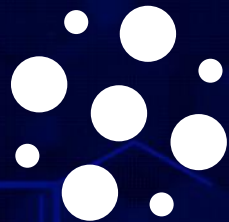


**Keine Innovation in der pulverbettbasierten Additiven Fertigung
ohne Werkstoffvielfalt: Serienqualität mit Polyolefinen (wie PP),
technischen Thermoplasten (wie TPU, PBT oder PA66) oder
veredeltem PA12 Rezyklat**



Andreas Wegner

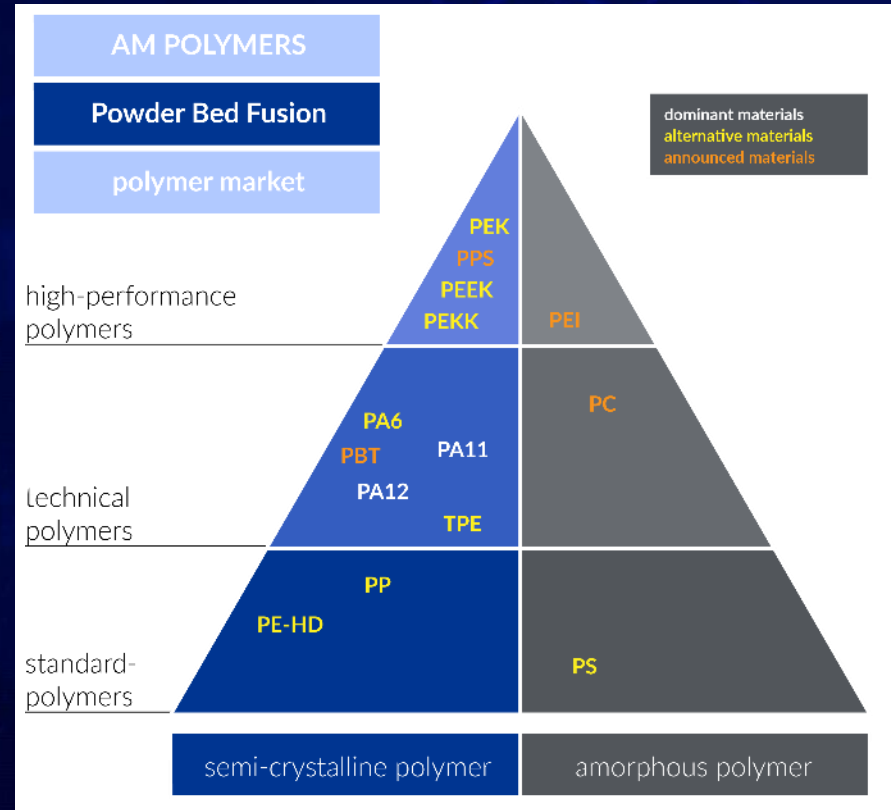
AM Polymers

19.04.2023





- ✓ Still dominance of PA12 and PA11
- ✓ Nevertheless: numerous gaps
- ✓ Alternative materials available, but niche products
 - High cost
 - Limited availability
 - Excessive batch fluctuations
 - Insufficient component properties
 - Difficult processing
- ✓ Available materials show strong differences
- ✓ Often rejection of the use of alternative materials due to bad experiences





Various applications require specific materials for additive production

- ✓ Automotive
- ✓ Aviation
- ✓ Electronics industry
- ✓ ...

But:

- ✓ **Changing the process is already one big hurdle**
- ✓ **Change of material is one step too much**



Extension of the material market by essential standard plastics:

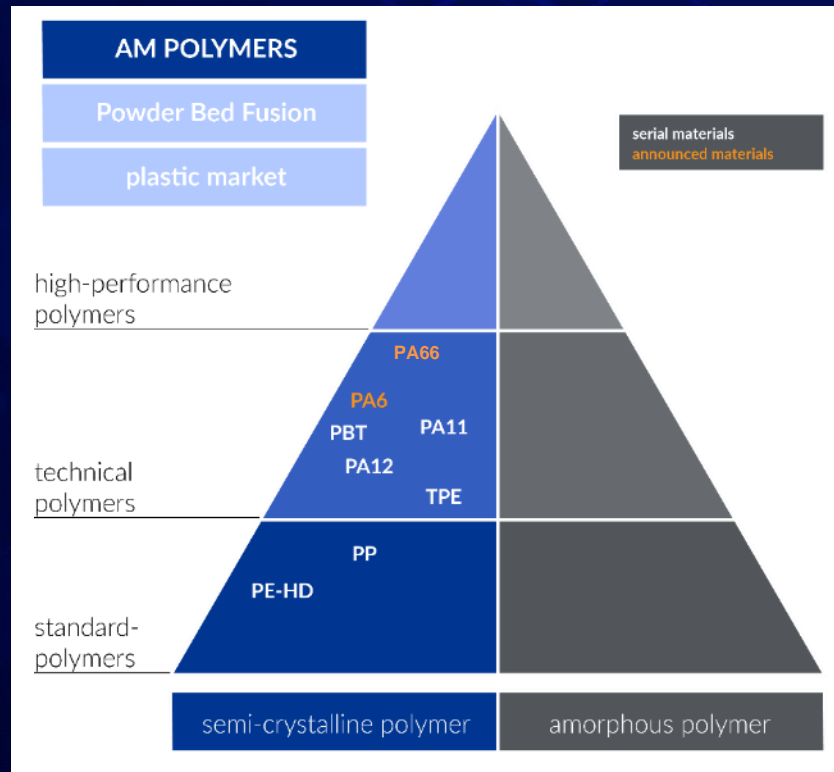
- ✓ Qualified polymer powder materials
- ✓ Easy to process
- ✓ Short running-in times
- ✓ Start parameter sets for each machine
- ✓ Part properties comparable to injection moulding
- ✓ High batch-to-batch consistency
- ✓ AM Polymers does system engineering with competence in polymer, powder and process
- ✓ 7 laser sintering machines on site





Polymer powder products for AM applications:

- TPU: ROLASERIT® **PB-01** (since 2013)
- HDPE: ROLASERIT® **PE-01-GR** (since 2015)
- PP: ROLASERIT® **PP-01** (since 2017)
- PP: ROLASERIT® **PP-03-O** (since 2019)
- PP: ROLASERIT® **PP-05** (since 2020)
- PBT: ROLASERIT® **PBT-01** (since 10/2020)
- PA11 and PA12: ROLASERIT® **PA12-01** and ROLASERIT® **PA11-01** (since 2021)
- PBT: ROLASERIT® **PBT-01-GF** and **CF** (since 08/2021)
- PA11: ROLASERIT® **PA11-01-CF** (since 09/2021)
- PA6 and PA66: ROLASERIT® **PA6-01** and ROLASERIT® **PA66-01** (part production service started in 10/2021)
- PA6-CF, PP-04, FR types and other materials in development



- ✓ Elastic material in natural and grey color
- ✓ Very good processability
- ✓ No smoking and no aging
- ✓ High surface quality and edge sharpness
- ✓ High elongation at break of up to 550%
- ✓ In process variable hardness Shore A 60-83
- ✓ Pressure tight - 5 bar on 1,5 mm wall thickness
- ✓ Chemically smoothable



ROLASERIT®A

TPU

Thermoplastic polyurethane

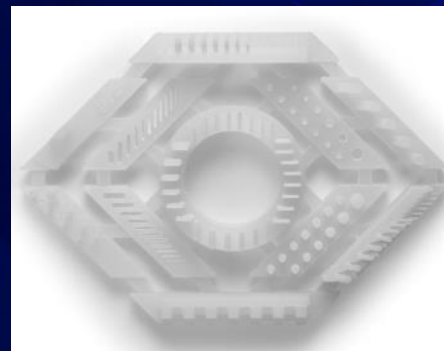
	x	z
Young's modulus [N/mm²]:	55-65	55-65
Tensile strength[N/mm²]:	7-10	5-6,5
Elongation at break [%]:	350 - 550	200 - 300



fpm
rapid product manufacturing GmbH



- ✓ Available in natural, white and black
- ✓ Good processability on each machine (also with blade)
- ✓ Good mechanical properties
- ✓ Elongation at break up to 100 %
- ✓ Since 2017 series material with batches in several ton scale



ROLASERIT®

PP

Polypropylene PP01

	x	z
Young's modulus [N/mm ²]:	800	800
Tensile strength[N/mm ²]:	20	19
Elongation at break [%]:	30	10





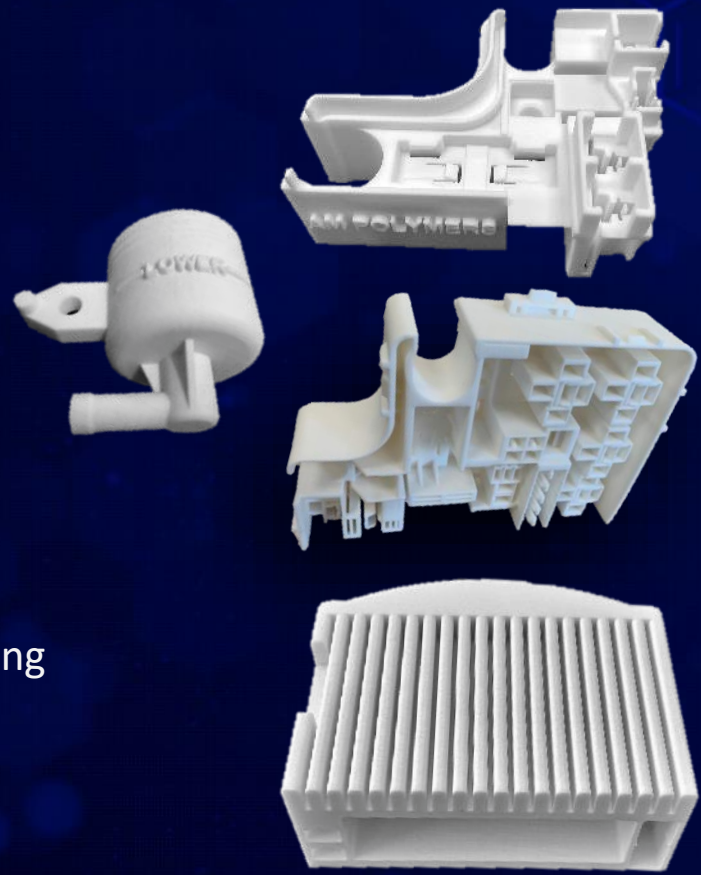
- ✓ Natural PP translucent
- ✓ Increase of EAB:
 - ✓ $x: > 200\%$
 - ✓ $Z: > 35\%$
- ✓ Increase of Charpy
 - ✓ 92 kJ/m^2 compared to 30 kJ/m^2
 - ✓ Notched: 5.2 kJ/m^2 compared to 4.7 kJ/m^2

Polypropylene (PP) ROLASERIT® PP - for LS & HSS 3D Printing
Produce End-Use Parts Like Injection Molding: Colorful and Translucent



Chemical Vapor Smoothing **postpro** by **amt**

- ✓ Joint development with Mitsubishi Chemical Cooperation
- ✓ SOP in 10/2020
- ✓ Good mechanical properties and high ductility
- ✓ Excellent electrical properties
 - ✓ Surface resistance [$\Omega \cdot m$]: $5.E+16$
 - ✓ Volume resistance [Ω]: $3.E+15$
 - ✓ Better than many IM PBT-grades
- ✓ Good processability
- ✓ Good post processability by vapor smoothing
- ✓ Processable on standard laser sintering machines
- ✓ -> No high temperature machine needed



ROLASERIT®
PBT

Polybutylene terephthalate

-Joint Development with Mitsubishi Chemical Cooperation –

Young's modulus [N/mm ²]:	2750
Tensile strength[N/mm ²]:	48
Elongation at break [%]:	15





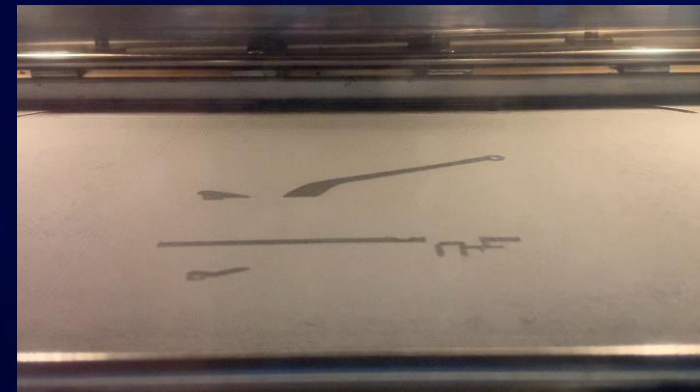
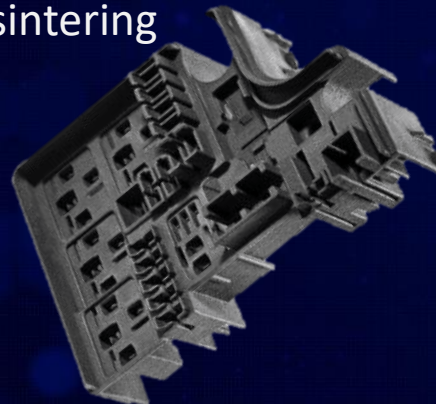
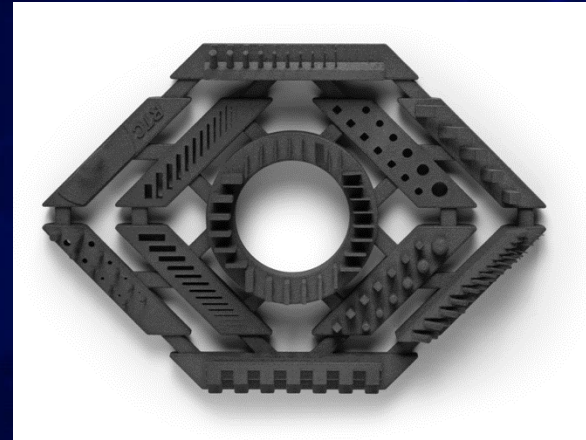
ROLASERIT®

PBT

Polybutylene terephthalate

-Joint Development with Mitsubishi Chemical Corporation –

Young's modulus [N/mm ²]:	6.200
Tensile strength[N/mm ²]:	60
Elongation at break [%]:	2.1



- ✓ First PBT Material with carbon fibers for powder bed fusion
- ✓ High modulus with up to 6,200 MPa
- ✓ High tensile strength of 60 MPa
- ✓ High temperature resistance with a HDT of 177°C (PA12GB: 157°C)
- ✓ Good processability
- ✓ Processable on standard laser sintering machines (< 190°C)

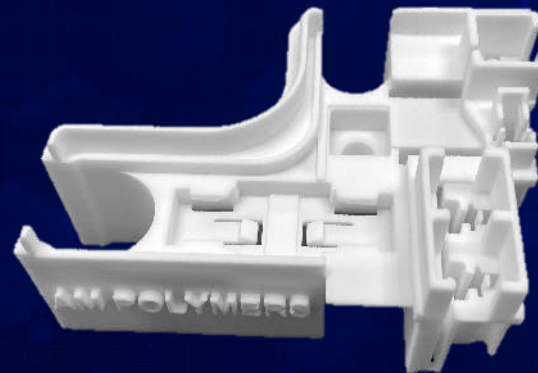
ROLASERIT®

PBT

Polybutylene terephthalate

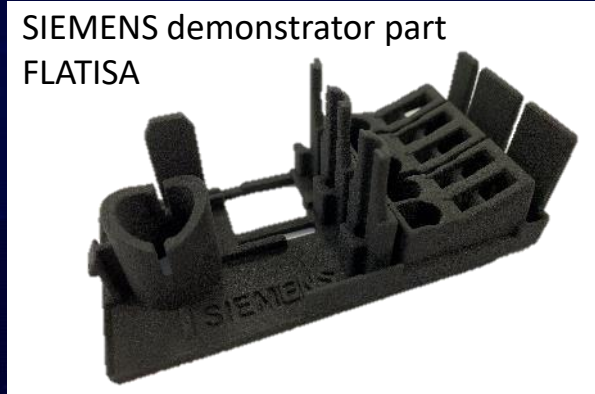
-Joint Development with Mitsubishi Chemical Corporation –

Young's modulus [N/mm ²]:	3.900
Tensile strength[N/mm ²]:	48
Elongation at break [%]:	6.0



- ✓ First PBT Material with glas fibers for powder bed fusion
- ✓ 30 % refresh rate
- ✓ High modulus with up to 3,900 MPa
- ✓ High temperature resistance with a HDT of 175°C (PA12GB: 157°C)
- ✓ Good processability
- ✓ Processable on standard laser sintering machines (< 190°C)

- ✓ Development Product
- ✓ First ever PA66 for powder bed fusion
- ✓ Properties in as-build/dry condition
- ✓ Tensile strength of 75 MPa
- ✓ Young's modulus > 3000 MPa
- ✓ EAB of 7-15 %
- ✓ Flame retardant according to UL94-V2



ROLASERIT®A

PA

Polyamide 66

Young's modulus [N/mm²]:	3000
Tensile strength[N/mm²]:	75
Elongation at break [%]:	15



- ✓ Recycled from used PA12 powder
- ✓ Increasing sustainability by reducing waste powder in laser sintering
- ✓ Chemical refinement to achieve quality of standard PA12 materials
- ✓ Refresh rate 50 %
- ✓ Available in black and white



ROLASERIT®A

PA

Polyamide 12

Young's modulus [N/mm ²]:	1.650
Tensile strength[N/mm ²]:	50
Elongation at break [%]:	15

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