

3D Printing Techniques for Anatomical Printing

INPUT – DICOM IMAGES

Medical 3D Printing starts with medical scans that result in DICOM images.



SOFTWARE: MATERIALISE MIMICS

DICOM images can be segmented and converted into an accurate virtual 3D anatomical model.



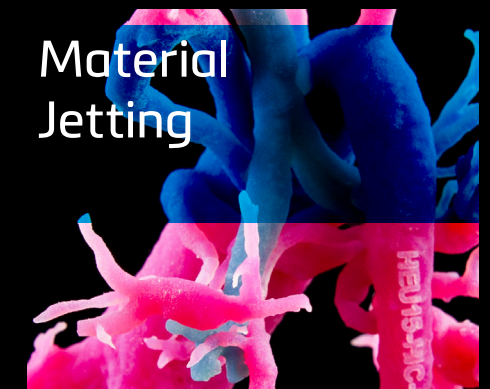
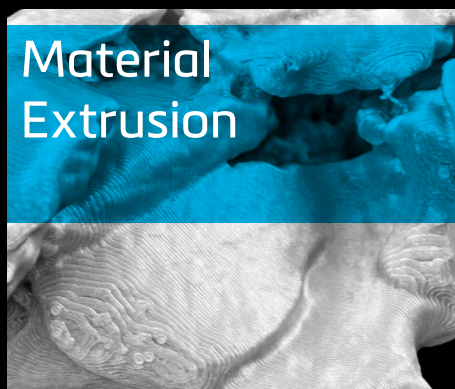
OUTPUT – PRINTABLE FILE FORMAT

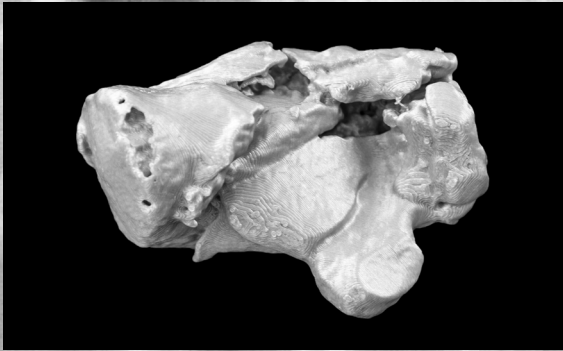
STL, VRML, OBJ



3D PRINTING PROCESS

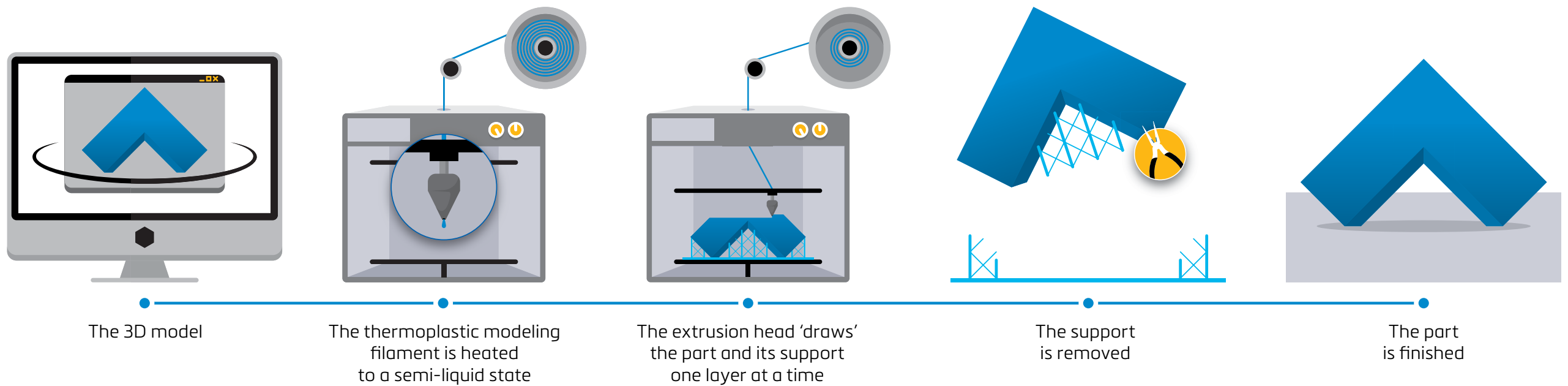
A unique process which allows the creation of a physical 3D model.





Material Extrusion

Fused Deposition Modeling / Fused Filament Fabrication



Benefits

- Relatively low total cost of ownership

Considerations

- Printed with supporting structures
- Mechanical post-processing
- Visible layers

Suggested applications

- Device prototyping, orthopedic and CMF anatomical models

Cost:



Detail:



Printing duration:



Material:

PLA, ABS

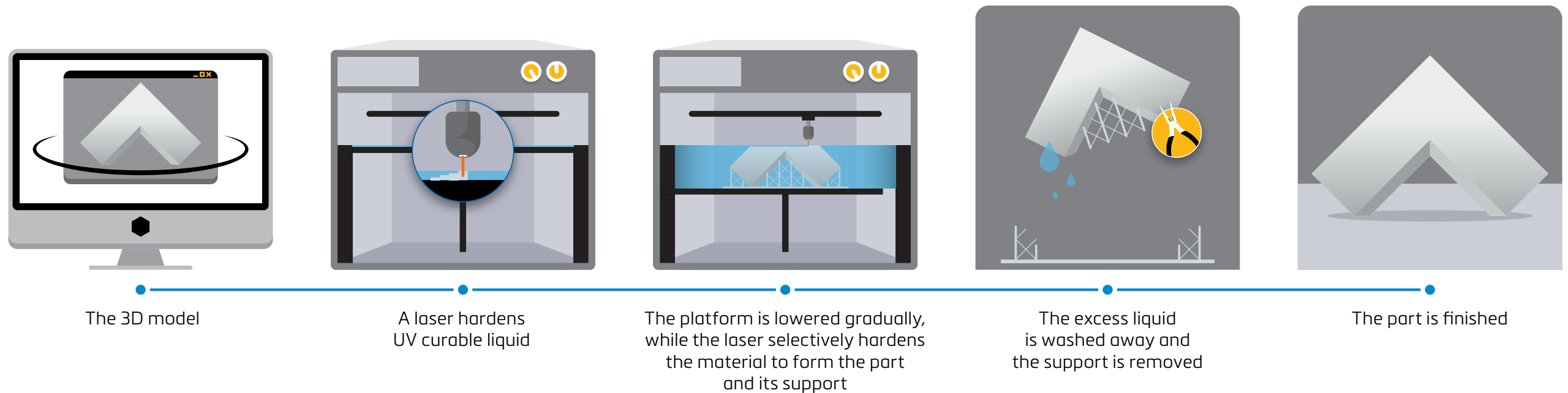
Color options:

1 per extruder



VAT Photopolymerization

Stereolithography / Digital Light Processing



Benefits

- Available in desktop format

Considerations

- Requires manual removal of lattice supports, chemical cleaning and postcuring
- Discoloration over time

Suggested applications

- CMF, orthopedic, and vascular anatomical models

Cost:



Detail:



Printing duration:

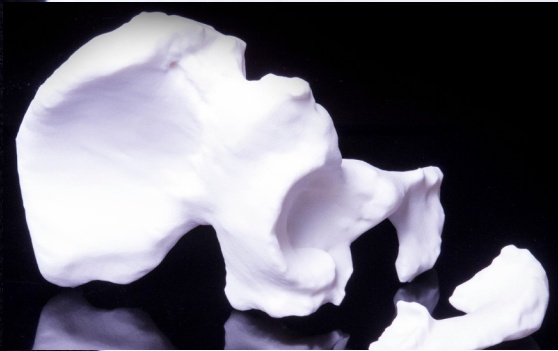


Material:

UV cured polymers

Color options:

Single resin with highlights

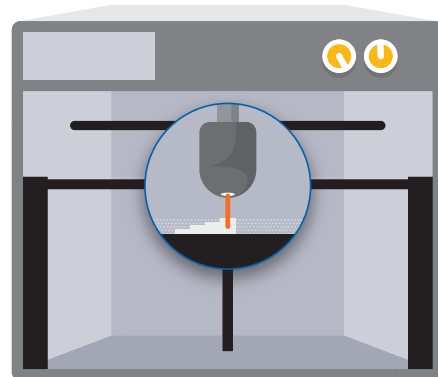


Powdered Bed Fusion

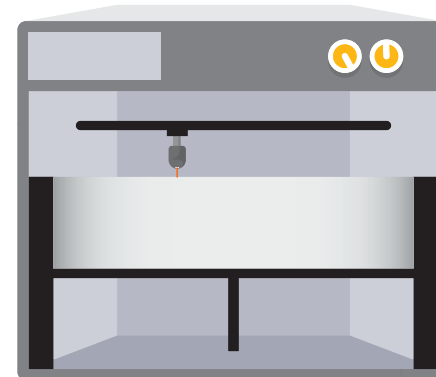
Selective Laser Sintering / Laser Melting / Multi Jet Fusion



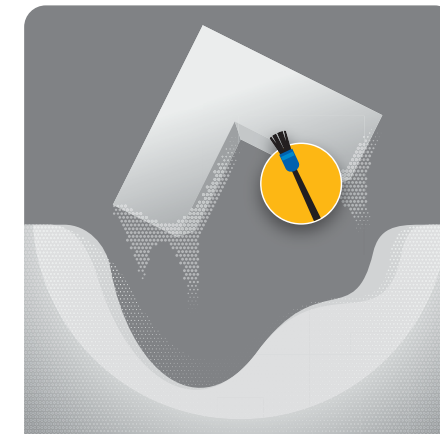
The 3D model



A laser binds powder particles together



Successive powder layers are spread on top of each other, while a laser selectively binds particles to form the part and its support



The loose powder is removed



The part is finished

Benefits

- Sterilizable
- No supporting structures
- Highly durable

Considerations

- Creates dust during the cleaning process

Suggested applications

- CMF and orthopedic anatomical models, surgical guides and implants

Cost:



Detail:



Printing duration:



Material:

Nylon, Titanium, ...

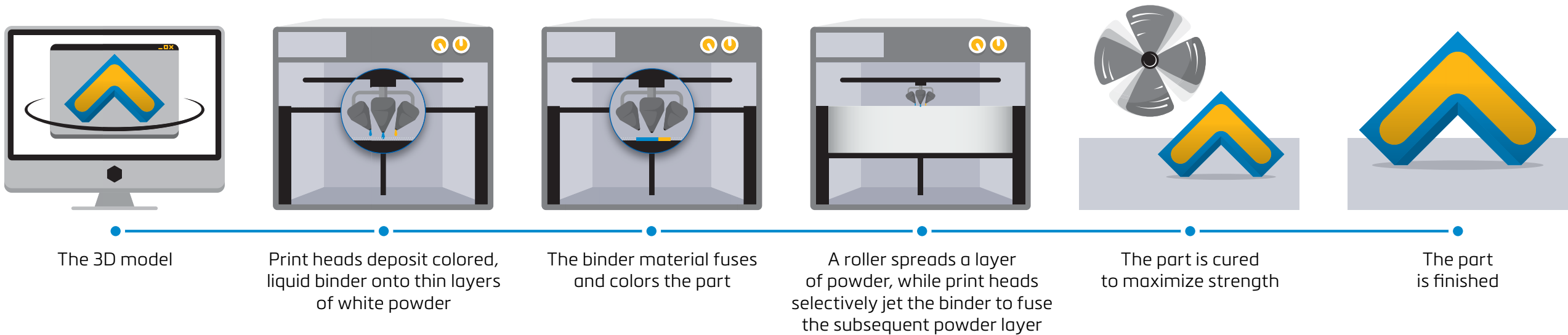
Color options:

Single color



Binder Jetting

Inkjet Printing / ColorJet



- Benefits
 - Multicolor
- Considerations
 - Brittle material
 - Creates dust during the cleaning process
- Suggested applications
 - Various anatomical models with custom structures

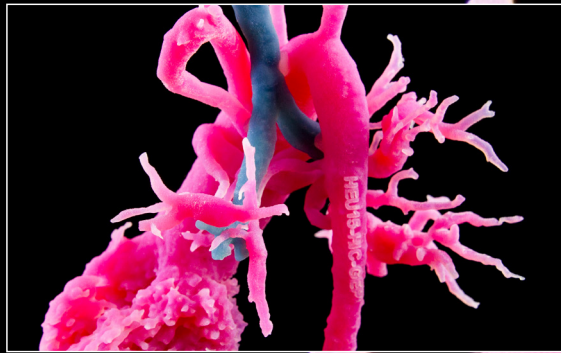
Cost:

Detail:

Printing duration:

Material:
Gypsum

Color options:
Unlimited

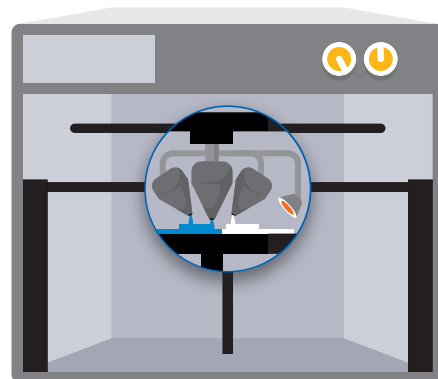


Material Jetting

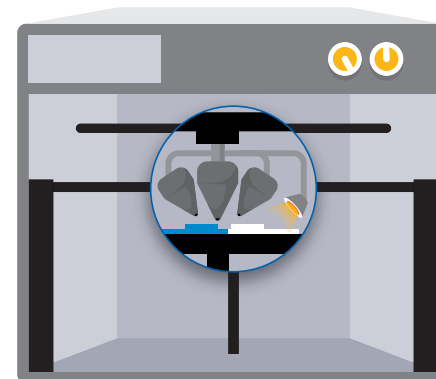
PolyJet / MultiJet Printing



The 3D model



Print heads deposit photopolymer materials and support in ultra-thin layers



Each layer is cured by UV light immediately



The gel-like support material is washed away



The part is ready, without further finishing

Benefits

- Multicolor
- Multi-material incl. flexible polymer

Considerations

- Heavy post-processing
- High total cost of ownership

Suggested applications

- Cardiac and soft tissue anatomical models

Cost:



Detail:



Printing duration:



Material:

UV cured polymers

Color options:

Multiple