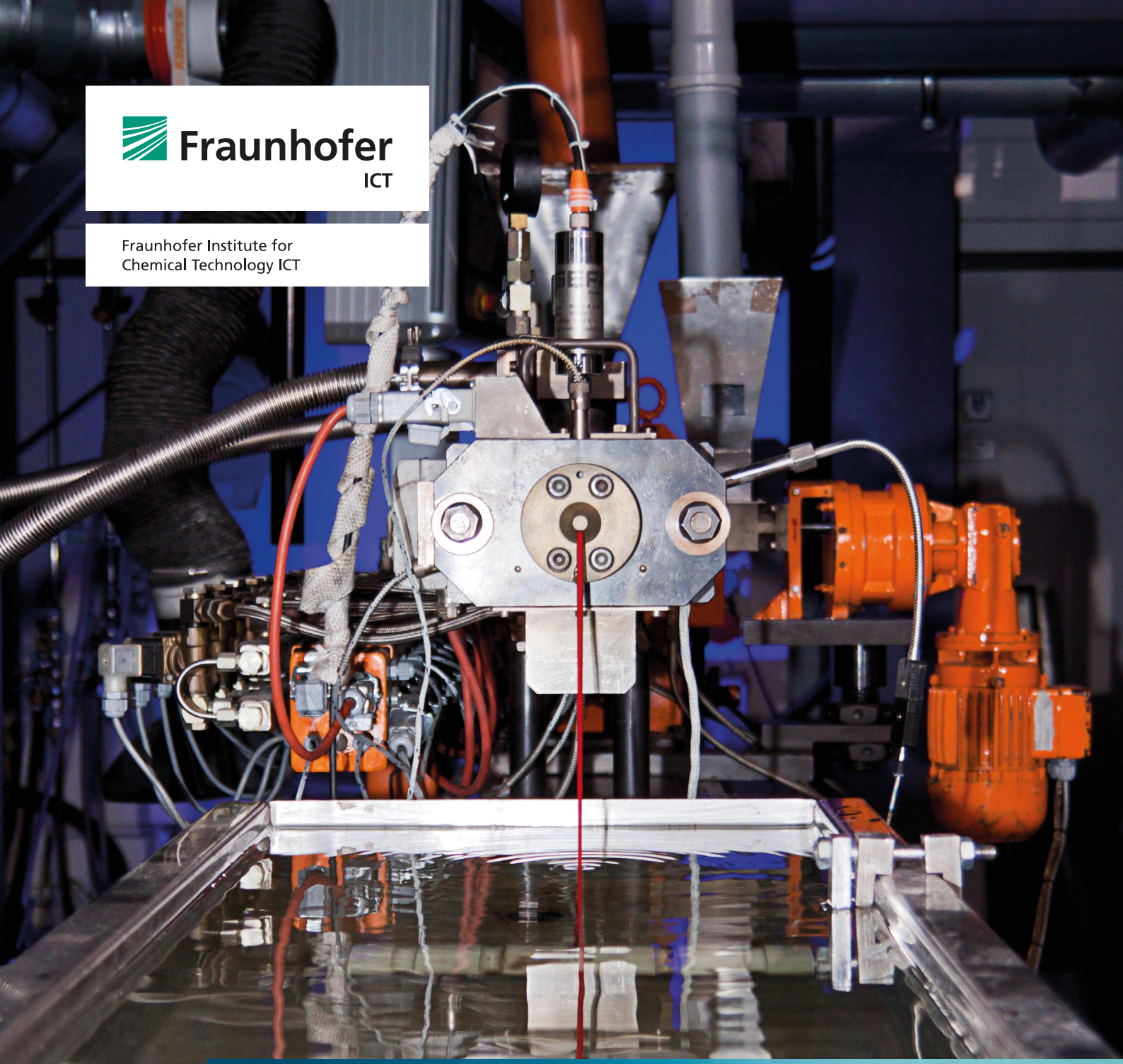


Fraunhofer ICT

Fraunhofer Institute for Chemical Technology ICT

Polymer Engineering Department

Facilities and equipment – Material Development 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 expertise 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 to produce 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. A melt pump is available for specialized applications.

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

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

Minilab Haake Rheomex CTW 5

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

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

Three-Tec ZE 9 HMI

Co-rotating twin-screw extruder for the production of small-volume compounds.

Technical data	
Screw diameter	9 mm
Processing length	L/D = 40
Max. temperature	350 °C

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 are available 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 18 and 27 extruders

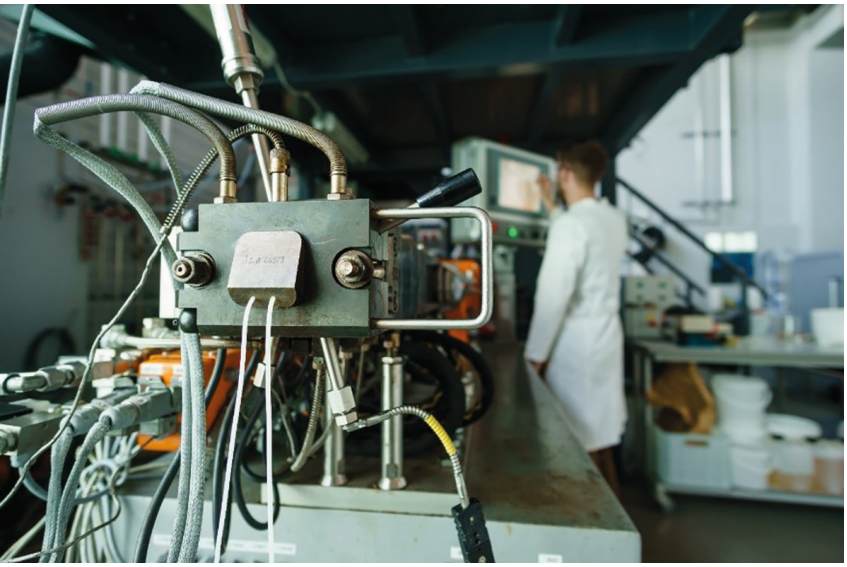
Pelletizing system with a rotating knife directly after the outlet nozzle. Very robust pelletizing system for a variety of material systems and process settings (highly filled compounds, natural-fiber-reinforced compounds, low throughputs).

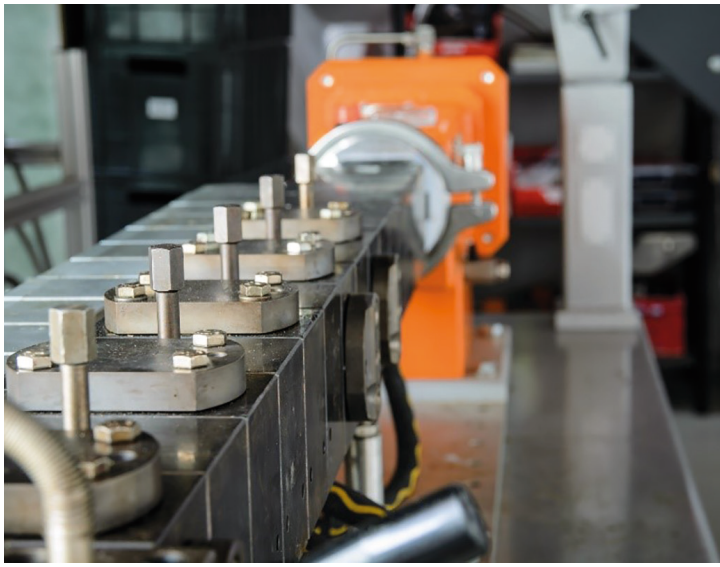
Technical data	
Cutting plate	2 × ∅ 3 mm
With cooling air flow	

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





Hubral 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-lubricated rotary vane pump

Throughput vacuum pump for demanding degassing and melt purification processes.

Technical data	
Pressure	up to 0.5 mbar (abs.)

Pellet dryer

Various dry-air dryers for the treatment of pellets.

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

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

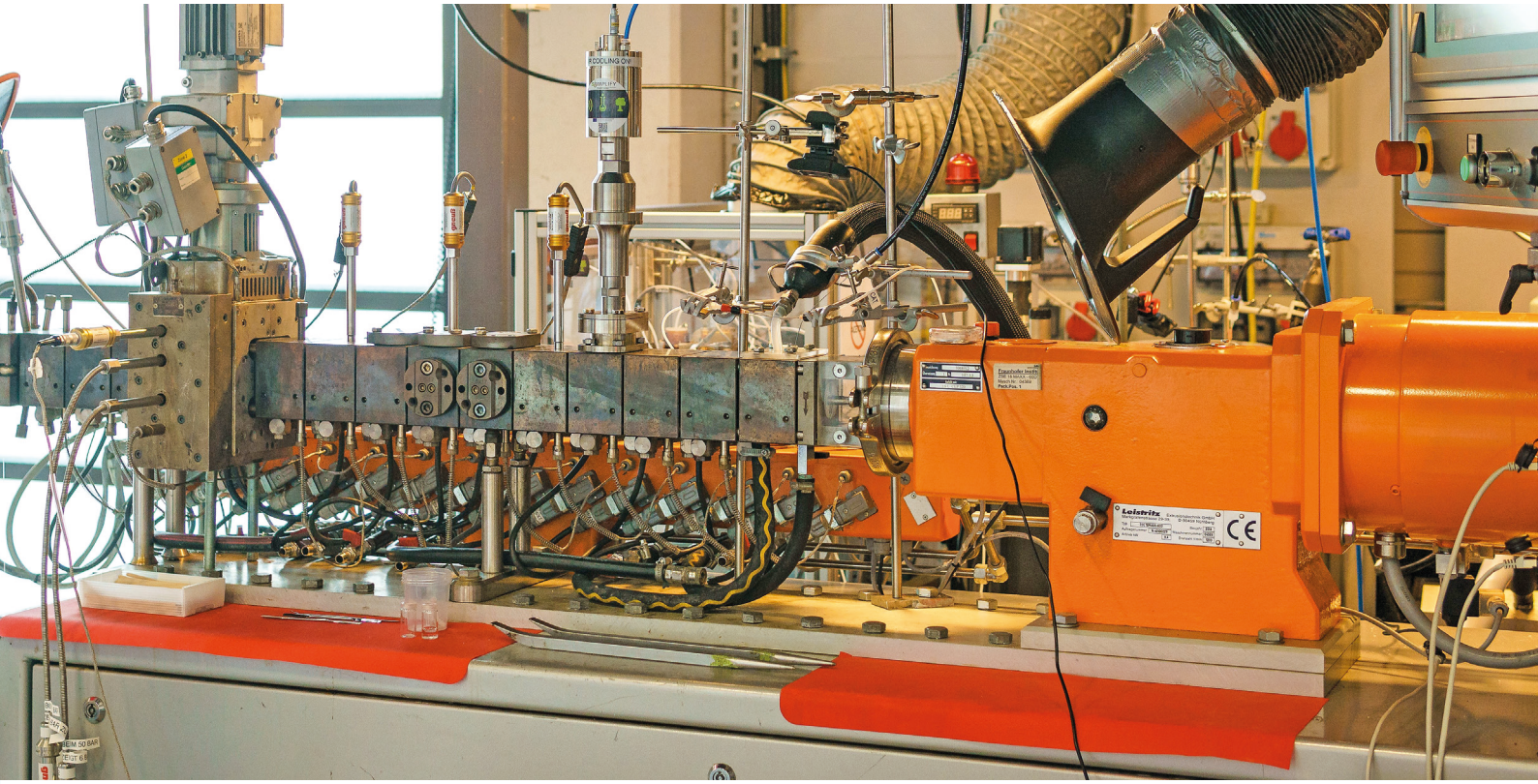
Introduction of microwaves into twin-screw-extruder

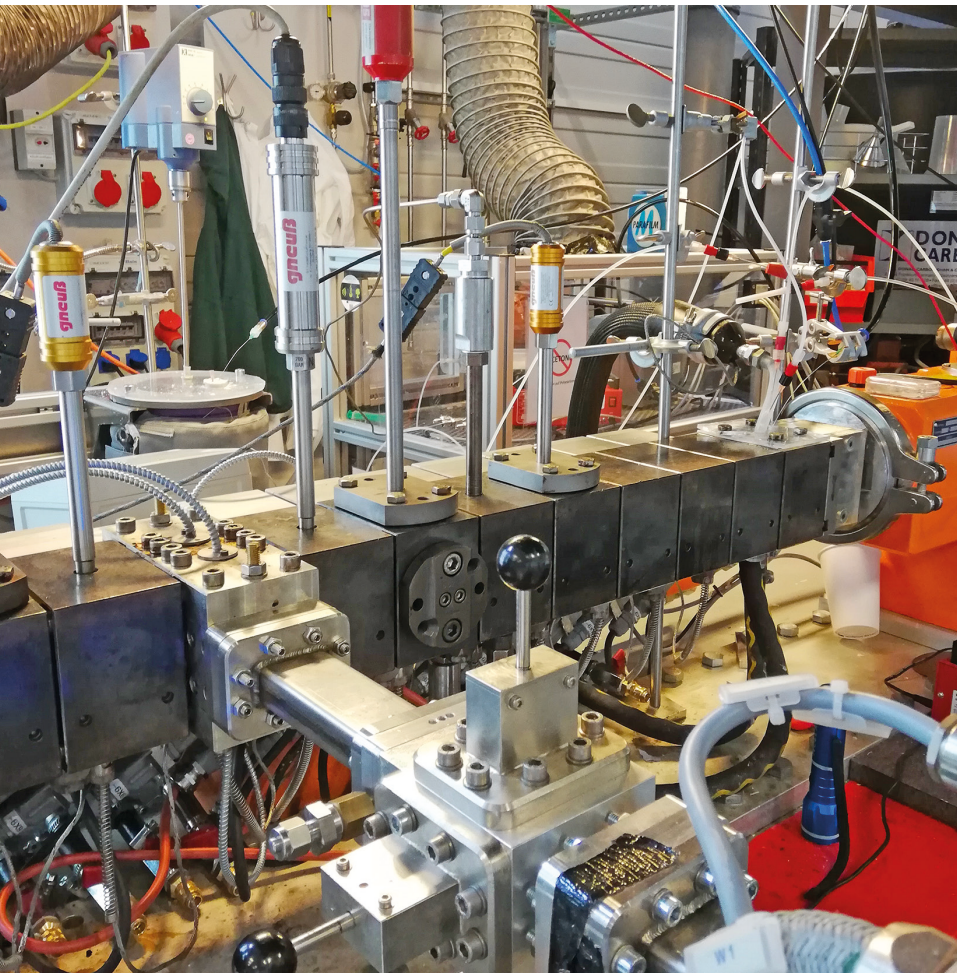
Antenna array including tailored cylinders and screws for the introduction of microwaves into standard twin-screw extruders. Used as additional, rapidly adjustable energy source for different research tasks.

Technical data	
Nominal power	750 W
Frequency	5.8 GHz

Extrusion system for the production of filaments

Our modular extrusion line enables the processing of a variety of materials into high-quality filaments. Whether it's high-temperature materials, highly filled, or recycled materials – our system offers maximum flexibility. Continuous monitoring of diameter and roundness ensures seamless control of product quality. Sampling is possible with our system from 0.5 kg to 50 kg.





Above:
Extruder with
ultrasonic coupling.

Left:
Extruder with
microwave coupling.

Below:
Filaments for 3D printing.

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-Straße 7
76327 Pfinztal
Germany

www.ict.fraunhofer.de

V05.0