

Stay curious!

Innovative 3D-Printing solutions from BASF.

An introduction into BASF offerings to the Additive Industry

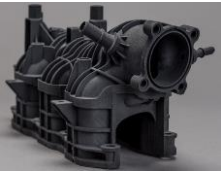


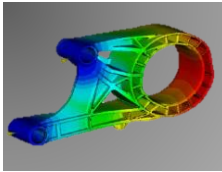









October 29th, 2018



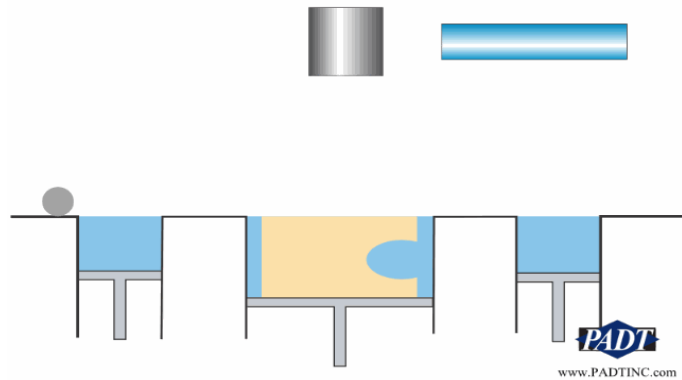
Key drivers for BASFs activities in the field of additive manufacturing

- BASF Group (€64bn TO, 110k employees) subsidiary: BASF 3D-Printing Solutions (2017, HD):
- AM represents an **opportunity** as an integral part of the digital manufacturing world of tomorrow: functional integration, individualisation, light-weight construction, faster time-to-market
- Building on BASF's broad know-how from various divisions, we **understand applications** and enhance existing **customer intimacy**
- We drive the **industrialisation of AM**: prototypes → spare parts → (small) series production
- **Open business model** architectures are needed
- 3D-P has great advantage in **complex and flexible production** while traditional manufacturing will stay favored for high volumes of ordinary parts

BASF range of activities in Additive manufacturing

| Powder Bed Fusion (PBF): for Laser Sintering | | Additive Extrusion Sol. (AES): for filament printers | | Liquid Formulations & Sys. (LFS) for SLA/DLP printers | | Services and Metal Solutions (SMS) | |
|---|----------------|--|--|--|-------------------------------|---|-------------------------|
|  | PA6-based |  | Filament from legacy BASF |  | Photopolymers for SLA and DLP |  | Design and Simulation |
|  | PA11, PA12, PP |  | Filament from Innofil3D |  | Ceramic photopolymers |  | Finishing and coating |
|  | TPU powders |  | Flash-fuse tech (Co-operation with Essentium) |  | Photo-Resin for PPJ |  | Metal filaments |
| | | | | | |  | Parts and qualification |

Powder Materials for Laser Sintering



Source: PADT, Inc.

Solutions

- PA6-based materials → reliable processing
- **In-particle fillers** → perfect in-part distribution
- PA6: mineral filled / flame retardant / low melting
- PA11, PA12, PP, TPU available
- Powder blends

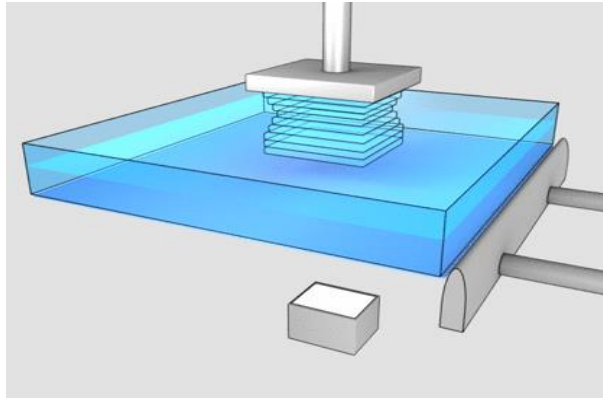
Identified needs

- Mechanical strength
- Temperature and aging stability
- Versatility of part properties
- Integration into existing process chains

What can it do for you?

- Functional parts
- High burst resistance & gas tightness
- Can be welded
- High strength, modulus, heat distortion temperature
- Machine landscape

Liquid photopolymers for Stereolithography (SLA) and Digital Light Processing (DLP)



Source: Asiga

Solutions

- Transparent acrylic resin
- multipurpose materials (SLA & DLP)
- Different flexible grades available

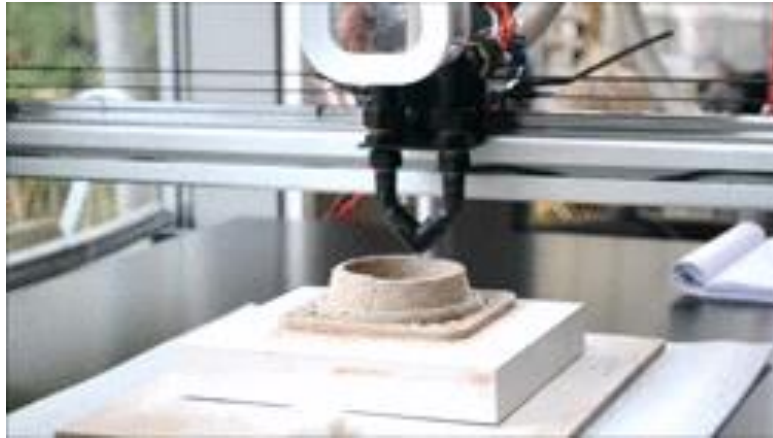
Identified needs

- Impact strength at reasonable heat distortion temperature and modulus
- Thermal and UV aging stability

What can it do for you?

- Tough and durable functional parts
- Smooth surface and feature resolution
- High curing speed
- Long-term stability with little discoloration
- No thermal post processing necessary

Filaments for Fused Filament Fabrication (FFF)



Identified needs

- Layer-by-layer adhesion
- Speed of parts fabrication
- Versatility of part properties
- Multi-material parts

Solutions

- Standard filaments (ABS, PLA, TPE, PVA, ...)
- Engineering filaments (PA, TPU, PET, ...)
- Filled filaments (CF, GF, FR)
- High-temp fil. (PPSU, PESU, PSU, PEEK, ...)
- Partner: Essentium Flash Fuse™ technology

What can it do for you?

- Very wide range of materials from one supplier
- From simple prototyping to industrial applications
- Suitable for jigs, fixtures, molds
- Functional prototyping possible

Stainless Steel parts through FFF printing



Solutions

- Metal-polymer composite filament
- Works on any FFF apparatus
- Debinding & sintering in classical MiM process, reliable field-proven debinder and sinter equipment available

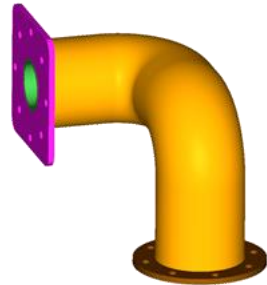
Identified needs

- SLM: high investment costs
- Overcome safety issues from powder handling
- High price of metal parts

What can it do for you?

- Low investment costs
- Easy material handling
- Reliable filament quality
- High purity of final metal parts

Wide range of services accompanies all printing technologies



Solutions

- Ultrasim®
- BASF Coatings expertise
- BASF laboratory capabilities

Identified needs

- Design for 3D
- Functional and decorative finishings
- Part production and testing

What can it do for you?

- One-stop-shop
- Technology-agnostic consulting
- Not locked with any printer producer – yet broadly connected with most manufacturers

Your contacts

| Plastic Powder Bed Fusion | | | Metal filaments | Photopolymers | Plastic Filaments | Plastic Filaments (Innofil3D) | North America | | Asia / Pacific |
|--|--|--|--|---|---|---|---|---|---|
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