



# UNIQUE SYSTEM FREEFORMER

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## Current developments and industrial applications

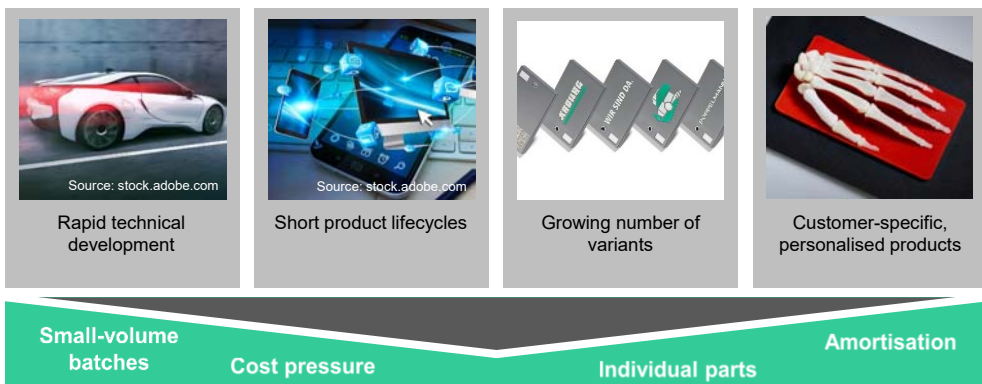
MARTIN NEFF

HEAD OF DEPARTMENT APF

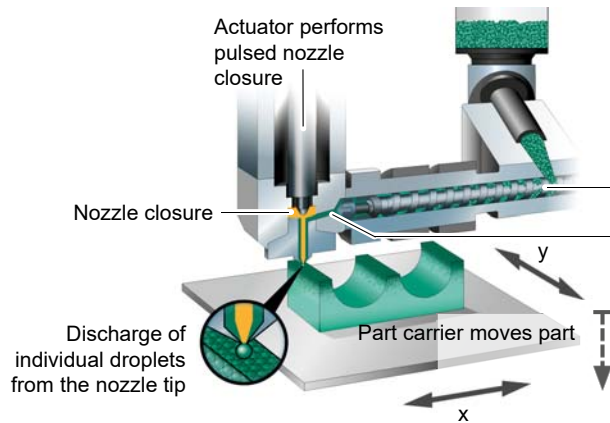
Technology Days 2019  
Lossburg, 13 - 16 March 2019

# ADDITIVE MANUFACTURING AND FREEFORMER

## PRODUCT DEVELOPMENT IS CHANGING



## PROCESS PRINCIPLE IN DETAIL



- Qualified standard granulates and original materials
- Material preparation via screw as with injection moulding
- Drying possible depending on the material
- Self-colouring possible via Masterbatch

## MATERIAL DATABASE GROWS CONTINUOUSLY



<b>Standard material types</b>	<ul style="list-style-type: none"> <li>- ABS, PC, TPEs, PA (amorphous)</li> <li>- Blends of these materials, e.g. PC-ABS</li> </ul>
<b>Special original materials</b>	<ul style="list-style-type: none"> <li>- PP (semi-crystalline)</li> <li>- X Customer-specific materials</li> <li>- Flame-proof materials</li> <li>- Medical polylactides</li> <li>- Bio-polymers</li> <li>- Conducting materials</li> </ul>
<b>Support materials</b>	<ul style="list-style-type: none"> <li>- Water or alkaline soluble</li> <li>- Compatible with build material</li> </ul>

## AVAILABLE SIZES

**freeformer 200-3X**

Discharge units		<b>2</b>
Build area		<b>200 cm<sup>2</sup></b>
Part carrier		<b>3-axis</b>

Usable	x	<b>154 mm</b>
Build chamber	y	<b>134 mm</b>
Space	z	<b>230 mm</b>

**freeformer 300-3X**

Discharge units		<b>2-3</b>
Build area		<b>300 cm<sup>2</sup></b>
Part carrier		<b>3-axis</b>

Usable	x	<b>234 mm</b>
Build chamber	y	<b>134 mm</b>
Space	z	<b>230 mm</b>

## WORLD PREMIERE – LARGE FREEFORMER

- Up to three discharge units for
  - 2-component parts with hard/soft components
  - 2 different build materials + support material
  - 3-component parts
- Build area 300 cm<sup>2</sup>
- Build chamber 234 x 134 x 230 mm
  - reachable with every nozzle
- Integrated dryer



## WORLD PREMIERE – LARGE FREEFORMER

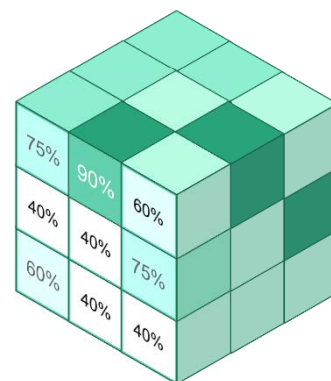
- Active electrical height adjustment of the nozzles
- Optimised nozzle design and geometry
- Build chamber with automated door
  - Integration into automatic production
- External water cooling optional



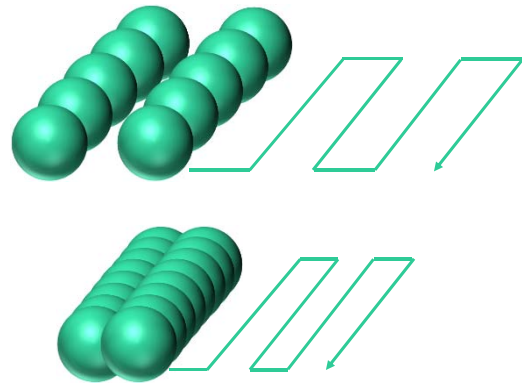
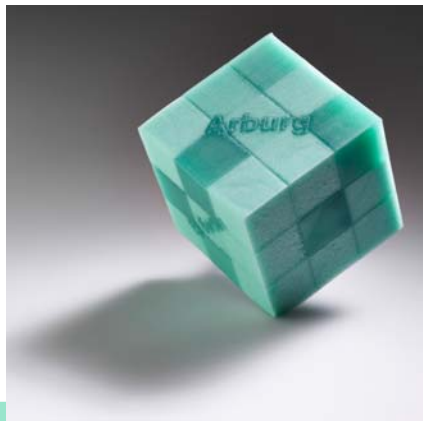
# TARGETED INFLUENCING OF PROPERTIES

## PART PROPERTIES CAN BE INFLUENCED

- Reproducible control of droplet discharge
- Variable density within a part
- Mechanical characteristics of the part can be adjusted according to requirements

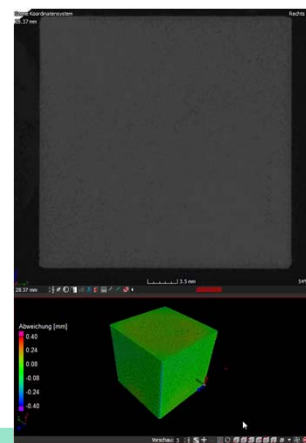


## INDIVIDUALLY ADJUSTABLE DROPLET DISCHARGE



## SPECIFIC SETTING OF COMPONENT STRENGTH

- Material: PC 2805
- Determine density with CT scan
- High mechanical values can be achieved



## OPTIMAL BUILD STRATEGY MINIMISES DISTORTION

- Semi-crystalline materials (PP) tend to distort
- Minimisation of distortion by means of
  - part-specific process control
  - optimised build strategy



## OPTIMISING PART DESIGN FOR LIGHTWEIGHT PARTS

- Lightweight structures are possible
- Design and process optimised for weight and materials
- Stability and strength at the same time





# INDUSTRIAL APPLICATIONS

## PARTS MADE OF SOFT MATERIALS

- Different types and Shore hardnesses
- Reversible, tear-resistant and impermeable
- Suitable for fully functional parts
  - Hard/soft combinations (3 components)
  - Bellows
  - Seals



## TWO-COMPONENT PART WITH INSERT

- Material
  - TPU Desmopan 9385AU
  - PA 10 Grilamid TR-XE 4010
- 2-component combination adjustable with ARBURG software
- Insertion of mechanical parts
- Check material pairing in advance



## PROTOTYPES – FAST TRACK TO MARKET MATURITY

- Magura GmbH und Co. KG
- Material
  - PA 10
  - Desmopan
- Speed up the development process
- Functional testing with prototypes



## PARTS WITH CONDUCTIVE MATERIAL

- Materials
  - PC-ABS, with carbon nanotubes (CNTs)
- Customer-specific material compound
- Direct contact with a manually inserted LED
- Capacitive applications
  - Contactless actuation of a switch



## THREE-COMPONENT PARTS

- Materials
  - ABS Terluran GP35
  - Desmopan 9385 A
- For tactile tests of hygiene products attention to material pairing necessary
- Functional test of hard-soft components
- Assembly manufactured in one piece



## IMPLANTS MADE OF APPROVED MATERIAL

- Samaplast AG
- Material
  - PCU (polycarbonate urethane) FDA-approved
  - Degrees of hardness: 90A, 80A, 65D, 55D
- Processing very close to original material specification
- Minimal reduction of inherent viscosity (IV) – comparable to injection moulding



Polymer name	Moulded part	Remo Lactid [% (m/M)]	IV measured with CHCl <sub>3</sub> at 25 °C. 0.1%		Reduction [%]
			IV of moulded part [dl/g]	IV of raw material [dl/g]	
LR 704 S	Freeformer	<0.54	1.830	2.4	24%
LR 706 S	Freeformer	<0.54	2.255	3.9	42%

## MEDICAL TOOLS AND CONSUMABLES

- AESCULAP AG
- Rivet removing device
  - ABS Terluran GP35
  - Repair of needle holders for worldwide service
- Packaging for surgical tools
  - PP Meliflex M8260 BLT
  - Fast development of new variants
  - PP approved material for medical packaging



## ORDER-BASED PRODUCTION OF EQUIPMENT – SINGLE-UNIT BATCHES

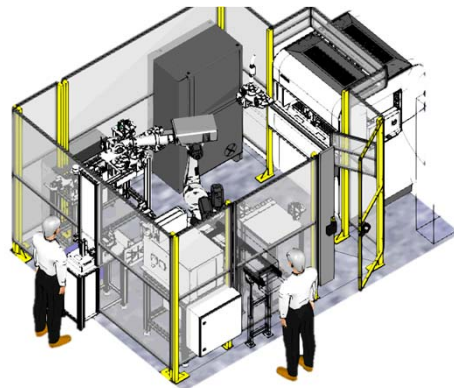
- Materials
  - ABS Terluran GP35
  - Desmopan 9370 AU
- Individually adapted gripper systems
  - Tailored to product properties
  - Manufactured directly on anodised metal plate

AM factory  
Hall 22



## COMBINING INJECTION MOULDING AND APF

- Adaptation of series components to specific requirements
- Insert – Applying a combination of different production steps possible
- Two different materials
- Integrating freeformer into automated production cell
- Communication via standardised interface

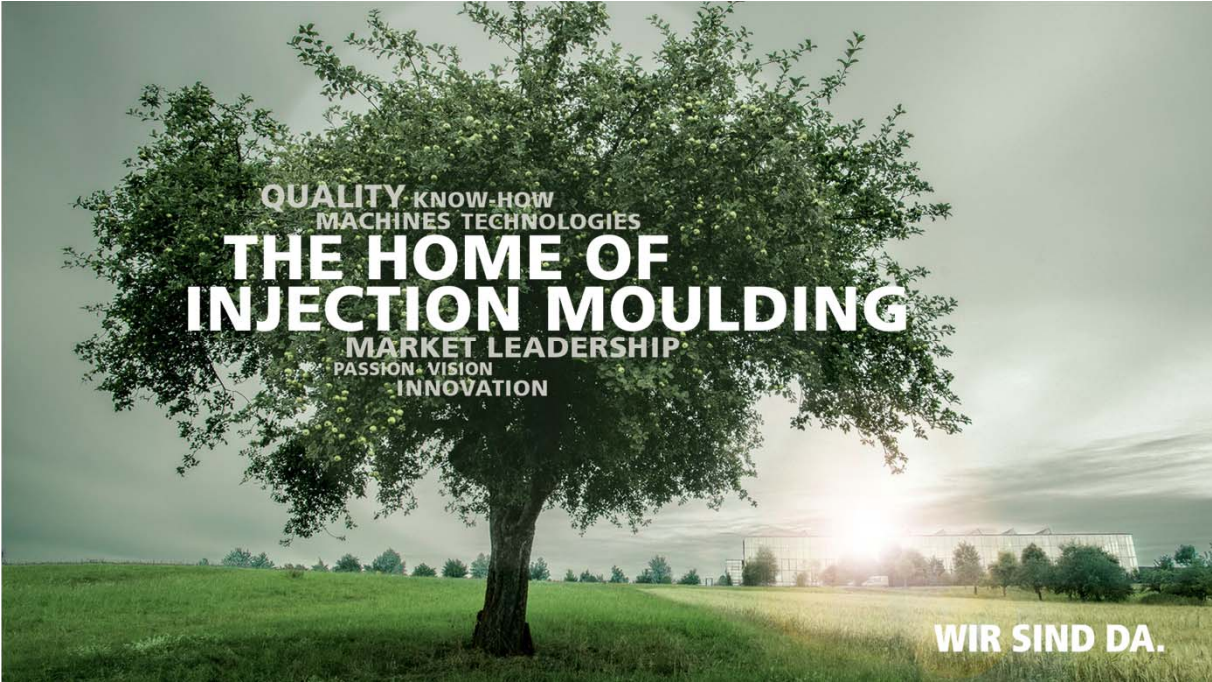


## SUMMARY

## UNIQUE FREEFORMER SYSTEM

- **Open system** – targeted influencing of part properties
- **Material database** – diversity is constantly increasing
- **Large freeformer** – functional parts made from up to three materials
- **Requirement** – get involved with the technology





QUALITY KNOW-HOW  
MACHINES TECHNOLOGIES  
**THE HOME OF  
INJECTION MOULDING**  
MARKET LEADERSHIP  
PASSION VISION  
INNOVATION

**WIR SIND DA.**