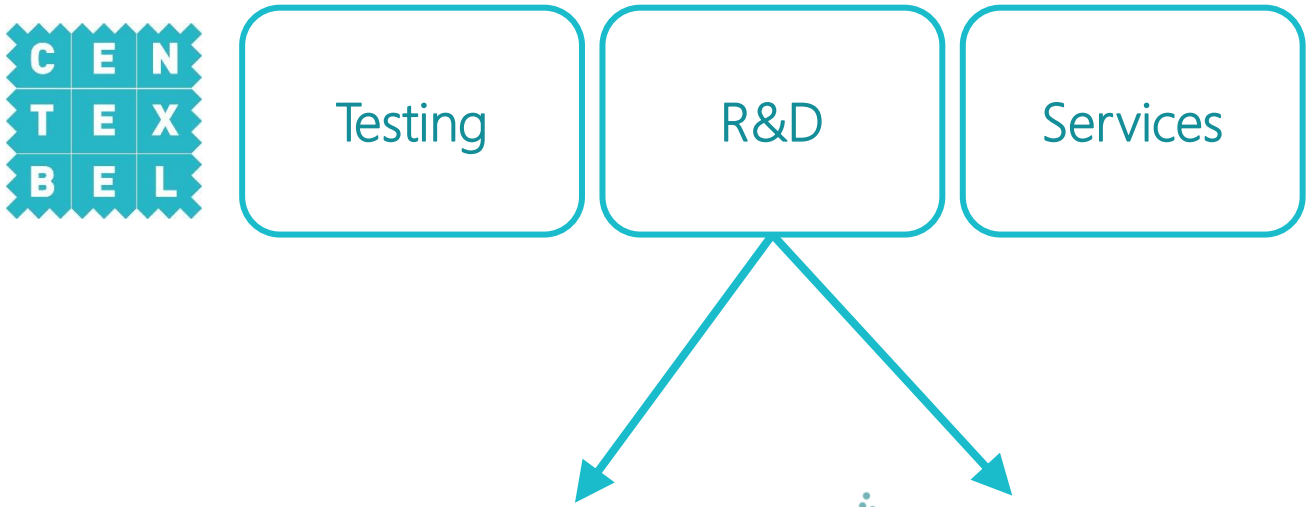
Ontwikkeling van composietmaterialen voor 3D-printen

Sofie Huysman, Gertjan Vancoillie

Introductie



Repair 3D

Horizon 2020
European Union Funding
for Research & Innovation

http://www.repair3d.net

SeaBioComp

Interreg
EUROPEAN UNION
2 Seas Mers Zeeën
European Regional Development Fund

http://www.seabiocomp.eu

Repair 3D

Recycling and repurposing of plastic waste for advanced 3D-printing applications

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Recycling and repurposing of plastic waste for advanced 3D-printing applications

MAIER

Manufacturer of complex injection moldings for the automotive industry




DALBELLO

Ski boot specialist

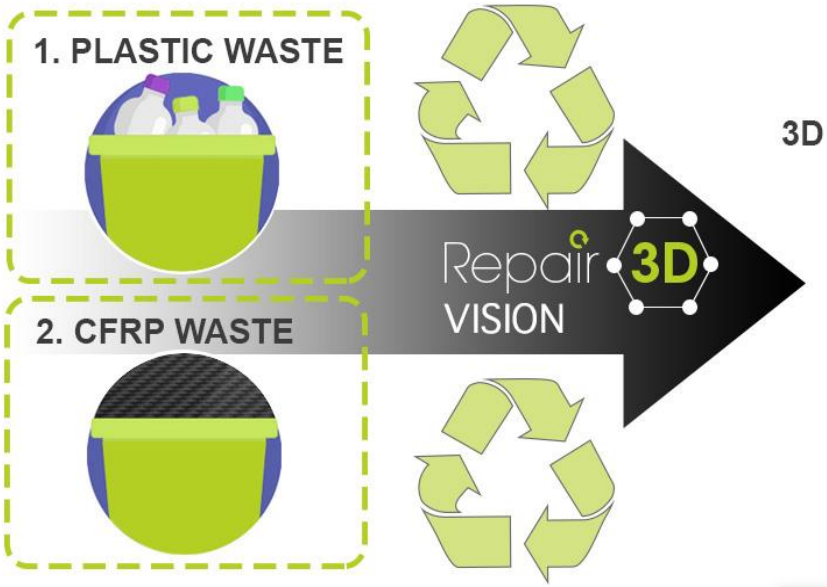
JOTIS

Food & beverage producing company

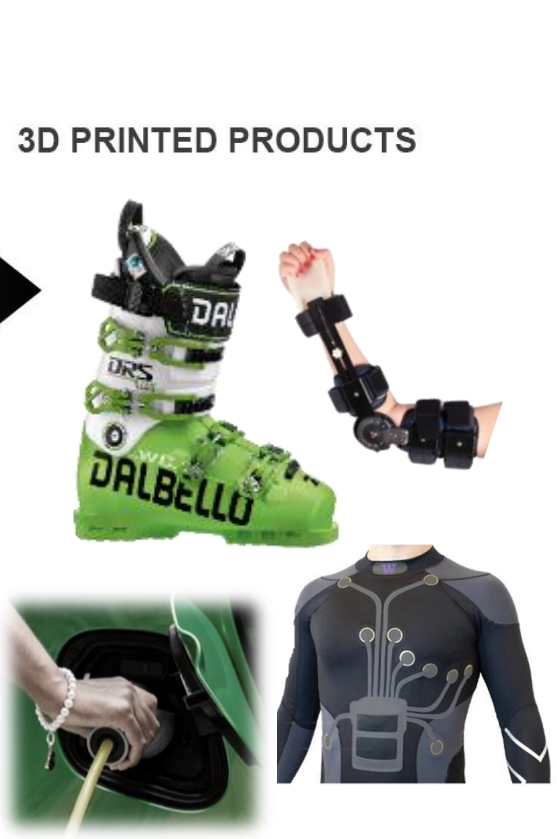
Repair 3D

Maier: PC/ABS, PP
Dalbello: PA12, TPU
Yiotis: PP (cups)
NTUA: PET (bottles)

Sigmatex & Airbus
carbon fiber waste

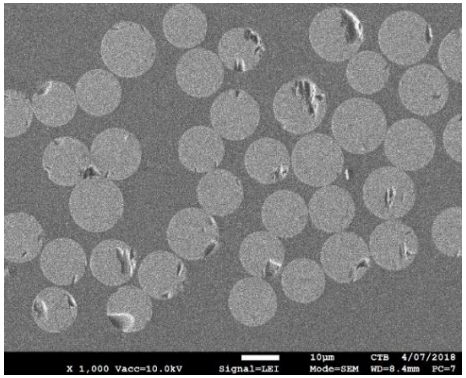


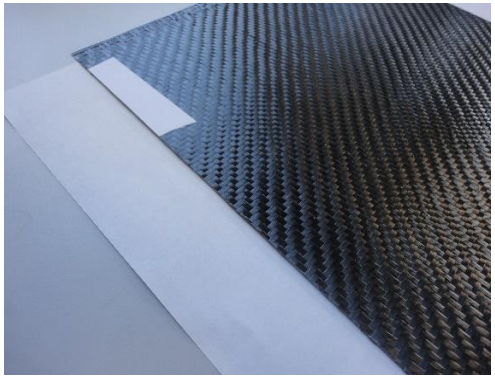
Polymer + fibres
= COMPOSITE



What are composites?

Materials containing multiple components in distinguishable phases





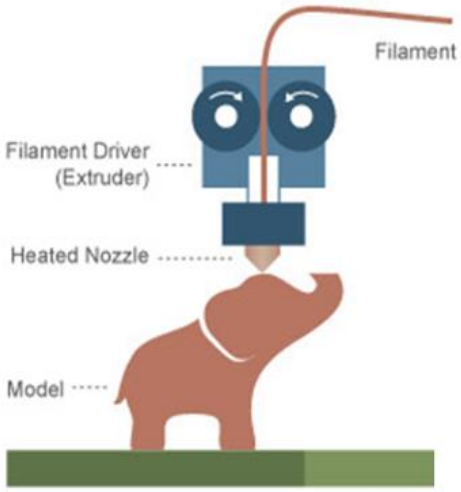
For example: fibre-reinforced composite = Fibres + resin

- Fibres for strength and stiffness e.g. carbon/glass/natural fibres
- Resin to bind the fibres and transfer the forces e.g. epoxy, but also thermoplastic polymer including PP, PA, PLA

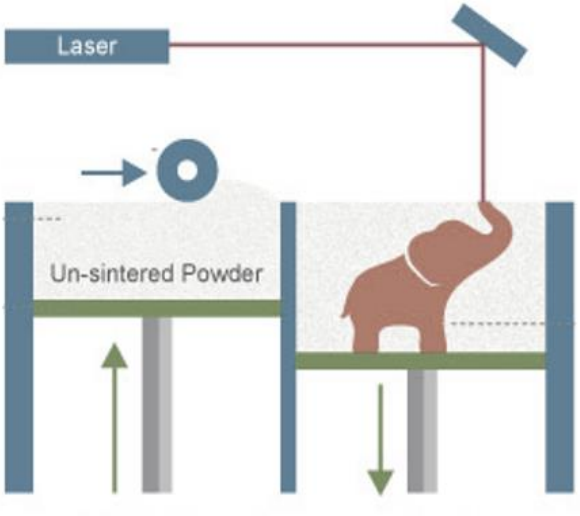
Repair 3D

THERMOPLASTS

MATERIAL EXTRUSION

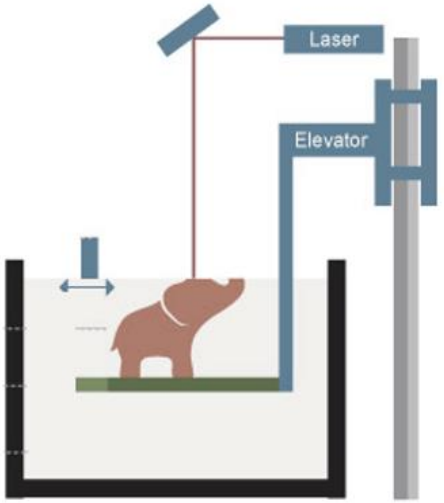


POWDER FUSION



THERMOSETS

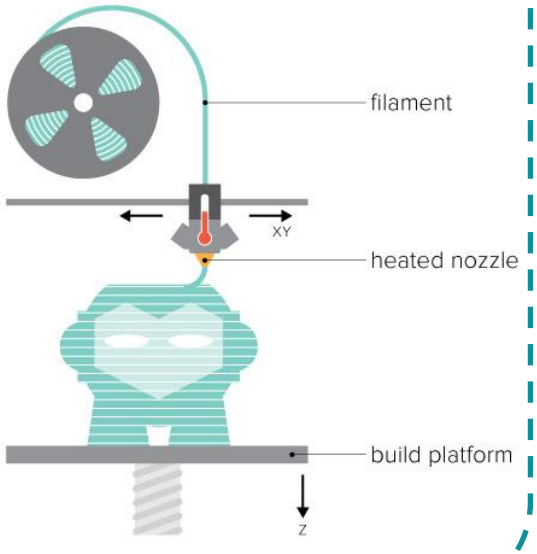
PHOTOPOLYMERISATION



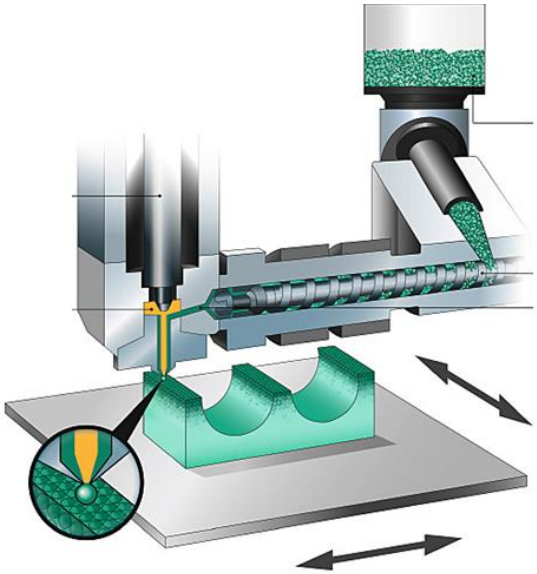
CENTEXBEL

AM techniques:
- Extrusion-based
- Thermoplastic polymers

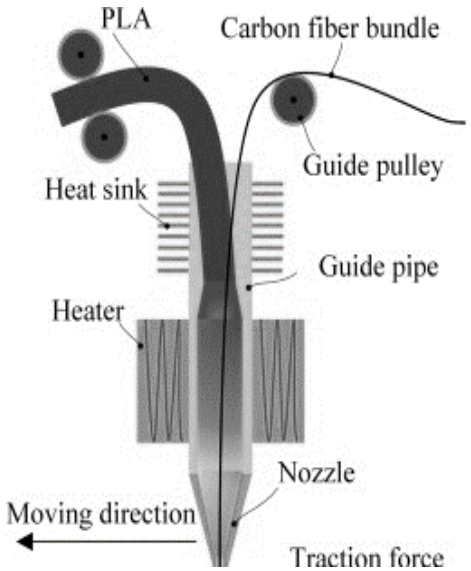
Filament printer
BIOG3D



Pellet printers
Centexbel - UGent



CF-printer
Eurecat



Recycled
PP, TPU
PA12, PC/ABS

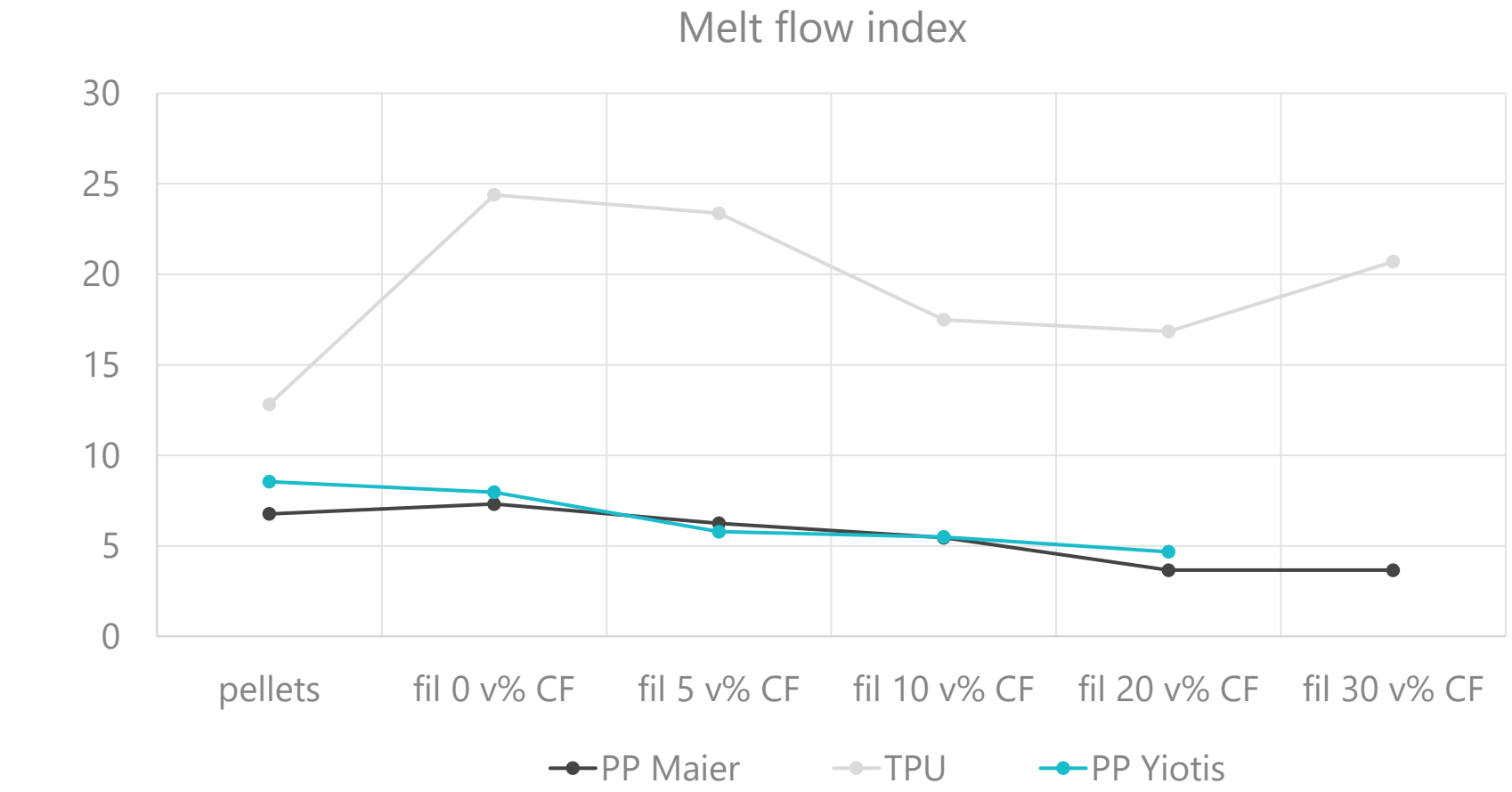
Virgin CF
5-10-20-30 v%

Twin-screw compounder

Compound

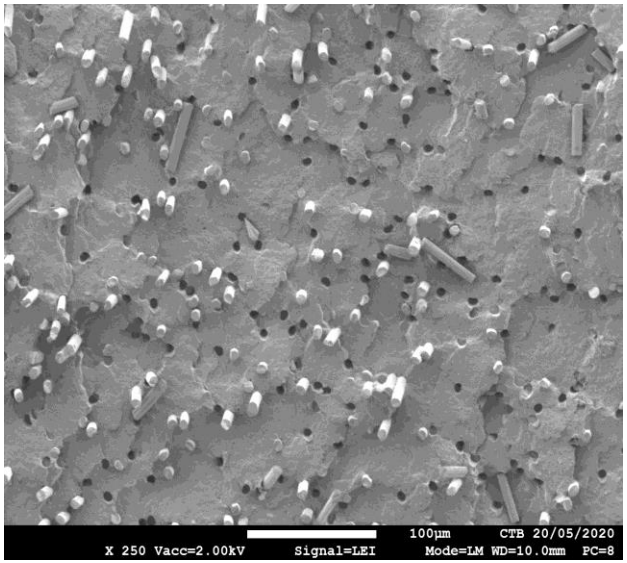
Filament extrusion line

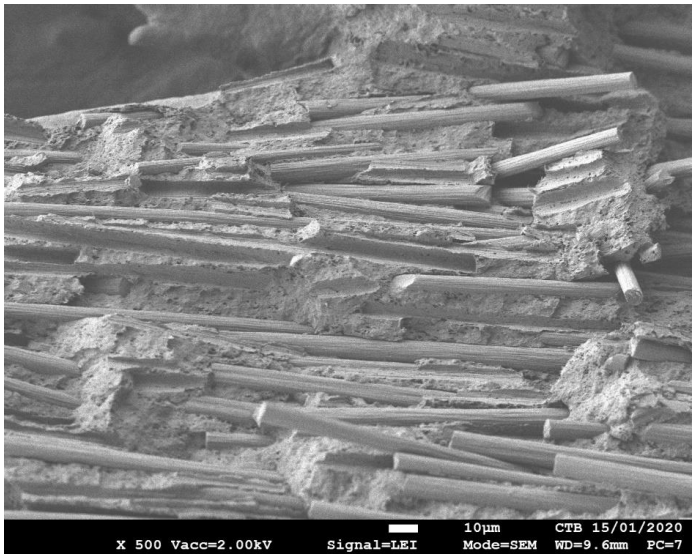
Filament

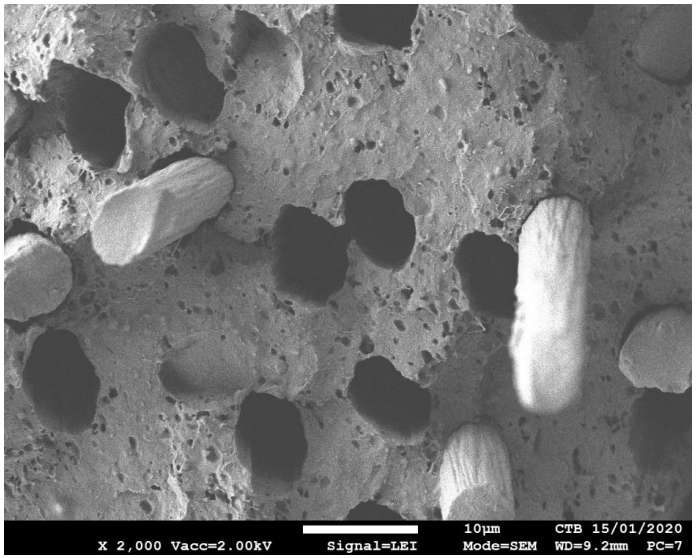


Decreasing MFI (increasing viscosity) with increasing CF%

PP (Maier) + 10 vol% CF

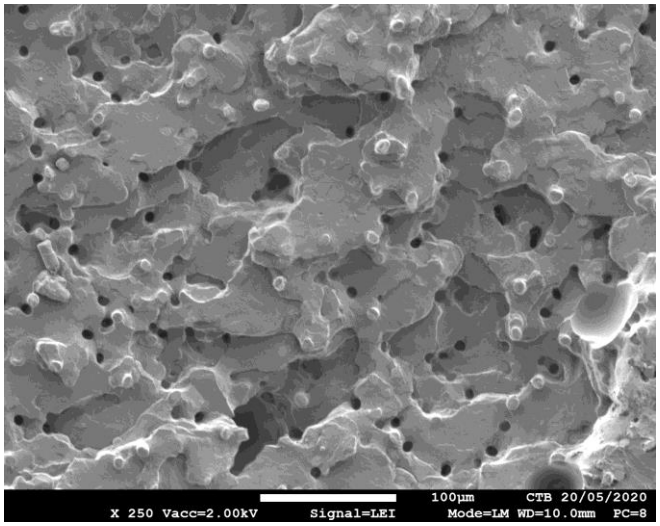


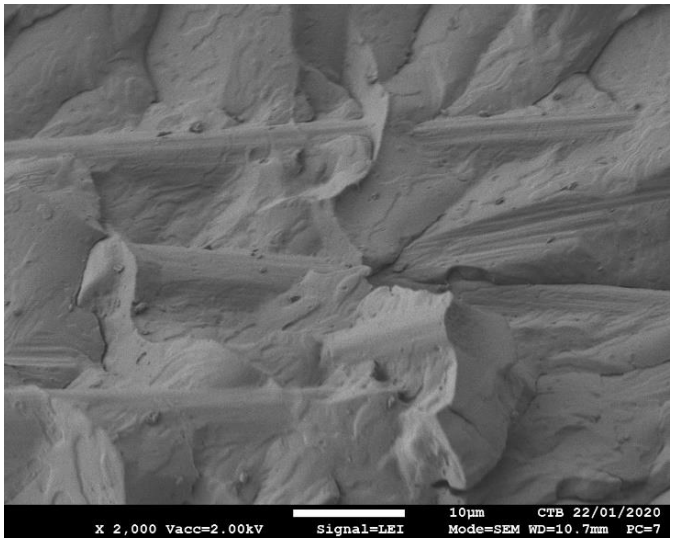


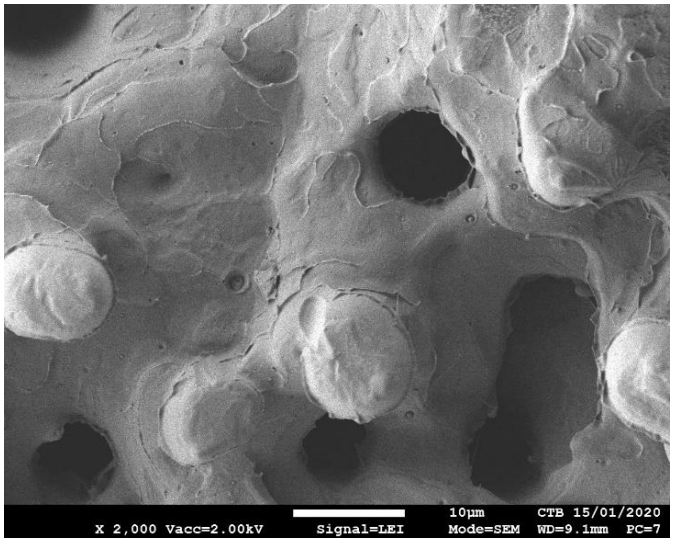


Good distribution – low fiber-matrix adhesion

TPU (Dalbello) + 10 vol% CF

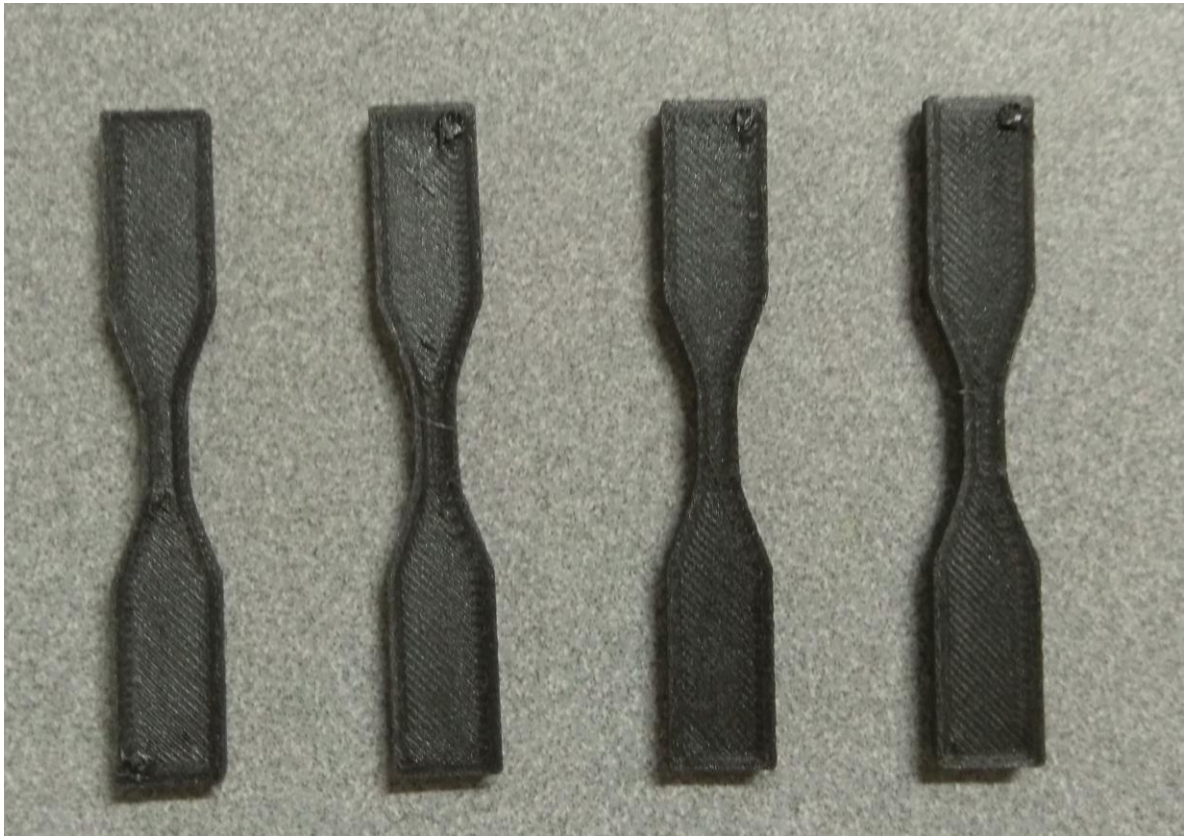






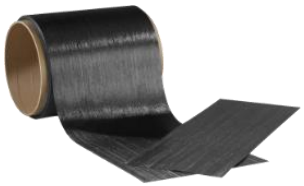
Good distribution – better fiber-matrix adhesion

TPU (Dalbello) + 7,3 m% CF



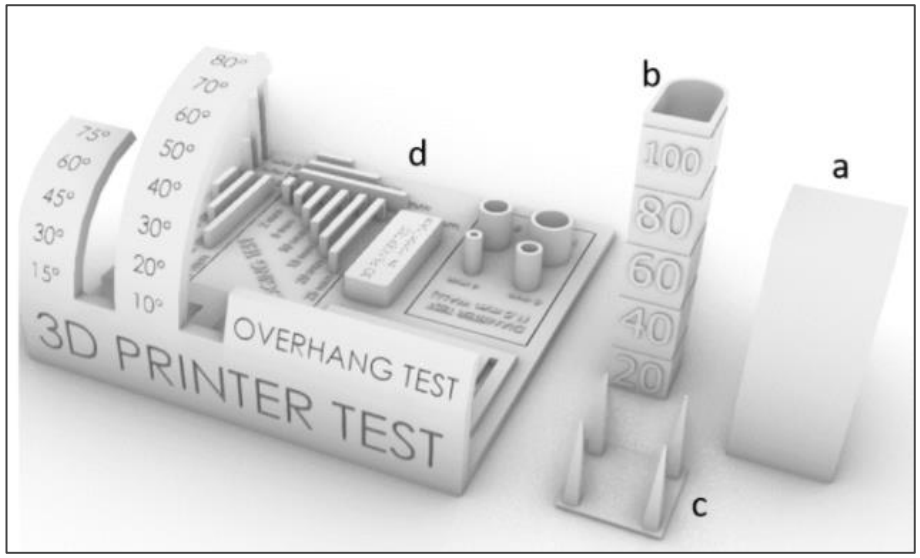
Next steps

UD prepreg
Airbus



End-of-spool
Sigmatex

recycled polymer +
recycled carbon fibers



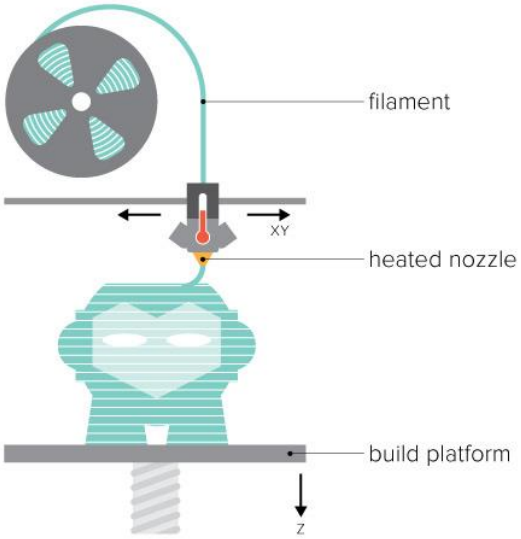
Evaluate 3D-printability (FDM)

- Determine max % CF
- Printing temp, speed, retraction
- Determine geometrical features that can be reliably printed

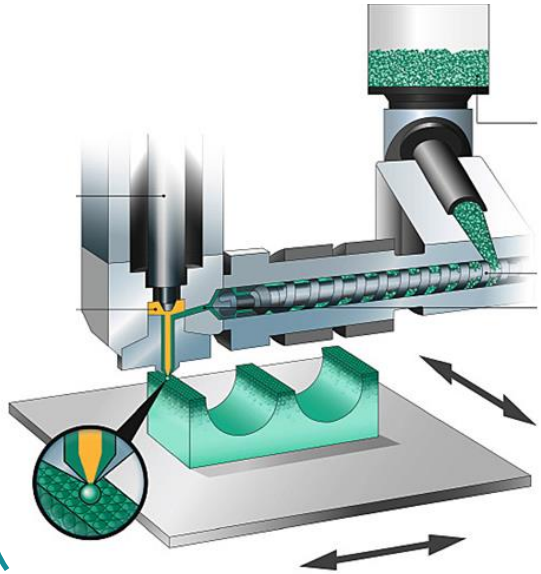
AM techniques:

- Extrusion-based
- Thermoplastic polymers

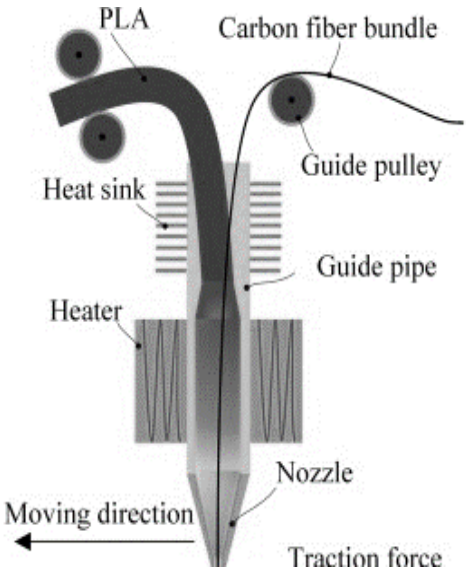
Filament printer
BIOG3D



Pellet printers
Centexbel - UGent



CF-printer
Eurecat



Repair 3D

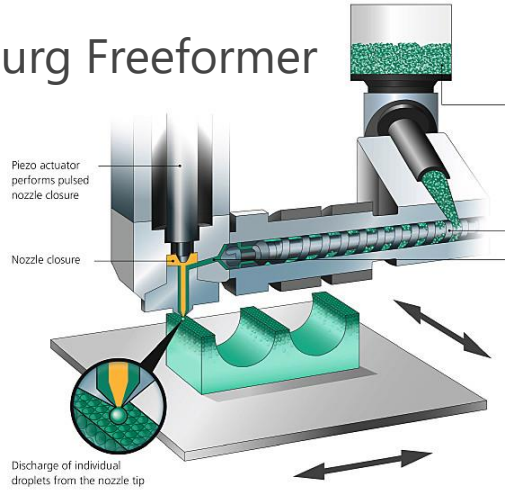
Recycled
TPU, *PET*

Virgin CF
powder 5-10%

Twin-screw compounder

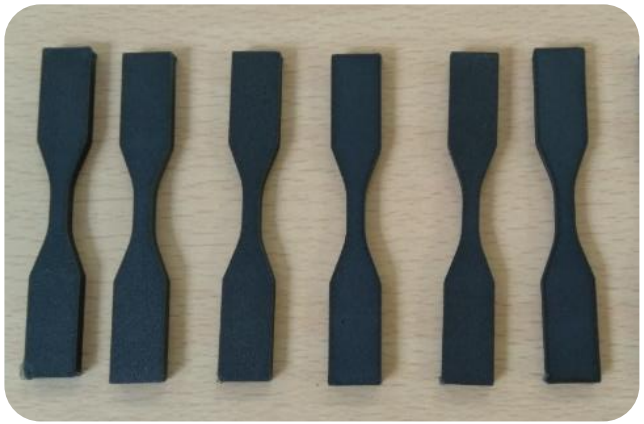
Compound

Arburg Freeformer



3D-printed tensile bars

rPET + 5% CF powder



Property	E(t)	σ(M)	ε(M)	σ(B)	ε(B)
unit	Gpa	Mpa	%	Mpa	%
rPET	2,61	33,42	1,38	33,15	1,39
rPET + 5% CFP	3,26	55,4	1,90	54,45	1,95

Improvement of all mechanical properties & overall 3D-printability

Contact

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