

# Overview Test Specimen

CKZ

2023-11



# Overview of the business fields



More than 400 members in the FSKZ network | Events with more than 10.000 participants annually

## NETWORKING

Product monitoring  
Product certification  
Product testing  
Expert opinions  
Damage analysis

### TESTING



Product analysis  
Process measuring technology  
Damage analysis  
Polymer characterisation



### ANALYTIK SERVICE OBERNBURG

Practical training  
Workshops  
Courses  
In-house training  
Training for masters and technicians  
Studies  
Online-courses

### TRAINING



Materials  
Processing  
Material development  
Compounding  
Extrusion  
Injection Moulding  
Additive Manufacturing  
Inspection and test methods  
Sustainability  
Circular Economy  
Lightweight construction  
Digitization

### RESEARCH

ISO 9001  
ISO 14001  
ISO 45001  
ISO 50001  
IATF 16949  
ISO 22000  
ISO 13485  
SpaEfV  
FW 605

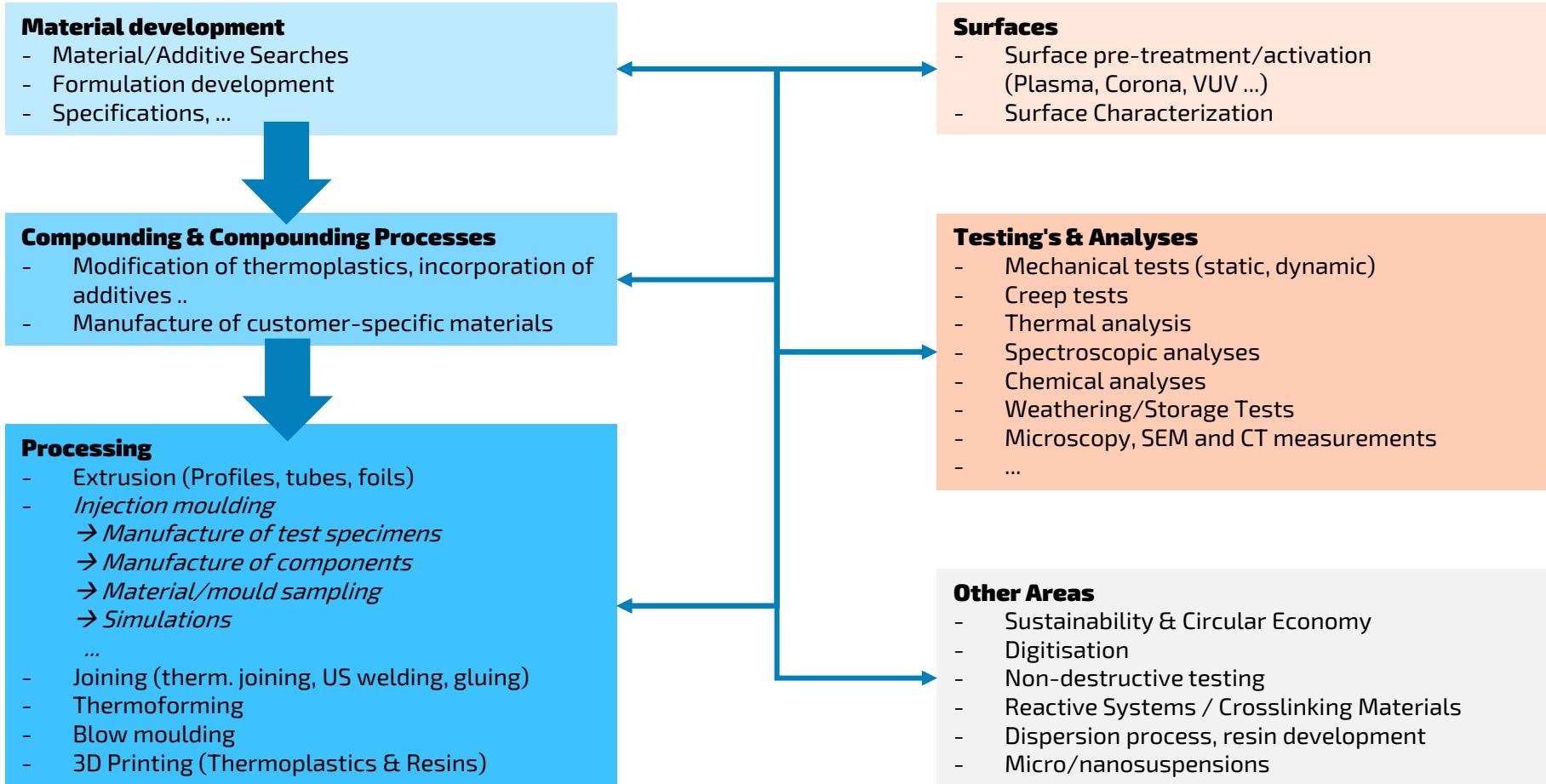


DAkkS  
Deutsche Akkreditierungsstelle  
D-PL-19033-01-00  
D-PL-19033-01-00  
D-ZE-19033-01-00

### CERTIFICATION

DAkkS  
Deutsche Akkreditierungsstelle  
D-ZM-17265-01-00

# Industrial-Service Units in SKZ



# Injection Moulding at a glance



Over 130 industrial orders per year

| More than 150 courses

| 20 - ongoing research projects

## Research, Industrial Services & Education

More than 10 injection moulding machines with clamping force of 500 – 5,000 kN

Multi-component injection moulding

Thermoplastic Foam Injection Moulding

ARBURG FDC , Processing of long fibres

Processing of thermosets

Processing of LSR

Industry 4.0 Injection Moulding Cell

Colouring with Masterbatch and Liquid Colours

### Injection moulding

Adhesion of hard/hard and hard/soft composites (TPE, VDI2019)

Fiber Length Distribution (SKZ- "FiVer")

Determination of fiber fractions and orientations

Inline thermography for 100% component inspection (SKZ "TDI")

DOE: Statistical Design of Experiments (SKZ "MESOS")

### Testing & Analysis

Practical courses

Workshops

Courses

In-house training

Master craftsman and technician training

Online training

Creation and provision of WBT's

Individual training and further education concepts

### EDUCATION

Production of standard and individual test specimens

Simulation of injection moulding processes (Moldex3D, SIGMASOFT)

Material and mould sampling

Processing of PVC and high-temperature thermoplastics

Customer-specific material/mould tests

On-site (process) consulting

Feasibility studies

### Industrial Services

Publicly funded projects (e.g. ZIM, IGF, BMBF ...)

Bilateral R&D projects

Research

Industry Consortium Projects (SKZ Trailblazer)

### Research

- All services are also part of our research and development focus, so that we can rely on personnel with many years of experience.
- To process your enquiries, our certified technical center offers state-of-the-art injection moulding machines between 800 and 5,000 kN and peripheral devices.
- Our strength is to deal with your individual questions competently and at short notice.
- We have a wide range of test specimens.
- If no suitable test specimen is available, please contact us.
- The production of test specimen geometries according to your specific specifications is possible!:
  - Our test specimen moulds are designed as a "universal master moulds"
  - The production of a new mould plate or new cavity according to customer specifications is possible at any time
  - The production of the interchangeable plate is carried out by external mould makers
  - A pro rata allocation of costs is only made for the first order  
(approx. 1,000 € – approx. 5,000 € depending on surface finish, size, etc.)

In our certified technical facility, we are happy to produce test specimens and plates for you on request:

- Standard test specimens
- Special test specimens
- Plates with a wide range of dimensions, thicknesses and surface structures
- Test plates / specimens with dimensions according to your individual specifications
- Parts (including customer moulds)
- Processing of high-temperature thermoplastics, PVC, etc. ...

All work is carried out by industrial foremen or technicians.

The measurement of the processing moisture, a detailed injection molding protocol and rapid processing as well as the dispatch of the test specimens are integral parts of our services.

We can offer you over 50 different plate geometries and over 150 different test specimens / components

e.g.:

- small plates  
25 mm x 25 mm x 4 mm
- medium plates  
150 mm x 100 mm x 3 mm
- large plates
  - 450 mm x 110 mm x 2 / 3 / 4 / 6 mm
  - 310x310x2 / 3 mm

&

to

▪

- large plates
  - 450 mm x 110 mm x 2 / 3 / 4 / 6 mm
  - 310x310x2 / 3 mm

A detailed list of the test specimens and our other services can be found on the following pages and in the **download** area

# Tabular overview

# Excerpt of test specimens



- 1 Cold runner / bar gate**
- 2 Hot runner nozzle**
- 3 Multi-fold hot runner**



Sprue system			Geometry								
1	2	3	Designation	L	x	B	x	D	Surface	Remark	
			2C-Peel test specimens according VDI 2019						stroke polished / eroded	Geometry and peel testing according to VDI2019, Insertion of any substrate possible	
			2C-Peeling test specimens according VDI 2019 "mini"						ground	Moulding of substrates (inserts) - manual repositioning - overmolding	
			2C peeling test specimen "SKZ - old"						ground	Insertion possible, hard component with ribs, peeling force test	
			2C tension rod according to Type 1A						ground	based on type 1A according to DIN EN ISO 527-2	
			Flow spiral	770	x	10	x	0,4 0,8 1,5 2,5 4 6	ground	Six different thicknesses, in variant "1.5/2.5" insert "Thin 0.6 & 1.1 mm"	
			Flow spiral	3000	x	5	x	2	milled	single-sided aluminum mold plate, markings for flow length	
			Flow spiral	1100	x	25	x	3	finely blasted		
			Folie/Blech überspritzen	220	x	115	x	2			
			Standard specimen fire test sticks	125	x	13	x	1,2 1,5 2,0 4,0		milled	
			Standard specimen fire test sticks	125	x	13	x	0,4 0,8 1,6 3,2		ground	
			Standard specimen LOI rod	150	x	6,5	x	3		ground	
			Standard specimen LOI rod	150	x	10	x	4		ISO 4589	
			Standard specimen impact rod	80	x	10	x	4		ground	
			Standard specimen tensile test according to ASTM D638							ISO 4589	
			Standard specimen tensile test Type 1A							stroke polished	
			Standard specimen tensile test Type 1A for PVC/Fluoropolymers							DIN EN ISO 179-1 for Charpy; DIN EN ISO180 for Izzod, Mould according to DIN EN ISO 294-1	
			Standard specimen tensile test Type 1BA							ground	
			Standard specimen tensile test Type 4							ASTM D638 - Typ1	
			Tensile test specimen with weld seam							stroke polished	
			Tensile test specimen according to Type 1A - cambered							Tensile test according to DIN EN ISO 527-2; Mould according to DIN EN ISO 294-1	
			Standard specimen tensile test Type 1A							stroke polished	
			Standard specimen tensile test Type 1BA							Tensile test according to DIN EN ISO 527-2; Mould according to DIN EN ISO 294-1	
			Standard specimen tensile test Type 4							stroke polished	
			Tensile test specimen with weld seam							Impact-tensile strength according to DIN EN ISO 8256	
			Tensile test specimen according to Type 1A - cambered							ground	
			Leaning against tensile test Type 1A according to DIN EN ISO 527-2, "parallel" area as radius, thin point in the middle (lower tolerance), wider towards the shoulder (upper tolerance)							ground	

# Excerpt of test specimens



- 1 Cold runner / bar gate**  
**2 Hot runner nozzle**  
**3 Multi-fold hot runner**



Sprue system			Geometry				Surface	Remark		
1	2	3	Designation	L	x	B	x	D		
			Step plate	120	x	60	x	1	stroke polished	Thin to Thick
			Step plate	120	x	60	x	4	Polished	thick to thin, different gate inserts available
			Step plate	120	x	60	x	4	strichpoliert	thick to thin, different gate inserts available
			Step plate	120	x	60	x	4	VDI 3400 ref. 27	thick to thin, different gate inserts available
			Step plate	120	x	60	x	4	VDI 3400 ref. 39	thick to thin, different gate inserts available
			Plate	25	x	25	x	4	ground	for centrifugal test adhesion strength
			Plate	36	x	18	x	5	milled	with two cylindrical openings
			Plate	60	x	60	x	2	ground	DIN EN ISO 6603-1 Puncture behaviour / shrinkage measurement
			Plate	60	x	50	x	4	stroke polished	
			Plate	60	x	50	x	4	tech. gloss polish	
			Plate	60	x	50	x	4	VDI 3400 Ref. 21	
			Plate	60	x	50	x	4	VDI 3400 Ref. 33	
			Plate	60	x	60	x	2	strichpoliert	Puncture behaviour DIN EN ISO 6603-1 / shrinkage measurement DIN EN ISO 294
			Plate	80	x	60	x	2	polished, double-sided	
			Plate	80	x	80	x	5	ground	
			Plate	90	x	80	x	1	milled	
			Plate	100	x	50	x	6	milled	
			Plate	100	x	100	x	2	ground	Cavity as insert, four inserts available in four thicknesses, Alu-reducer insert available --> 5x 50x6xmm
			Plate	100	x	24,5	x	4	ground	for bonding, tensile/shear test
			Plate	105	x	105	x	10	ground	
			Plate	110	x	100	x	3	polished, double-sided	
			Plate	140	x	115	x	2,2	ground	Vacuum pins included (foils)
			Plate	150	x	100	x	2	VDI 3400 Ref. 33	
			Plate	150	x	100	x	3	stroke polished	Cavity as an insert
			Plate	150	x	150	x	1,6	milled	
			Plate	170	x	60	x	4	ground	
			Plate	170	x	60	x	4	ground	Vacuum pins included (insert foils)
			Plate	175	x	42	x	4	ground	Ribs/feet on narrow side
			Plate	190	x	70	x	6	milled	Sprue directly on plate
			Plate	210	x	70	x	0,8	ground	Film gate long side
			Plate	250	x	90	x	3	milled	Alu-reducer available --> to 60x60x3
			Plate	250	x	30	x	2	ground	Flow path plate as insert, steel insert + two additional copper inserts available
			Plate - Round	D250		x	1		ground	Bar sprue in the middle

# Excerpt of test specimens



- 1 Cold runner / bar gate**
- 2 Hot runner nozzle**
- 3 Multi-fold hot runner**



Sprue system			Geometry			Surface	Bemerkung			
1	2	3	Designation	L	x	B	x	D		
			Plate with/without textures	192	x	152	x	2,5	ground	Cavity in AS, texture insert plate in D5 - currently three texture plates available
			Overmolding foil/sheet metal	220	x	115	x	2	milled	Overmoulding of an insert (240x145x2 mm) - "Cut-out (220x115x2 mm)" is overmoulded, protruding pins for hanging the insert + blind pins
			Rib Plate 2x10	320	x	130	x	3,8	milled	Bore for breathing measurement (eddy current sensor) available
			Rib Plate 2x2	320	x	26	x	3,8	milled	Bore for breathing measurement (eddy current sensor) available
			Rib Plate 2x4	320	x	52	x	3,8	milled	Bore for breathing measurement (eddy current sensor) available
			Rib Plate 2x6	320	x	78	x	3,8	milled	Bore for breathing measurement (eddy current sensor) available
			Rib Plate 2x8	320	x	104	x	3,8	milled	Bore for breathing measurement (eddy current sensor) available
			Rib Plate 4+4	320	x	52	x	2,5	milled	central bar gate, ribbed plate symmetrically left/right of center
			Stripes with shoulder geometry(s)	190	x	20	x	4	milled	Shoulder geometries: standard/ribbed/for soft materials + blind insert
			Special plate LFG "Spaceship" - with reducer insert	120	x	120	x	4	milled	small plate 120 x 120 x 4 mm + 2x directly moulded tensile test specimens type 1A + 2x directly moulded weld tensile test specimen with weld seam according to Type 1A, e.g. for TSG tests
			Plate	150	x	150	x	5	milled	
			Plate - with reducer insert	200	x	200	x	3	milled	Aluminium insert to reduce size from 310x310 to 200x200
			Plate - Fields with seven polishing grades	210	x	140	x	3	7 differ. polishes	Cavity designed as an insert
			Special plate for LFG "Spaceship"	300	x	260	x	4	milled	Test specimens for fiber-reinforced / filled plastics (0°, 45°, 90°) + 2x tensile test specimen Type 1A + 2x tensile test specimen Type 1A with weld line
			Plate	310	x	310	x	2	milled	
			Plate	450	x	110	x	2	milled	fire test plate FMVSS 571, FMVSS 302
								3		
								4		
								5		
								6		

# Excerpt of test specimens



- 1 Cold runner / bar gate**
- 2 Hot runner nozzle**
- 3 Multi-fold hot runner**



Sprue system			Geometry				Surface	Remark			
1	2	3	Designation	L	x	B	x	D			
			Tensile test specimen Type 1A						stroke polished	Hot runner 2-fold, two tensile test specimen each over two inserts, two pairs of inserts: 2+2 Type 1A aluminium insert & steel inserts with 1xType 1A each and "grid plate"	
			Plate	80	x	75	x	4x1	4x2 4x4	ground	Hot runner 4-fold different needle geometries
			Plate	80	x	75	x	1x3		ground	Hot runner 4-fold, base plate 3 mm with 0.3 mm overmolding, supernatant of overmoulding, + 2x "overflow cavity, vacuum pins available
			Plate	100	x	75	x	1x0,3		ground	
			Plate	210	x	70	x	0,8		milled	Hot runner 4-fold, connection via two hot runner nozzles Valve gate
			Plate	235	x	60	x	0,8		milled	Hot runner 4-fold, connection via two hot runner nozzles Valve gate
			Segmented plate (40 - 480 mm length in steps)	480	x	110	x	2,5	4   8	finely blasted	segmented, wall thickness jumps/steps possible, fire test plate FMVSS 571, FMVSS 302
			Plate segmented	520	x	110	x	10		finely blasted	Lateral connection, segmented, wall thickness jumps/steps possible
			Plate segment	240	x	110	x	2,5	4	grained/textured	
			Plate segment	240	x	110	x	2,5	4	eroded, VDI 3400 Ref. 36	
			Plate segment	240	x	110	x	2,5	4	polished	
			Plate segment - Flow obstacle round			110	x	4		finely blasted	
			Plate segment - Rib longitudinal			110	x	4		finely blasted	
			Plate segment - Rib transverse			110	x	4		finely blasted	
			Plate segment - House			110	x	4		finely blasted	
			Plate segment - Impact rod	80	x	10	x	4		finely blasted	
			Plate segment - fire test specimen	125	x	13	x	3,2	1,6   0,8	finely blasted	
			Plate segment - tensile test specimen Typ 1A							finely blasted	
			Plate segment - S2 tensile test specimen							finely blasted	
			Plate	310	x	280	x	3		stroke polished	
			Plate	310	x	200	x	2		stroke polished	
			Special plate LFG "Spaceship"	300	x	260	x	4		stroke polished	Test specimens for fiber-reinforced / filled plastics (0°, 45°, 90°) + 2x tensile test specimen Type 1A + 2x tensile test specimen Type 1A with weld line
			Plate	100	x	100	x	3		stroke polished	
			Plate	200	x	200	x	3		stroke polished	

# Excerpt of test specimens



- 1 Cold runner / bar gate**
- 2 Hot runner nozzle**
- 3 Multi-fold hot runner**



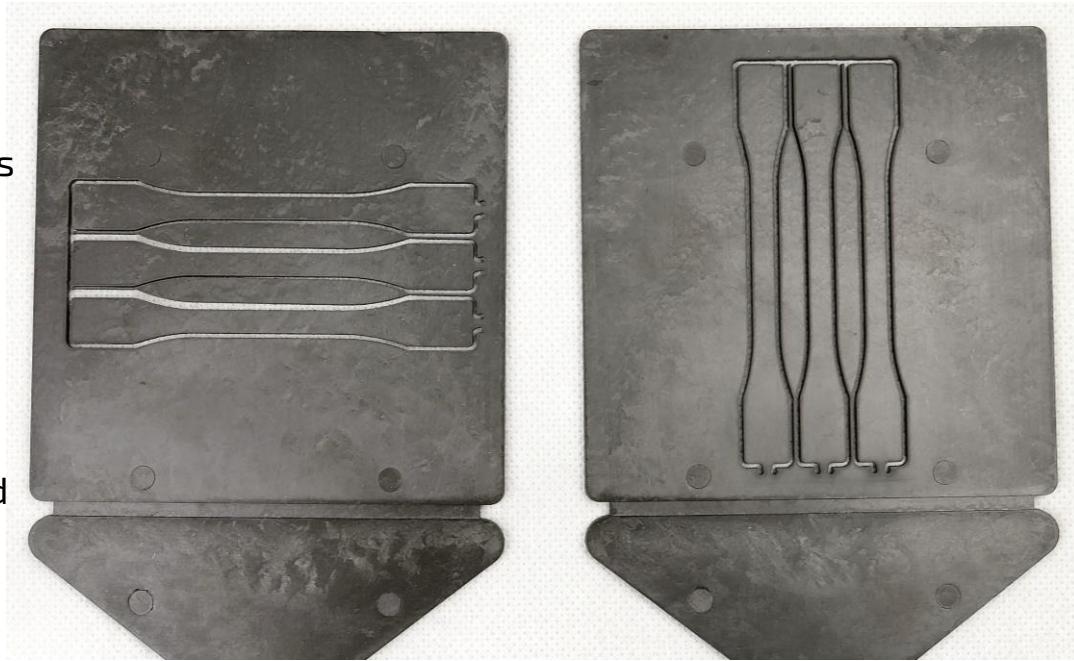
Sprue system			Geometry						Surface	Remark	
1	2	3	Designation	L	x	B	x	D			
			Plate "Storage compartment" - 4 variants	290	x	160	x	4 5 3 6	ground/polished	Geometry for overmolding a pre-molded part in different sizes Thickness combinations, e.g. 3+3 mm, 4+1 mm, hot runner connection, manual repositioning	
			Special test specimens - round	Da		40,5		Di 10,5	ground	Friction test specimens	
			Shell	154	x	154	x	2 4 6 8	ground	Injection stamping tool, central gating via hot runner valve gate, base thickness variable	
	<b>Overmoulding of inserts:</b> Insert geometry			80	x	20	x	0,8 2	metallic inserts	Determination of the pull-out force and media tightness between insert / overmolding	
	Length of overmoulding 8 & 16 mm									Variants Insert geometry/overmoulding can be combined	
	Thickness of overmoulding: 1,5 & 3 mm										
	Insert geometry "bending beam"			90	x	11,4	x	4,2	ceramic inserts	Flat overmoulding on the pulp side (11.4 mm), overmoulding length variable between 13-45 mm (6 steps)	
	Insert geometry "rod - overmoulding"			90	x	11,4	x	4,2		short/long overmoulding 8/16 mm - thin/thick overmoulding 2/3.5 mm	
	Insert geometry "bearing block"			10	x	Da 8	x	Di 4 Di 6		Sleeve thick-walled/thin-walled - overmoulding 2/3.5 mm	
	Insert geometry "cuboid"			20	x	20	x	8,3		"5-sided" overmoulding of the cuboid	
	Insert geometry "sleeve"			12	x	Da 15	x	Di 10		Overmoulding thin-walled/thick-walled 1.3/2.5 mm	
	Insert geometry "sleeve"			12	x	Da 20	x	Di 10		"Internally overmoulded/injected", thin-walled/thick-walled 2.5/5 mm	

## ▪ Waterjet Cutting

- for small to very large plates/test specimens
- Well suited for carbon fiber reinforced and highly filled materials
- No heating of the cut edges due to cutting

## ▪ Milling/sawing

- suitable for small and medium-sized plates/test specimens
- not suitable for carbon fiber-filled materials
- No contact with water during processing



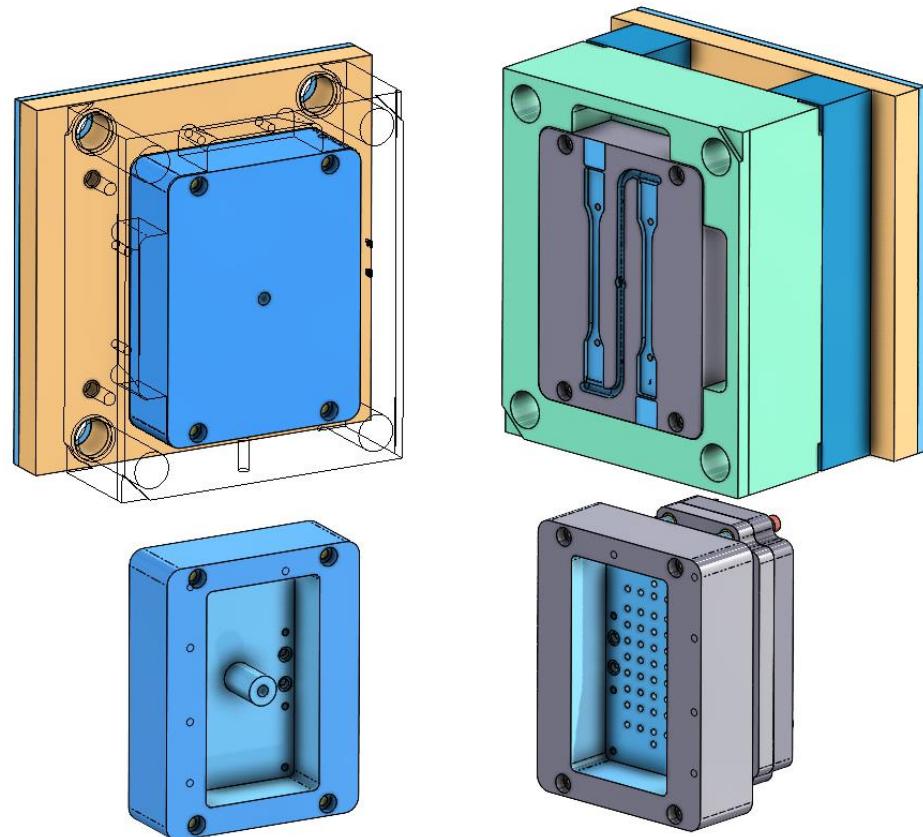
**Waterjet cutting of test specimens from a 100x100 plate made of highly filled thermoplastic**

# Universal moulds

# For small component dimensions

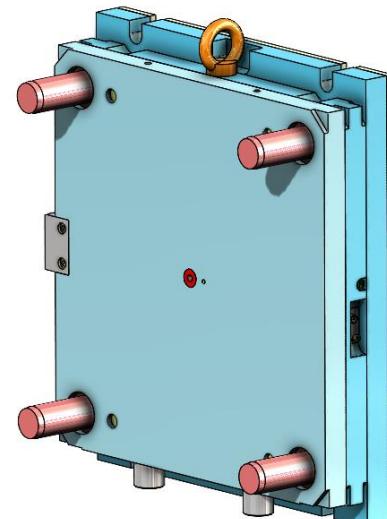
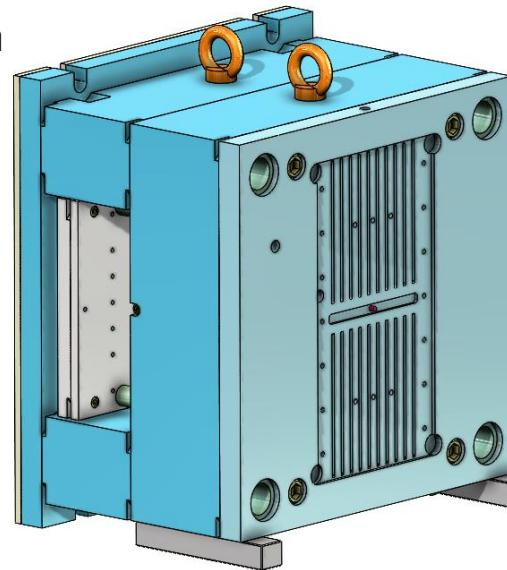
## Meusburger FW superstructure

- Cavities AS/DS via interchangeable packages
- Complete interchangeable packages, with ejector package, available as standard parts
- Insert size 220 x 170 x 60 mm
- Cold runner connection
- Moulded plates with cavities can be produced according to customer requirements



# For medium component dimensions

- A large number of moulded plates with different cavities available
- Customer-specific mould plates can be produced
- Dimensions mould plates 396 x 396 mm
- Variable height of interchangeable mould plates
- Cold runner and hot runner connection
- Nozzle sides with 2- and 4-fold hot runner available
- Mould-plates with cavities can be produced according to customer requirements

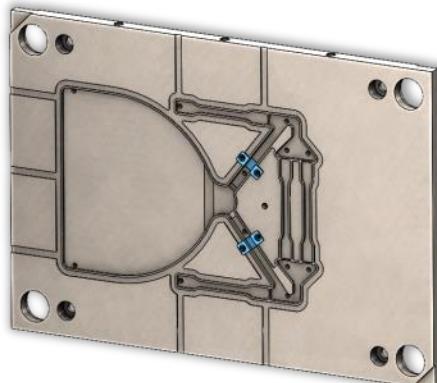
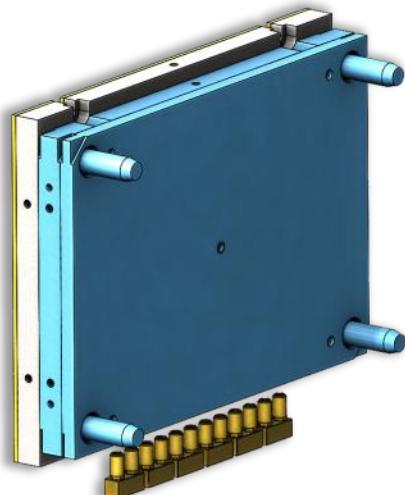


# For large component dimensions Ejector side & nozzle sides can be replaced

SKZ

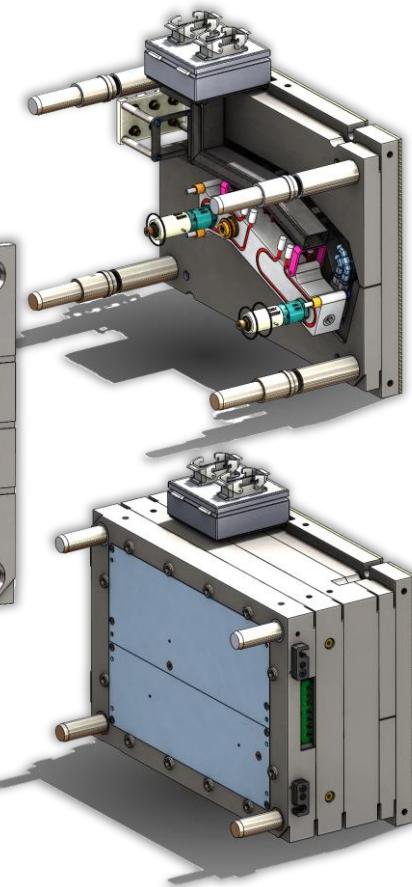
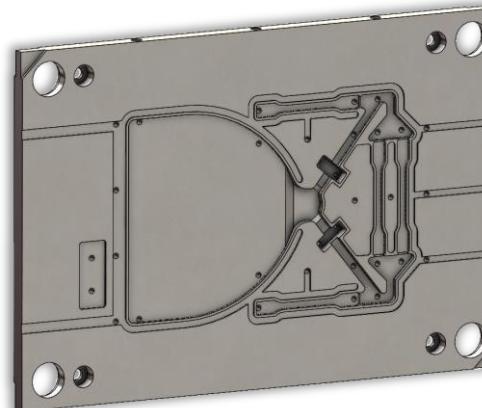
## Cold runner tool

- Bar sprue  
d:10/14, 110 mm



## Hot runner tool

- 2-fold hot runner
- Valve shut-off nozzle



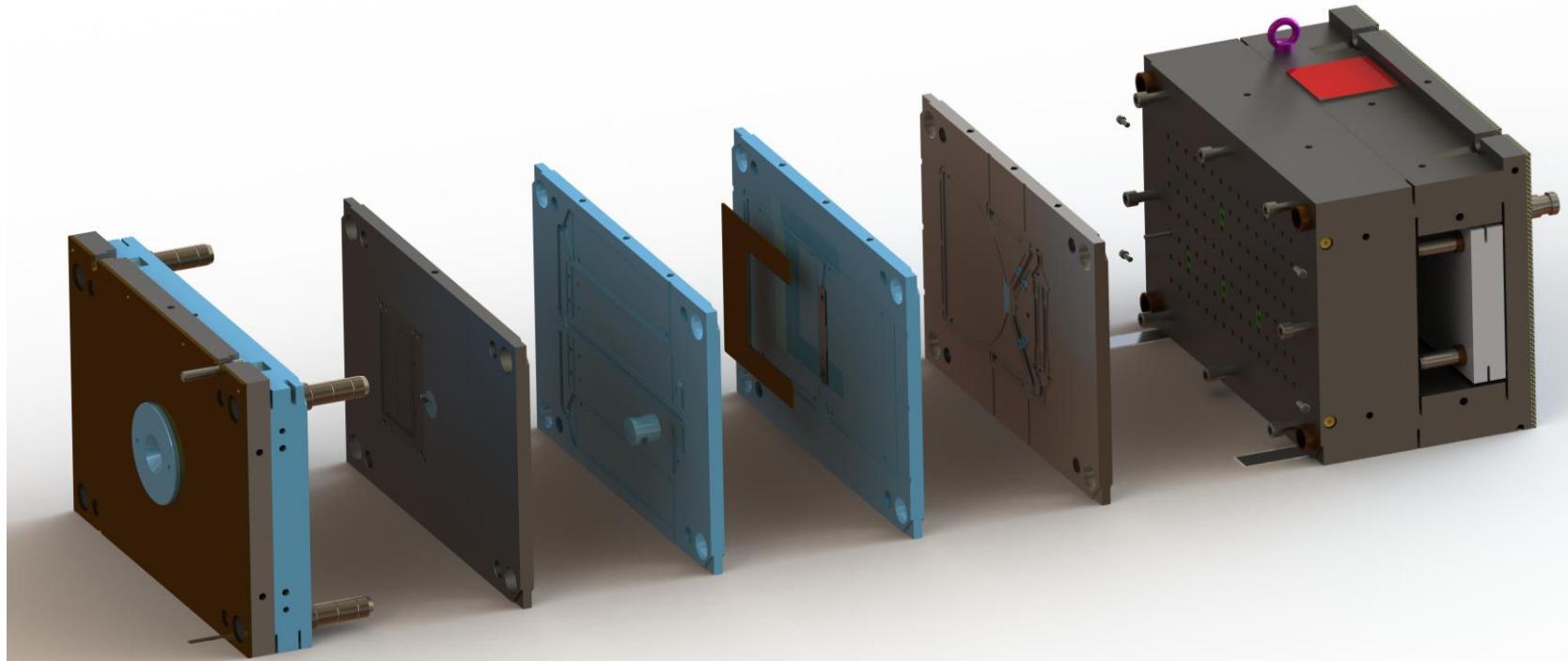
**Dimensions of mould plate:** 796 x 546 mm

# For large component dimensions

## Ejector side & nozzle sides can be replaced

### Universal mould design with various interchangeable mould plates

- Mould-plates with cavities can be produced according to customer requirements



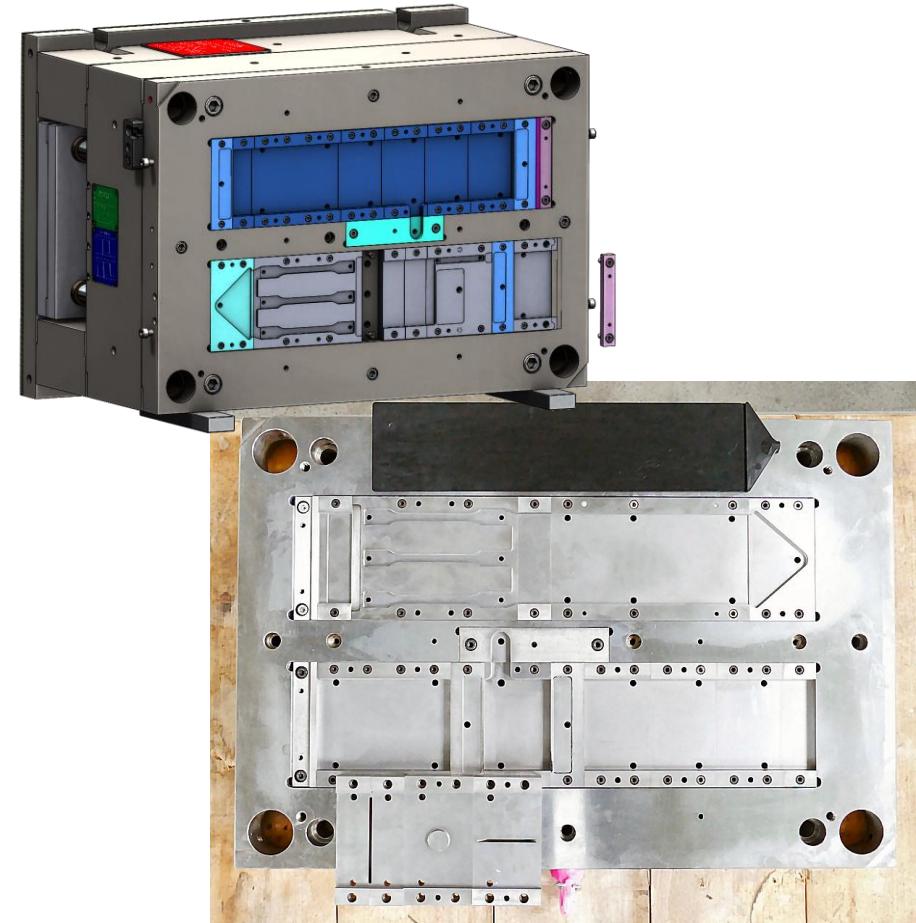
# For large component dimensions

## Mould plate with segmented interchangeable inserts

SKZ

### Configurable Plate Mould

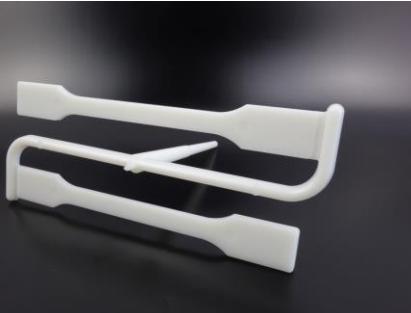
- 2-fold hot runner with valve gate
- Max. length 480 mm
- Width 110 mm
- Thicknesses 2-10 mm
- Inserts at the end of the plate with tensile test specimen, impact bending specimen
- Flow obstacles:
  - Rib longitudinal
  - Rib transverse
  - Large bore
- Inserts with textures, polished, eroded



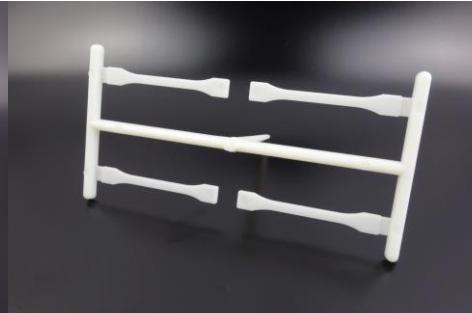
# **Examples of Test Specimens/Plates**

# Example of standard test specimens/plates

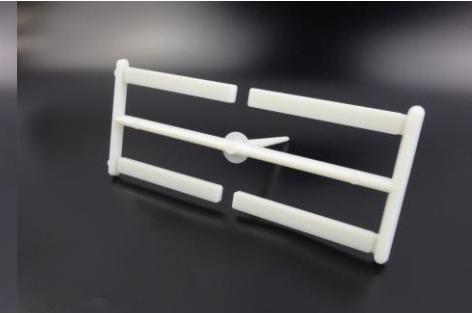
SKZ



**Test specimen type 1A according  
to DIN EN ISO 527 - 2**  
**Mould according to DIN EN ISO  
294 - 1**



**Test specimen type 1BA  
according to DIN EN ISO 527 - 2**  
**Mould according to DIN EN ISO  
294 - 1**



**Impact rods according to DIN EN  
ISO 179 - 1 for Charpy DIN EN ISO  
180 for Izod, Mould according to  
DIN EN ISO 294 - 1**



**LOI-Test specimen**  
**150mm x 6,5mm x 3mm**  
**150mm x 10mm x 4mm**



**UL 94 specimen 125 x 13 x  
0,4 / 0,8 / 1,2 / 1,5 / 1,6 / 2,0 / 3,2  
/ 4,0 mm**



**Plate 60 x 60 x 2 mm for  
shrinkage measurement  
according to DIN EN ISO 294-4**



**Step plate 120 x 60 mm, graded  
from 4 mm to 2 mm to 1 mm,  
segments 40 x 60 mm each**

## Different surfaces possible:

- Stroke polished,
- Polished
- Structure
- Grain
- Eroded VDI 3400 Ref. 21
- Eroded VDI 3400 Ref. 27
- Eroded VDI 3400 Ref. 33
- Eroded VDI 3400 Ref. 39

# Examples of plates



**Plate 100 x 100 x  
2 / 4 / 6 / 8 / 10 mm**



**Plate 110 x 100 x 3 mm  
Highly polished on both sides**



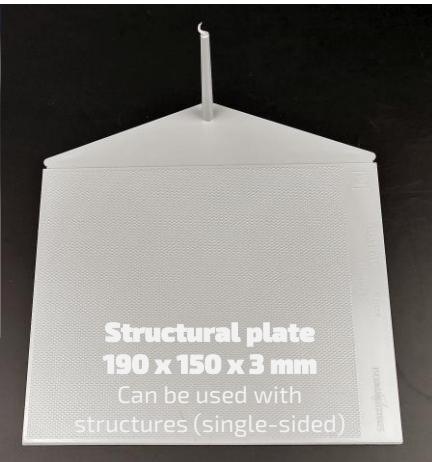
**Plate 150 x 100 x 3 mm**



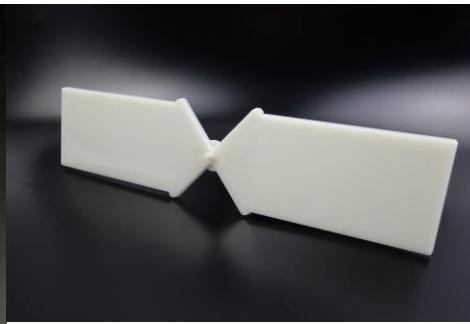
**Plate 310 x 310 x 2 / 3 mm**



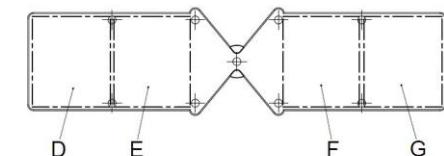
**Plate 450 x 110 x 2 / 3 / 4 / 6 mm**



**Structural plate  
190 x 150 x 3 mm**  
Can be used with  
structures (single-sided)



**Plate 100 x 60 x 4mm  
Different surfaces on components**

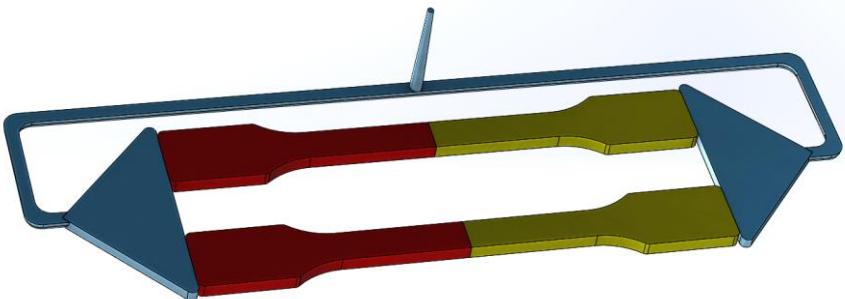


D: technical gloss polish  
E: Dash polished  
F: VDI 3400, Ref. 21  
G: VDI 3400, Ref.33

# **Examples of special test specimens**

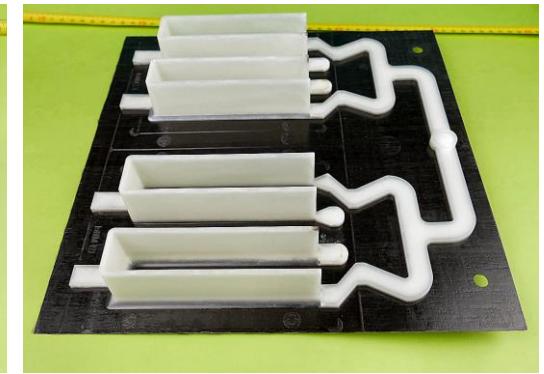
## 1K tension rod according to type 1A with weld line

- **Weld seam strength**  
(e.g. after the flow around an obstacle or after the confluence of two melt fronts)
- **Different gate geometries possible**  
(e.g. flow behavior TPE due to shear heating)



## Test specimen for injection moulding of rib geometries

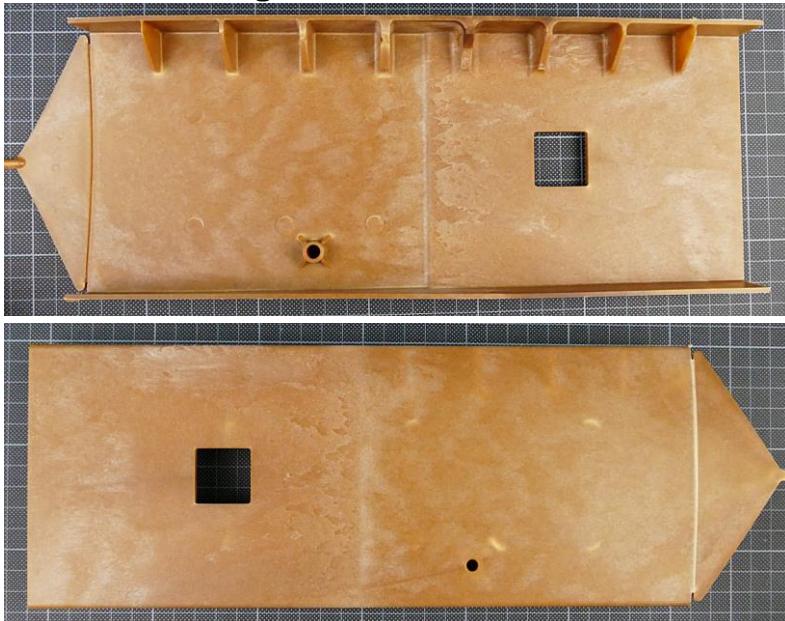
- Preheating station for organic sheets
- Inserts with different rib geometries/-heights
- Different organic sheet thicknesses possible
- Injection via hot runner with valve gate



# Test specimens for TSG tests

## Plate with ribs & opening

- Suitable for physical/chemical foaming
- Wall thickness jump with thick wall at the end of the flow path
- Breakthrough and dome-like geometry
- Different rib geometries



## Test specimens for mechanical tests

- Moulded tension rods
- Tension rods with weld seam
- Side branches can be locked off (tension rods)

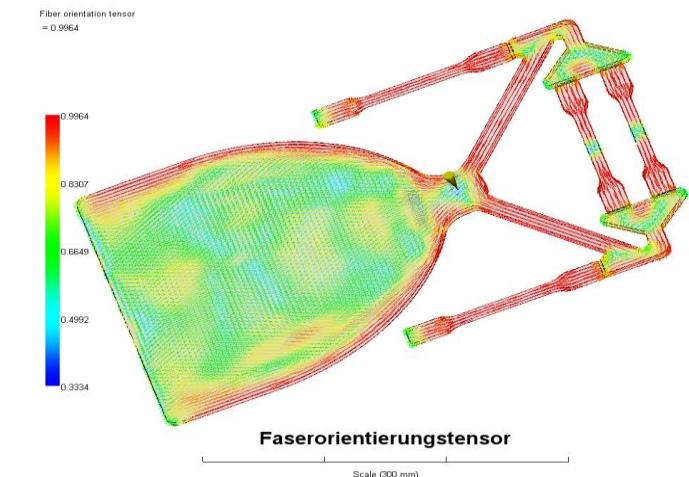
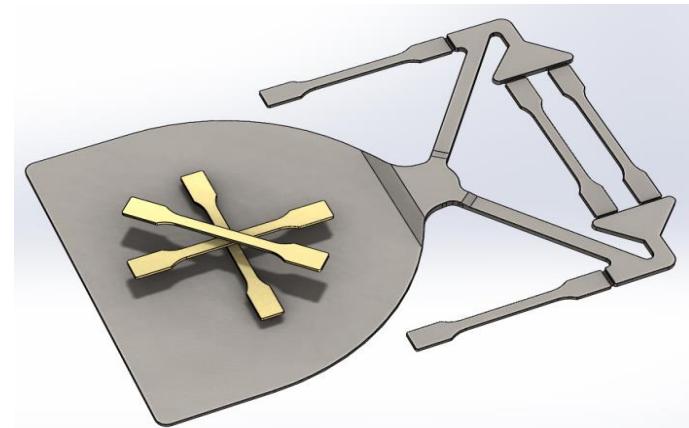
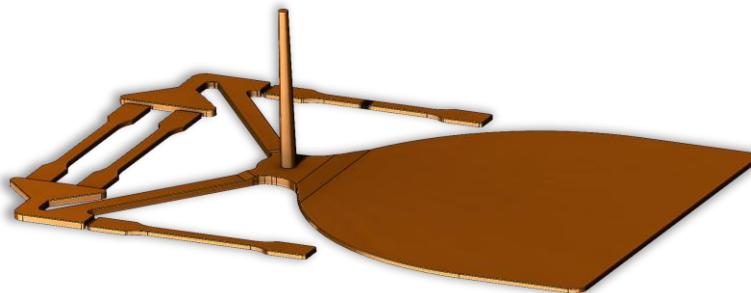


# Test specimens for fiber-reinforced polymers

SKZ

## Special test specimen 300 x 260 x 4 mm

- Tensile test specimen
- Tensile test specimen weld seam
- Side branches can be locked off (tension rods)
- Large-area plate for preparation (water jetting/milling) of test specimens at different angles to the direction of flow (e. g. 0° , 45° , 90° )
- Variants Connection:
  - Fiber-optimized hot runner
  - Cold runner with bar gate



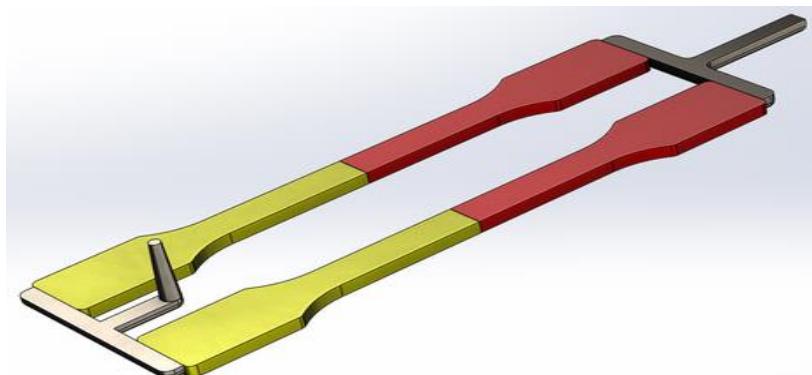
# **2K test specimens**

**&**

# **Adhesion tests**

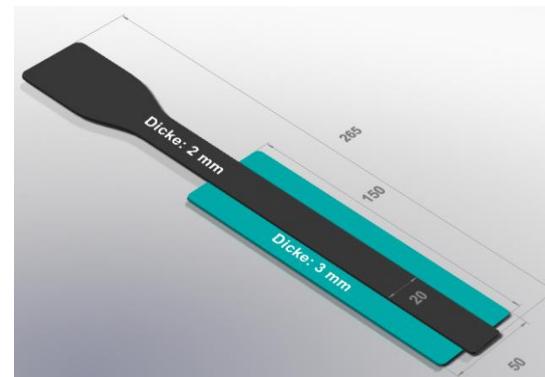
## 2C tensile test specimen according to Type 1A:

- For hard/soft composites &
- Hard/hard composites



## 2C peeling specimens according to VDI2019:

- Suitable for hard/soft composites
- Conditionally suitable for hard/hard composites



- Core – Back technology with interchangeable cores:
  - Surface structure in the overmoulding area!
  - eroded & polished
- Wall thicknesses of the hard and soft components can be varied:
  - Soft component infinitely variable between 0 - 3 mm
  - Hard component over inserts 2 & 3 mm
- Cold inserts possible, any substrates can be overmoulded

# 2C – Peel test specimens „MINI“ based on the test specimen according to VDI2019

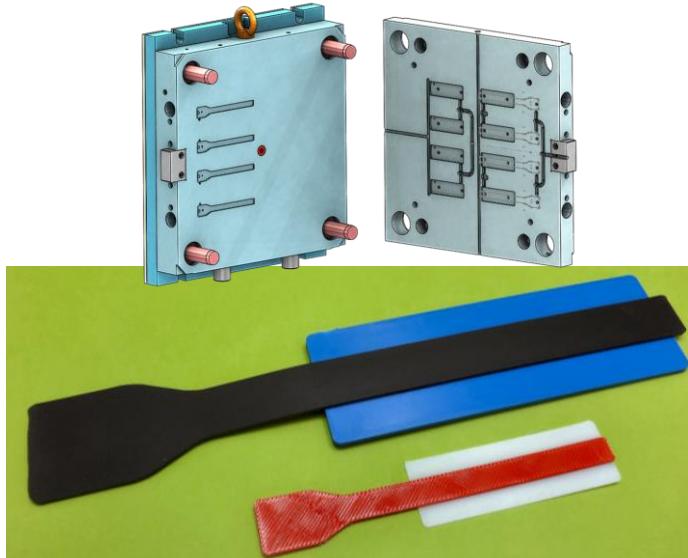
- Insertion procedure
- Manual repositioning of the pre-moulded part
- e.g. for comparison between injected & printed 2C test specimens

## Heart component

- Length: 50 mm
- Width: 25 mm
- Thickness: 2.5mm

## Soft component

- Length: 132 mm
- Width: 10 mm
- Thickness: 2.0 mm



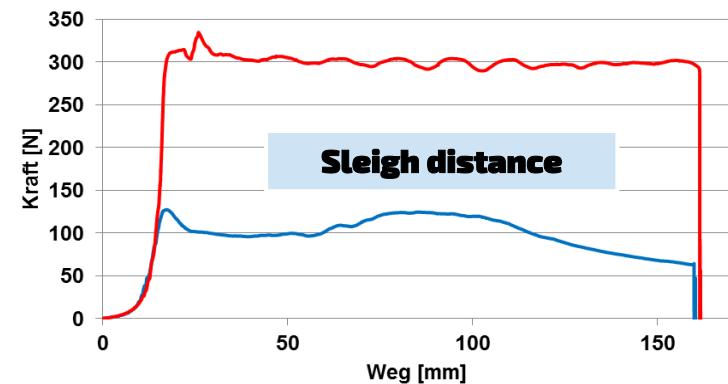
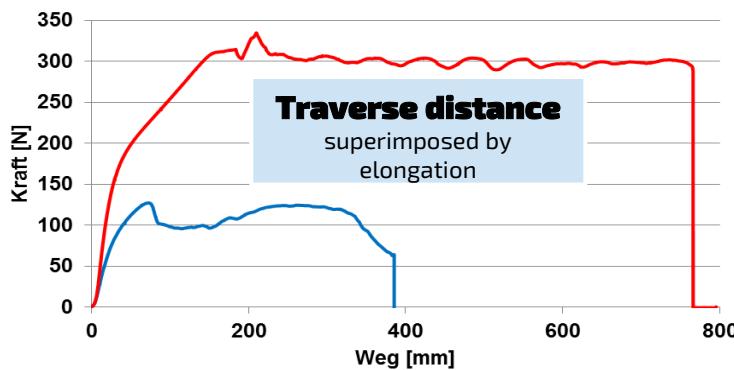
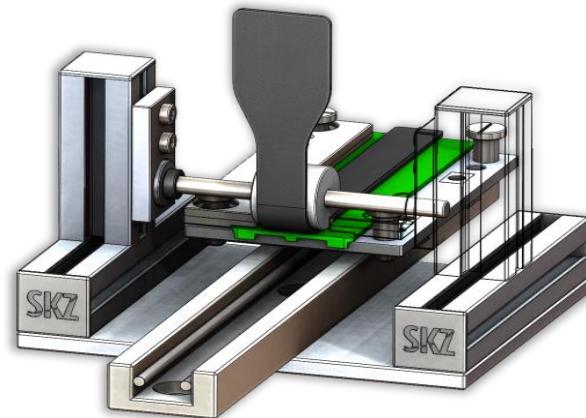
top: Peel test specimen according to VDI2019

Bottom: "Mini" Peel Specimen



## Peel test with measurement of the sledge

- Reproducible measurement possible from a peeling force > 1 N
- For materials from approx. 20 ShoreA - 40 ShoreD
- Use of pneumatic clamping jaws to fix the TPE
- Measurement of the peeling force, the traverse travel of the tensile testing machine and the slide travel
  - Better comparability of widely differing combinations
  - More precise and faster evaluation of the peeling force curve
  - Locally occurring force value can be assigned directly to the position on the test specimen



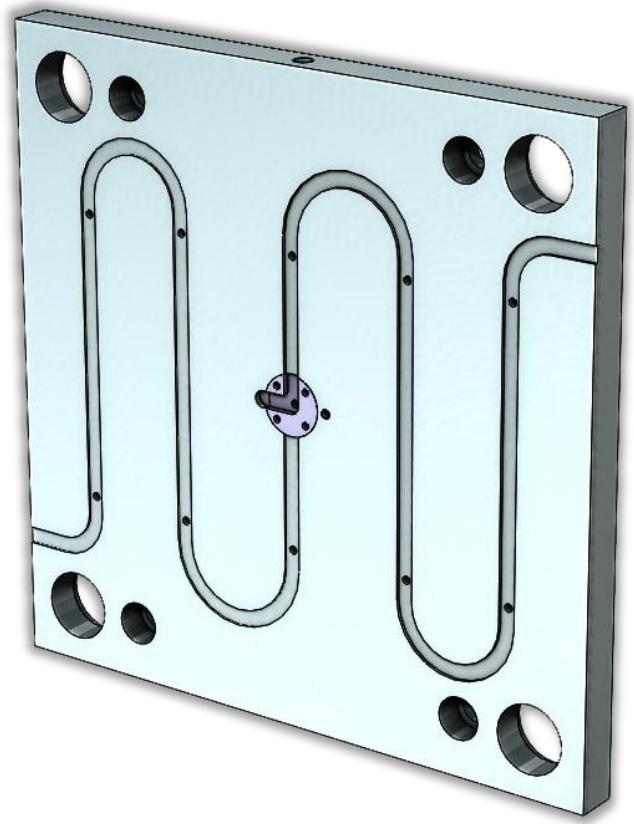
- Testing of different overlap lengths possible
- Test speed can be selected depending on the material combination
- Sawing of the test specimens to the required test or shear length
- Form-fitting clamping of the test specimens



Ductile Hard Component	Tough Hard Component	Brittle Hard Component	Brittle Hard Component	Low shear strength
Pronounced flow behavior without breakage	Break at the transition to flow	Break at the transition	Fracture within the composite surface	Complete detachment

# **Flow path test specimens**

- Replaceable Cavity Plates
- Geometry
  - Plate Material: Steel
  - Channel width: 10 mm
  - Duct length: 770 mm
  - Wall thicknesses: 0.4 ; 0,8 ; 1,5 ; 2,5 ; 4 & 6 mm
  - Demoulding angle: 1°
  - Sprue crossover for switching between two variants
  - Can be used with variant 1.5 / 2.5 mm "thin spot" or shear zone
- Fixed mould half
  - Tool material: steel
  - Cold runner gate



# Flow spiral II

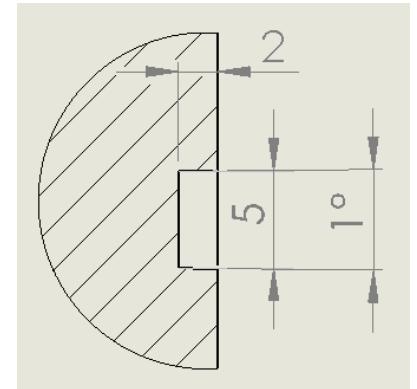
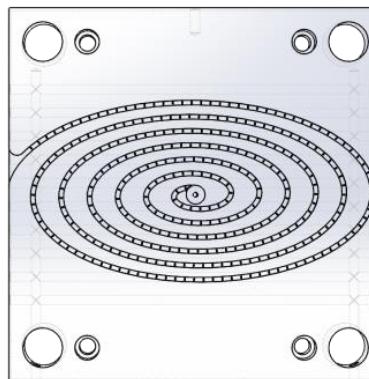
- Geometry
  - Temperature control circuits in the plate
  - Plate Material: Aluminum (3.4365)
  - Channel geometry: 5 x 2 mm
  - Demoulding angle: 1°
  - Markings according to 10 mm
- Fixed mould half
  - Tool material: steel
  - Cold runner gate



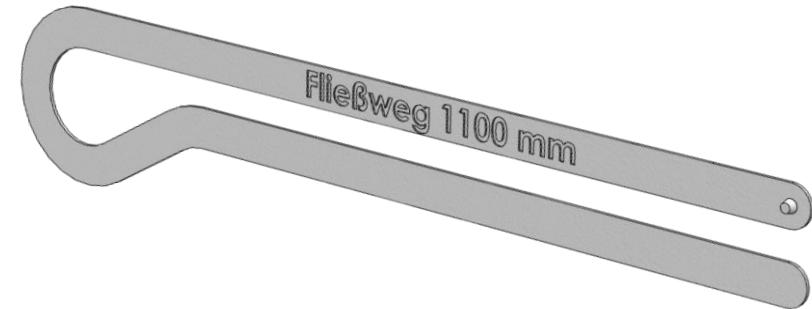
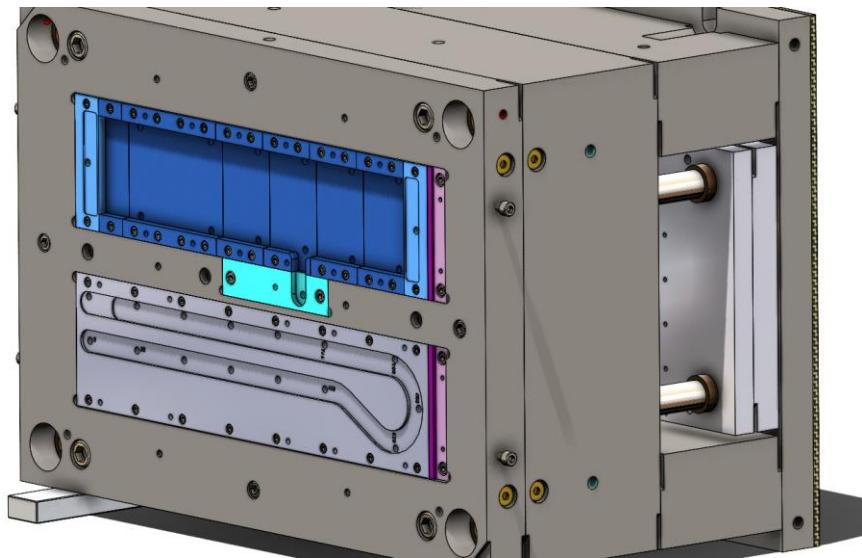
Ejector side



Fixed mould half



- Geometry
  - Temperature control circuits in the plate
  - Plate Material: Steel
  - Channel geometry: 1100 x 25 x 3 mm
  - Demoulding angle: 2°
- Fixed mould half
  - Tool material: steel
  - Hot runner gate



# **Fiber content**

# **Fiber Orientation**

# **Fiber Length Distribution**

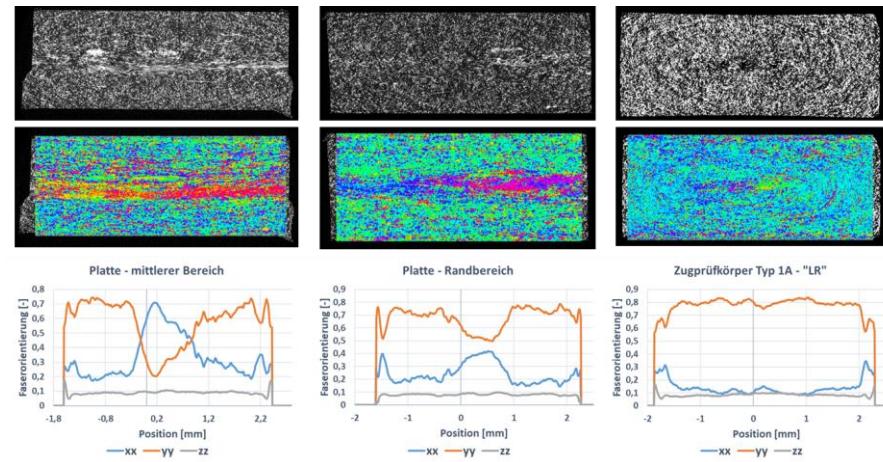
## Incineration & Determination of Fiber Content

- Incineration of components, mass cakes, hosed strands (machine nozzle, hot runner), granules, ...
- Exposure of the fibrous skeleton
- Determination of the local fiber content at one or more points of the component



## Determination of fiber orientation

- Determination of local fiber orientation or fiber tensors by means of computed tomography
- Graphical and numerical evaluation
- Use of numerical parameters for mechanical FEM simulations

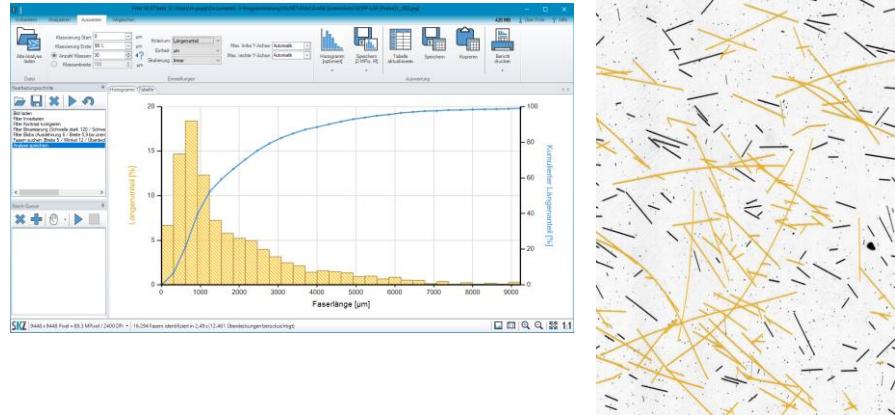


# Fiber Length Distribution

SKZ

## Range

- Acquisition of up to 65,000 individual fibers per scan/image
- Automatic detection of long, bent and/or crossed fibers
- Use of Scans and/or microscopy images
- Numerical and graphical evaluation of the fiber length distribution with mean values (arith. & weighted) as well as quantiles...



## Application

- Optimization of process parameters and tools
- Quality assurance
- Determination of local fiber length distributions on the component
- Correlation to mechanical properties
- For use in FEM simulation programs



Statistik						
Ausgewertet:	16.294 Stck.	Gesamtlänge:	9.140 mm	Faserpixel:	3,69 %	
Quantile						
Häufigkeit	d10: 31,8	d25: 42,3	d50: 285,8	d75: 732,4	d90: 1.327,2	d95: 2.111,4 d99: 4.195,2 µm
Längenannteil	d10: 409,6	d25: 669,9	d50: 1.168,4	d75: 2.447,9	d90: 4.295,8	d95: 5.579,5 d99: 9.230,8 µm
Klassentabelle						
Klasse	von	bis	Anzahl	Häufigkeit	I. Häufigkeit	Längenannteil
1	< 0 µm	0 µm	0	0,00 %	0,00 %	0,00 %
2	0 µm	308 µm	8.302	50,95 %	50,95 %	6,67 %
3	308 µm	615 µm	2.859	17,53 %	68,49 %	14,67 %
4	615 µm	923 µm	2.453	13,72 %	92,27 %	16,32 %
5	923 µm	1.231 µm	1.065	6,54 %	88,73 %	12,32 %
6	1.231 µm	1.538 µm	484	2,97 %	91,76 %	7,24 %
7	1.538 µm	1.846 µm	314	1,93 %	93,68 %	5,78 %
8	1.846 µm	2.154 µm	201	1,21 %	95,15 %	5,24 %
9	2.154 µm	2.462 µm	157	0,93 %	95,49 %	4,95 %
10	2.462 µm	2.769 µm	140	0,86 %	97,23 %	3,99 %
11	2.769 µm	3.077 µm	99	0,61 %	97,84 %	3,17 %
12	3.077 µm	3.385 µm	71	0,44 %	98,28 %	2,50 %
13	3.385 µm	3.692 µm	56	0,34 %	98,62 %	2,10 %
14	3.692 µm	4.000 µm	34	0,21 %	98,95 %	1,45 %
	4.000 µm	4.308 µm	35	0,21 %	99,04 %	1,58 %
	4.308 µm	4.616 µm	35	0,21 %	99,13 %	0,67 %
	4.616 µm	4.924 µm	35	0,21 %	99,22 %	0,34 %
	4.924 µm	5.232 µm	35	0,21 %	99,31 %	0,17 %
	5.232 µm	5.540 µm	35	0,21 %	99,40 %	0,08 %
	5.540 µm	5.848 µm	35	0,21 %	99,49 %	0,04 %
	5.848 µm	6.156 µm	35	0,21 %	99,58 %	0,02 %
	6.156 µm	6.464 µm	35	0,21 %	99,67 %	0,01 %
	6.464 µm	6.772 µm	35	0,21 %	99,76 %	0,00 %

We determine the fiber length distribution on your sample or component.

Alternatively, you can purchase the FiVer software from us.

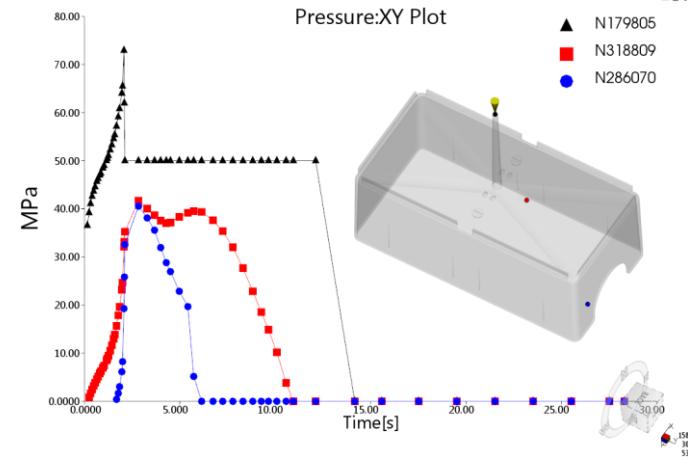
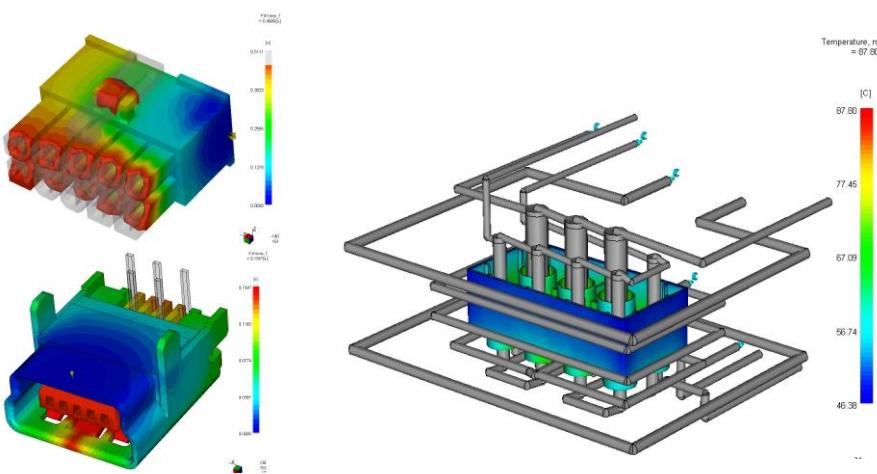
# Injection Moulding Simulations

# Industry Service: Injection Molding Simulation



## Our Capabilities

- We have more than 20 years of experience in injection molding simulation
- During this time, countless issues have been dealt with in R&D projects and industrial contracts
- For the simulation we use Moldex3D and SIGMASOFT



## What we offer

- We simulate your injection molding process from simple mold filling, shrinkage and distortion to transient considerations
- On request, our experienced employees will provide suggestions for optimization of the component/tool design and explain the results in a comprehensible way
- We provide the results in the form of reports and/or viewer files

# Industry Service:

## Simulative support from the idea to series production



### Our Capabilities

- Rheological Simulation
- Thermal Simulation
- Shrinkage & Distortion
- Transient Viewing
- ...

### What we offer

- We accompany your product simulative from the idea to series production
- From the initial fill analysis to the transient calculation of the injection moulding process, including tools and suggestions for optimal processing parameters
- Compilation of an individual complete package instead of individual simulations

Feature	Package I: Basic Fill & Pack	Package II: Advanced Fill, Pack & Warp	Package III: Professional Fill, Pack, Cool & Warp	Package IV: DigiTwin Transient
3D Model Component Required	✓	✓	✓	✓
Simplified layout of the temperature control required	X	✓	✓	✓
Final component geometry and final temperature control layout required	X	X	✓	✓
Mould required in 3D	X	X	X	✓
Simulation of different sprue positions	✓	✓	(✓)	(✓)
Fillability, pressure losses	✓	✓✓	✓✓✓	✓✓✓✓
Clamping force, balancing	✓	✓	✓	✓
Location of weld lines, air traps	✓	✓✓	✓✓✓	✓✓✓✓
Global Fiber Orientation	✓	✓	✓	✓
Gate Geometry, Gate Variants	X	✓	✓	(✓)
Shrinkage & Warpage	X	✓	✓✓	✓✓✓
Influence of Fiber Orientation on Shrinkage & Warping	X	(✓)	✓	✓
Consideration of the influence of a hot runner system	X	X	✓	✓✓
Suggestions for mould optimization / crowning	X	X	✓	(✓)
Consideration of a cascade, inserts ...	X	(✓)	✓	✓
Process simulation, settling and non-productive times, influence of the real mould/ influence of the moulding parameters on the component properties including shrinkage and warpage	X	X	X	✓
<b>Development stages:</b>	Pre-Development: Article Construction	Pre-development: Mould design	Design Freeze: Mould design	Process simulation: Process parameter and optimisation
<b>Simulation Quality and Prediction Accuracy:</b>	+	++	+++	++++
<b>Costs for tool modifications and troubleshooting:</b>	€	€€	€€€	€€€€



## Your contact persons

### SKZ - Das Kunststoff-Zentrum

Friedrich-Bergius-Ring 22  
Fax: +49 931 4104 - 377  
97076 Würzburg

#### **Christian Deubel**

*Industry Service*  
Phone: +49 931 4104 - 242  
E-Mail: [c.deubel@skz.de](mailto:c.deubel@skz.de)

#### **Christoph Mussauer**

*Head of Injection Molding Technical Center*  
Phone: +49 931 4104 - 190  
E-Mail: [c.mussauer@skz.de](mailto:c.mussauer@skz.de)