

GROWLAY Filament

print 3D objects and let biological cultures grow

1. grass; moss
2. fungus ; mildew
3. lichen
4. mycelium
5. pharma-cultures, mother cells

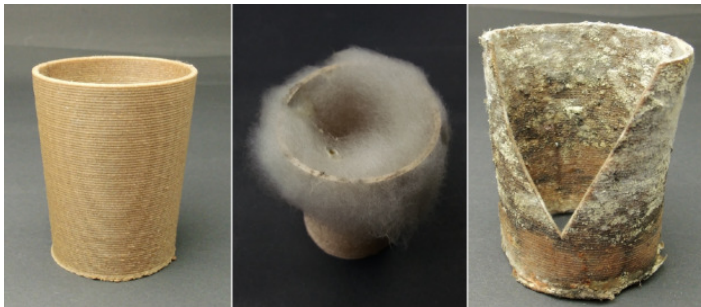
GROWLAY works like a breeding ground. Add seeds or spores to them and they will grow.

GROWLAY properties:

- GROWLAY is microcapillary. Its cavities absorb and store water, dissolved liquid nutrients or fertilizer. Promoted because of the capillary action throughout the printed object.
- Mold grows through the open-cell capillaries and forms a mycelium.
- Seeds of grasses can get caught and grow in Growlay.
- Spores find room to germinate in small cavities. (see SEM-Pics)
- Roots cling to the structures of the object filling.
- Even lichens grow on Growlay. These usually grow preferentially on stones of walls or trees.
- GROWLAY can be sterilized (for food use and research) with gases or wet (but not thermally)
- For color differentiation, objects printed with Growlay can be subsequently colored with food colors.
- absorptive carrier for agents

GROWLAY is available in the functionally different versions white and brown

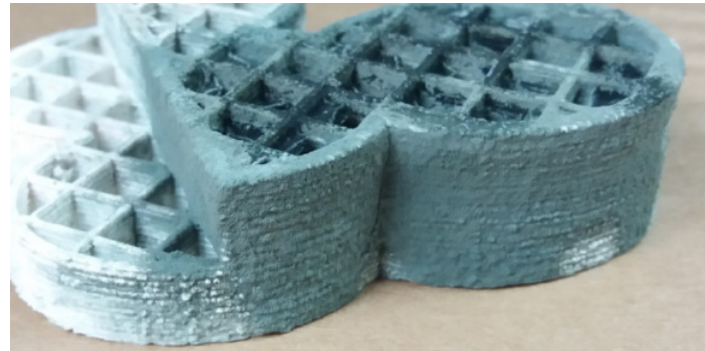
- Version white is an experimental filament & fully compostable
- The brown version contains not only pores but also built-in "food" in the form of cell material which is needed for growth



left: fresh printed GROWLAYbrown
middle: cotton-like mold growth
right: slow-growing lichen



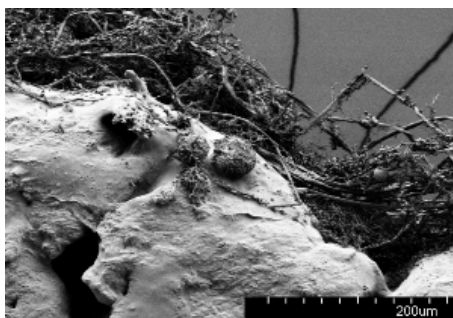
GROWLAY after some days with grass seed put on it



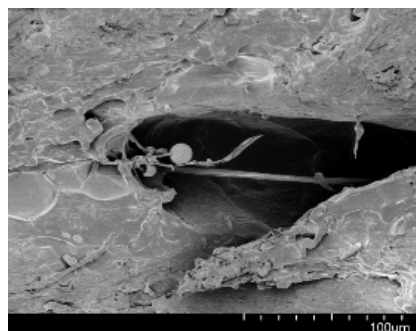
above: Gorgonzola chees (blue) grows on GROWLAY
below: white cheese



NEW



pics by scanning electron microscope
4) SEM, Lichen inside GROWLAY (Flechte)



5) SEM, Lichen inside GROWLAY



6) SEM, white Cheese inside GROWLAY

GROWLAY - two versions

GROWLAY-white pure porous

- **compostable** polymer
- with open capillaries
- white filament
- experimental filament for experienced users

GROWLAY-brown porous +woodparticles

- **not compostable**
 - with open capillaries
 - + polymer contains **organic nutrients** (wood particles)
 - **higher** tensile strenght
 - **more rigid** as version -white- ;
 - increased temperature stability
- the filament can be printed just as easily as Laywood, brown filament
// for any user

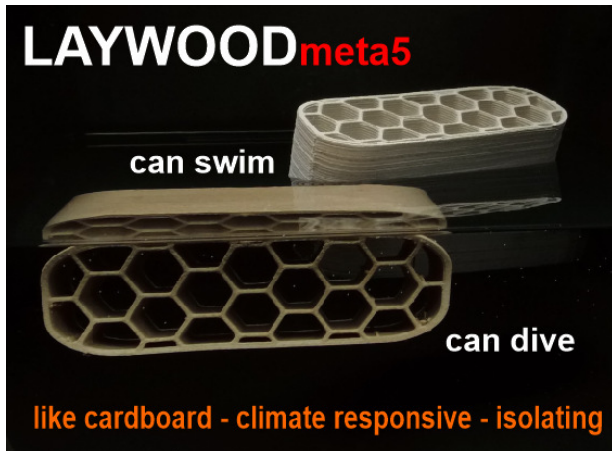
LAYWOODmeta5

1. floats on water, light as Balsa after rinsing in water, can swim, can dive, sucks water fast
2. porous, density: ~ 0.5 gr/ccm; rough, feels as cardboard
3. thermal isolating, low thermal conductivity
4. climate responsive (elongation)
5. absorptive carrier for agents

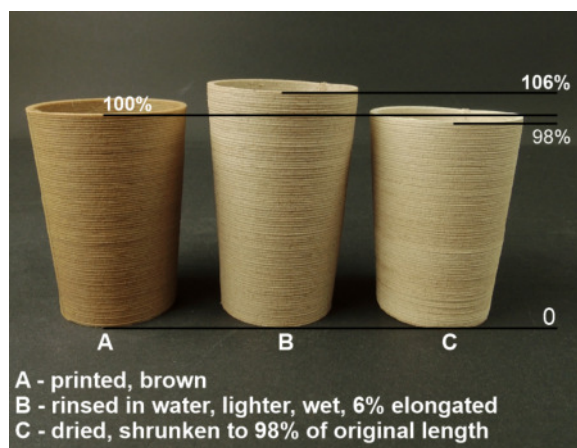
- print at: 225 – 250°C, cold! platform,
- zero warp, sticks well as ABS at platform
- only 50% density of standard 3d printing filaments
- contains open cell pores inside after rinsing with water for 2 days, dry the object with a fan, not in oven
- cell structure as mycellium
- possible to paint with waterbased inks

<https://www.3ders.org/articles/20170920-kai-parthys-new-laywoodmeta5-3d-printing-filament-is-climate-responsive-and-floats-on-water.html>

THE NEW ORIGINAL



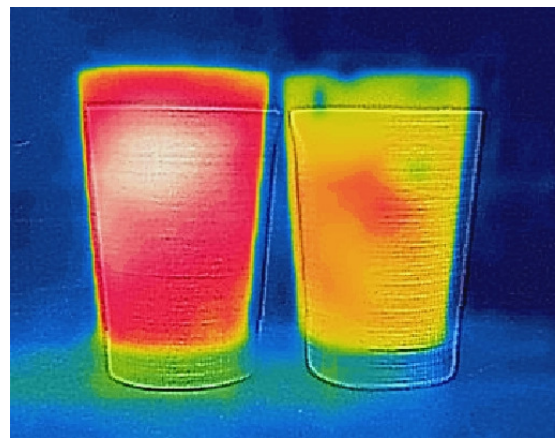
thermal isolating because of pores
low thermal conductivity



climate responsive with reversible elongation
if wet or dry



Unrinsed Laywoodmeta5 has a density as standard thermoplasts of about 1.1 gramms per ccm, thats why printed objects will dive in water



left: hot water in a cup wrapped with massive Original Laywood

right: hot water in a cup wrapped with porous LAYWOODmeta5



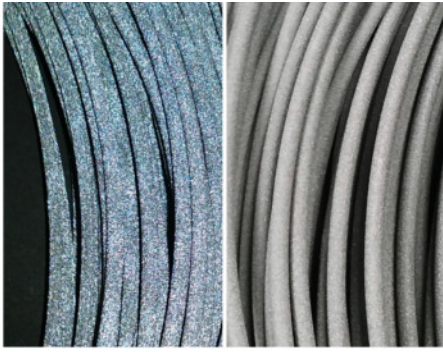
scanning electron microscope / micro porous



rinsed Laywoodmeta5
floating on water

REFLECT-o-LAY

FOR DESIGNERS



retro-reflective objects - what things may you print?

- fashion accessoires,
- savety gadgets for bikers
- to sew on patches,
- laser reflective big distance marking points
- parts for experimental cars

printing:

- 0.4 mm nozzle, sticks well at roughened PET-Tape and most other,
- cold to 60° platform
- 210°C / cold (20°C) or hot platform
- best refl. effect with low !!! feeding rate

they will „glow“ when lighted up by other light beams at road or highways. The filament is flexible and filled with millions of reflective pigments.

This pigments occur as little dots out of the ourface of filament and ofcourse after printing. They send incoming light back, as the drawing describes.

retro-reflective, flexible, sew-able

FOR DESIGNERS

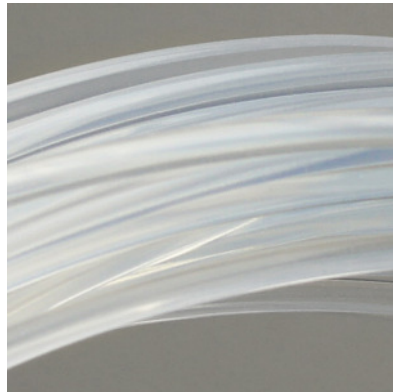
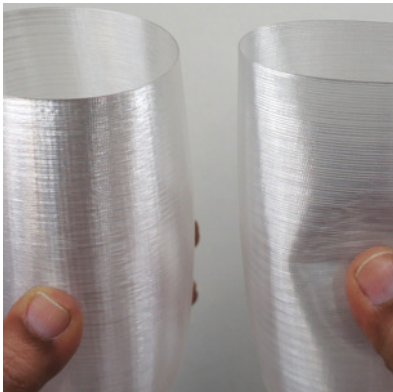


FOR DESIGNERS

- <http://3druck.com/3d-druckmaterialien/42582-3942582/>
- <http://3dprintingindustry.com/2016/02/25/new-reflective-filament-shines-light-kai-parthys-3d-printing-brilliance-part-1/>
- <http://www.3ders.org/articles/20160229-kai-parthy-reveals-new-reflect-o-lay-3d-printable-filament-that-reflects-light-in-the-dark.html>

BENDLAY-series (1 tough, 2 flex)

CLEAR AS GLASS



BENDLAY tough vs. BENDLAY flex clear, tough, flexible, bendable,

- <http://www.3ders.org/articles/20130614-bendlay-a-new-clear-tough-and-bendable-3d-printer-filament-from-germany.html>
- <http://www.3ders.org/articles/20150114-laywoo-d3-inventor-kai-parthy-unveils-bendlay-flex-3d-printing-filament.html>
- <https://3druck.com/tags/bendlay/>

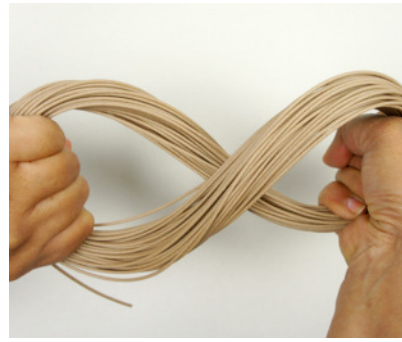
LAYWOO-D3 / LAYBRICK lowest warp / tree-ring effect

Sept. 2012

THE ORIGINALS



LAYWOO-D3 / 170 – 245°C



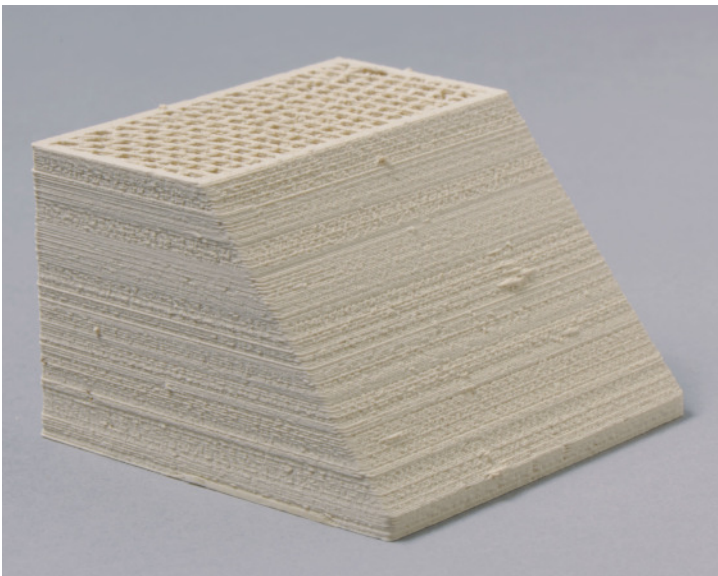
LAYWOOD-FLEX / 190 – 250°C



- <http://www.3ders.org/articles/20120920-laywoo-d3-new-fdm-filament-can-print-wood-with-tree-rings.html>
- <https://3dprintingindustry.com/news/the-last-wood-bender-kai-flexes-his-new-wood-3d-printing-filament-49540/>
- <http://www.3ders.org/articles/20150513-kai-parthy-is-back-with-laywood-flex-a-flexible-version-of-laywood-3d-printer-filament.html>

LAYBRICK lowest warp / tree-ring effect

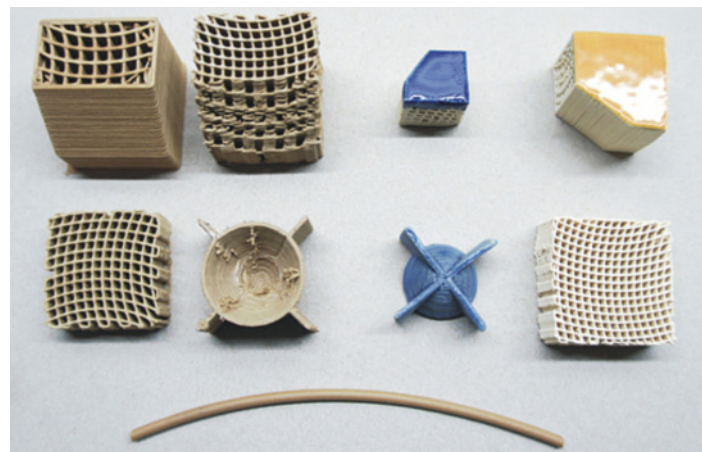
THE ORIGINALS



- <http://www.3ders.org/articles/20130527-laybrick-a-new-rough-3d-printer-filament-near-zero-warp.html>
- <https://3dprintingindustry.com/news/laybrick-a-new-filament-from-the-creator-of-laywoo-d3-12164/>
- <https://3druck.com/objects/laybrick-neues-sandsteinartiges-filament-2110754/>

LAYCERAMIC

CERAMIC / POTTERY



- <https://www.dropbox.com/s/3mst782b64mutzb/LAYCERAMIC-Instructions-7-2017-public.pdf?dl=0>
- <http://www.3ders.org/articles/20140310-3d-printing-branches-out-with-new-clay-based-filament-for-ceramics.html>
- <https://3dprintingindustry.com/news/3d-printing-filament-kai-parthy-24978/>

MOLDLAY / wax-alike / for lost wax casting / permanent mold casting

MOLDLAY

a wax-alike thermoplastic 3D printing filament

- 1. for lost wax casting / investment casting
- 2. for permanent mold casting



**1
LOST WAX CASTING
INVESTMENT CASTING**



f.e. bronze, silver, alu

**2
PERMANENT MOLD CASTING**



f.e. 2-component resins

MOLDLAY is a wax-alike thermoplastic 3D printing filament

(burn out at low temperatures)

dedicated for two main casting methods:

- 1. lost mold ; lost wax casting; investment casting; (used for metal casting)
- 2. permanent mold casting (used for 2K resins)

MOLDLAY is

super dimension stabil, stiff, rigid at room temperature, near zero warp, printable without heated bed, print at 200° C +/- 20°C, let your heated bed cold = 20°C max !!!

use HIPS-tape + ABS paint or other, it sticks well;

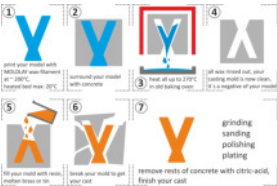
density: ~ 1.2 g/cm3

tensile strenght: ~ 40 N/mm2

contains harmless co-polyesters + wax and oils

casting:

treat your mold at ~ 270°C , in an old baking oven only, your object made from Moldlay flows restless out the mold, similar as hot paraffin, look for this scheme; (bigger at the end of these sheets)



MOLDLAY

(1) lost wax casting / investment casting



torso while being printed with a delta-printer



printed Torso (blue) embedded in molding material (grey), below one brown casting channel



right: statue from Moldlay with casting channels
left: ready casted and polished bronze statue



statue at exhibition

MOLDLAY

(2) permanent mold casting

<http://www.3ders.org/articles/20150128-filament-wizard-kai-parthy-unveils-his-new-moldlay-wax-3d-printing-filament.html>

<https://3dprintingindustry.com/news/industrial-manufacturing-desktop-new-moldlay-3d-printing-filament-42481/>

<https://www.youtube.com/watch?v=3RdwKWxnrM>

<https://3druck.com/3d-druckmaterialien/moldlay-kai-parthy-stellt-filament-fuer-giessverfahren-vor-5129578/>

(3)



form printed from Moldlay (blue) filled with a 2K resin (pink)

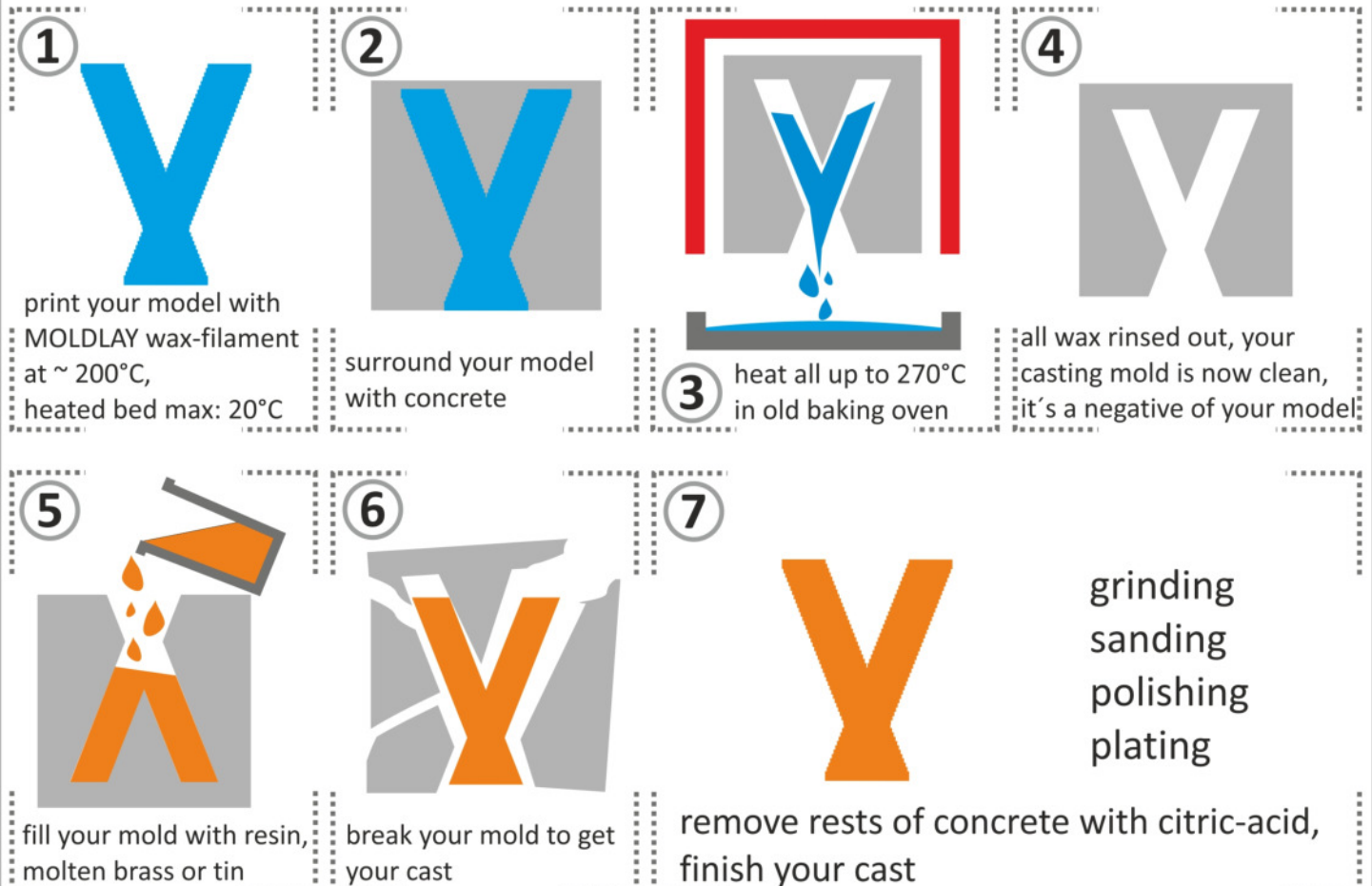


opened form



hardened 2K resin

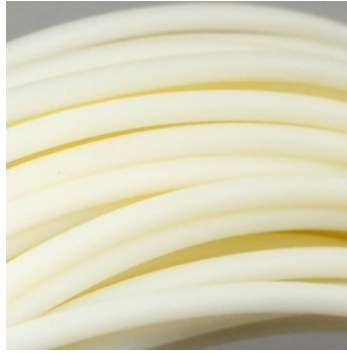
How lost wax casting works with MOLDLAY wax-filament



POROUS / 4D



LAYFOMM-40



LAYFOMM-60

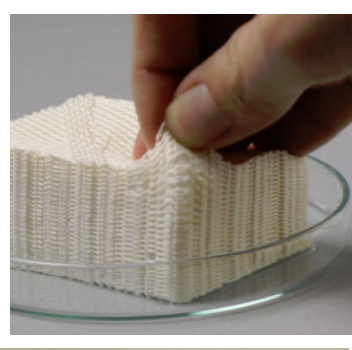
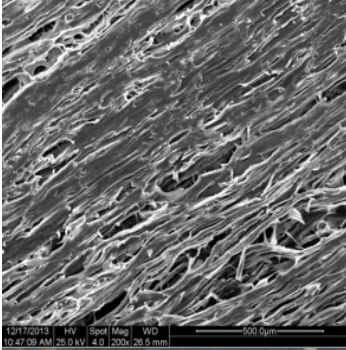


GELLAY

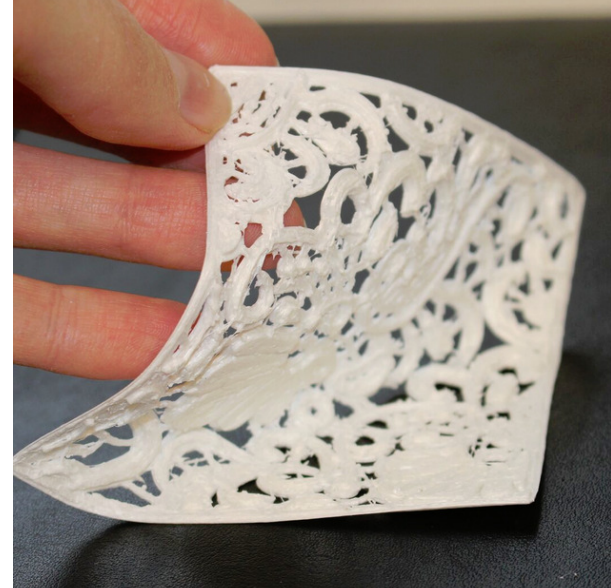


LAYFELT

SOPHISTICATED



POROUS / 4D / POROLAY



POROLAY series / LAYFOMM-40 / LAYFOMM-60 / GELLAY / LAYFELT

- <https://3dprintingindustry.com/news/kai-parthv-gets-felty-foamy-porous-poro-lay-line-filaments-21636/>
- <http://www.3ders.org/articles/20131222-printing-porous-and-fibrous-3d-objects-with-new-filament-line-poro-lay.html>
- <https://www.youtube.com/watch?v=2w-9KvBHago>
- <https://www.youtube.com/watch?v=Pkaus3DN2w0>

FOR EXPERTS



magnetic to magnets, filled with **carbonyl-iron**

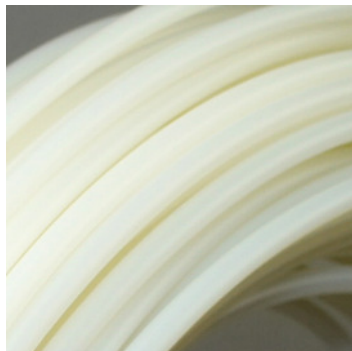


DI-ELECTRO-LAY, filled with TiO₂ 72%

- <http://www.3ders.org/articles/20140627-fdm-printing-ceramic-filled-polymers-for-electromagnetic-applications.html>

smartABS / PLA-Y-SOFT

BEST FOR ROUTINES



smartABS

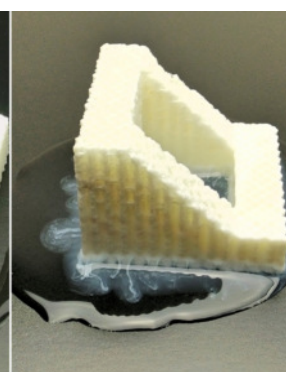
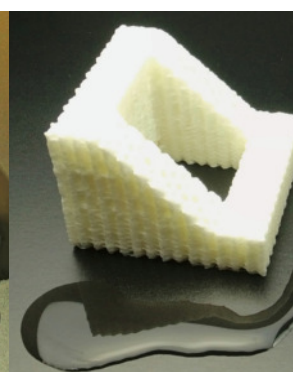
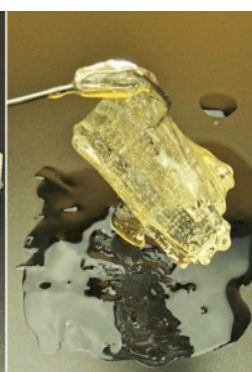
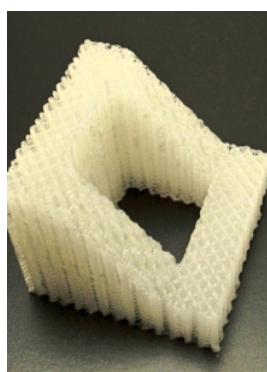
- enhanced inter-layer adhesion
- low warp at cold bed
- 235°C
- smoothable with acetone

PLA-Y-SOFT

- soft PLA
- high % of bio material
- of course lowest deformation at cold bed

LAY-AWAY series

of support filaments



LAY-a-PVA

improved PVA

print temperature

225 - 245°C

max.
build room
(chamber)
temperatur

55°C

for following
build materials

as common
ABS, PLA

if wet
dry in oven at max.
temperature for 3h

60° / 3h

ETHY-LAY

dissolve restlessly with alcohol

low temp.!
165 °C

50°C

for low temp custom
specific filament,
for waterfree use
(f.e. medical)

CHAMBERLAY^{100°}

improved formula based on
former HIGH-T-LAY filament,
very high max. printtemp.

230 - 280°C

100°C

**ABS, PC,
HIPS,
PET, PU,
PLA**

80° / 3h

in contrast to PVA
CHAMBERLAY draws very
slowly moisture from the
ambient air

CHAMBERLAY^{130°}

a new very high temp.
resistant formula specially

235 - 255°C

130°C

**ABS, PC, PET,
PU**

+NYLON

80° / 3h

in contrast to PVA
CHAMBERLAY draws very
slowly moisture from the
ambient air

notes:

former **HIGH-T-LAY** is now **CHAMBERLAY¹⁰⁰**
former **LAYCLOUD** users drive best with **CHAMBERLAY¹⁰⁰**

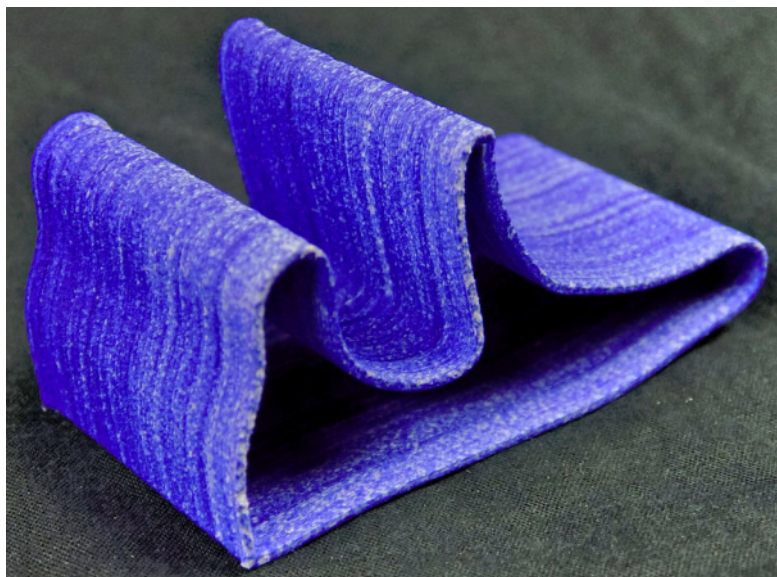
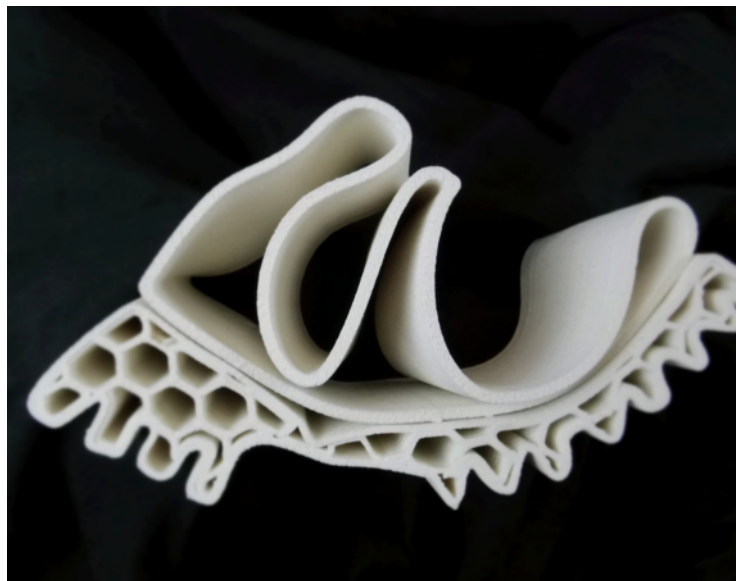
- <http://www.3ders.org/articles/20160428-kai-parthy-is-back-with-lay-away-series-of-soluble-support-filaments-for-fdm-3d-printing.html>
- <https://www.3printr.com/38505-5938505/>
- <http://3dprintingindustry.com/2016/04/28/lay-away-a-series-of-un-ordinary-support-filaments-for-fdm/>



- elastic as caoutchouc
- Shore A / ~ 90
- high filled with nature born organic pigments (over 30%)
- paintable with permanent markers
- colorable with inks (ethylalcohol marker inks)
- make your *vintage style*
- as stone washed effect / blue jeans effect
- for dampers, running shoes, experimental shoe-wear

printing:

- 0.4 mm nozzle, sticks well at roughened pet-tape and most other, cold to 60° platform
- 0.2 mm layer, thicker the more rough surface
- 175°C to 190° white colour, goes brownish when long under heat,
- rough and easy to feed filament
- experimental filament



<https://3druck.com/3d-druckmaterialien/solay-neues-elastisches-3d-druckmaterial-aus-der-rubberlay-serie-von-kai-parthy-0440295/>

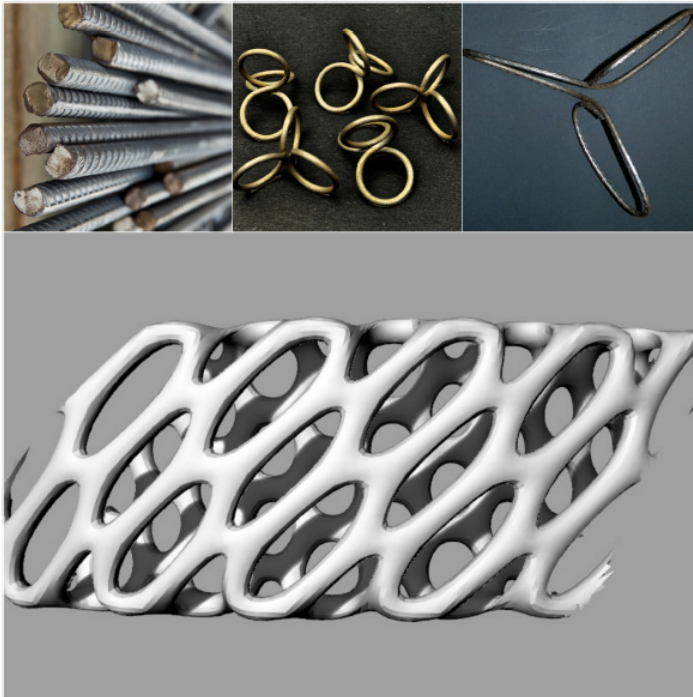
<http://www.3ders.org/articles/20151215-kai-parthy-unveils-rubber-like-solay-3d-printing-filament-for-your-future-shoes.html>

selected 3D-printing INVENTIONS by Kai Parthy

hot ends / concepts / patent applications

BIONIC MESH STEEL FIBRE / patent pending

PROOF OF CONCEPT



reinforcement of

freeform
architecture

using a new

bionic-mesh
steel-fibre

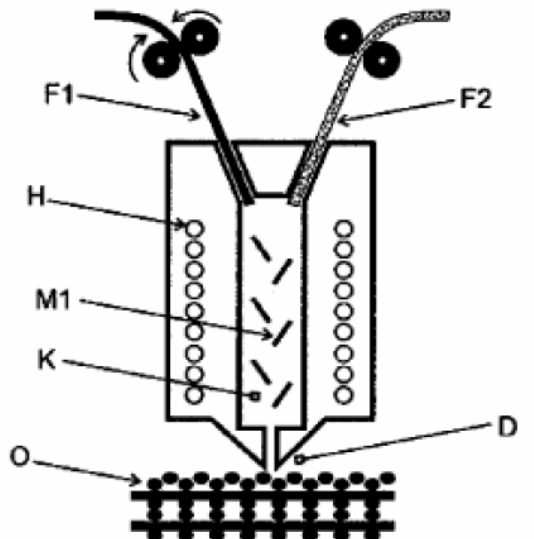
<http://www.3ders.org/articles/20161110-kai-parthy-makes-construction-3d-printing-viable-with-scalable-bmsf-steel-reinforcement-inserts.html>

<https://3druck.com/3d-druckmaterialien/bionic-mesh-steel-fibre-von-kai-parthy-macht-3d-druck-von-freiformstrukturen-aus-beton-moeglich-1451080/>

patent pending /
Kai Parthy / Germany

dual colour - dual filament hot end / concept

EARLY BIRD



german patent application from 2010
first concept for a hot end to blend filaments

Multi-Filament Printhead

filled: 16.12. 2010

published: 21.06.2012

DE102010054824A1

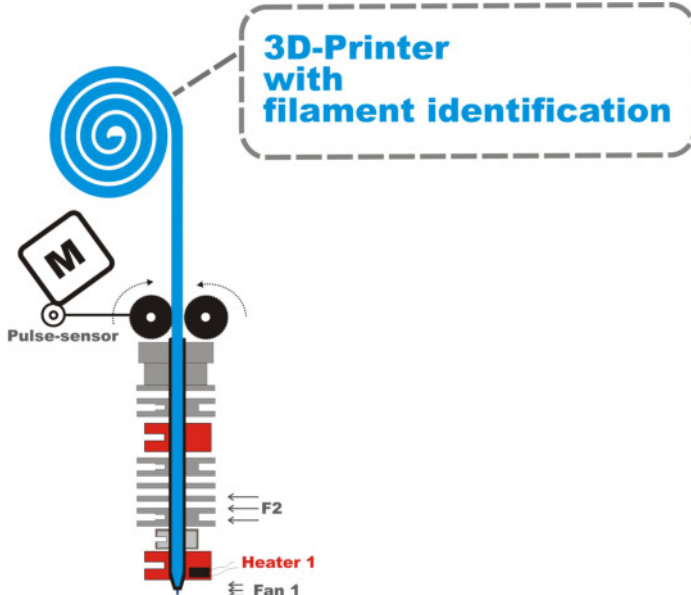
M1: static or dynamic mixing elements

[EN] Print head for rapid prototyping printer for extruding thermoplastic or reactive ...

[DE] Druckkopf für FDM-Verfahren mit mehrfacher Drahtzufuhr und Mischkammer zum Erzeugen von Objekten aus Polymerblends

complex hot end with lab inside / concept / patent pending

HOT END CONCEPT



filament detecting?

Each filament has specific viscosity-properties of it's molten mass, if we know the pressure & temperature under which the filament is feeded trough the feed-channel and the nozzle,

what for ?

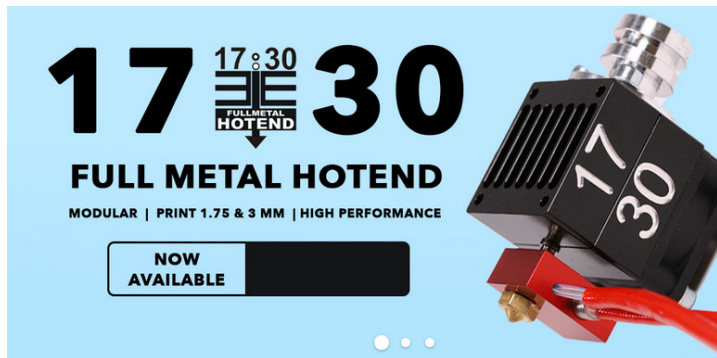
- the printers software can find out what filament you are using,
- can calculate best printing properties without blockages, f.e.
- flow rate, head-speed,
- retract parameters, acceleration-rates and some more
- sophisticated values, also to prevent
- stringy objects,
- you may print smooth, rough or cratered surfaces
- being able to print future filaments !

You don't need to be an expert for successful 3d-printing. The machine helps you!

<http://www.3ders.org/articles/20150624-commentary-smart-hotends-and-the-need-to-truly-innovate-in-3d-printing.html>

1730hotend / a cooperation with ReprapUniverse / Netherlands / patent pending

HOT END



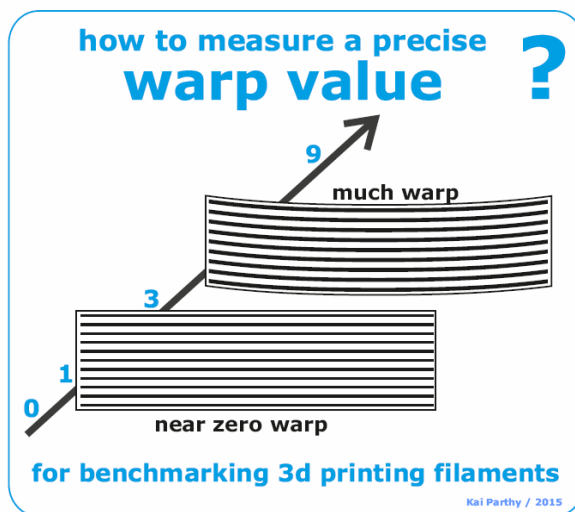
The 1730 Full Metal Hotend enables switching Nozzles between 1.75 mm and 3 mm in less than 5 minutes. Experience total 3D-Printing freedom and enjoy the best of both worlds.

<http://www.1730hotend.com/>

<http://www.3ders.org/articles/20160126-kai-parthy-reprapuniverse-launch-modular-175-3mm-3d-printer-hotend-on-kickstarter.html>
<https://3druck.com/tags/1730-fullmetal-hotend/80>

WARP – INDEX

MEASURING PRINCIPLE



The biggest obstacle for exact printing needs a measurement standard / Warp-Index found. The control of the warp is the everlasting problem of the 3D print scene - but at least we now can measure and classify the warp.

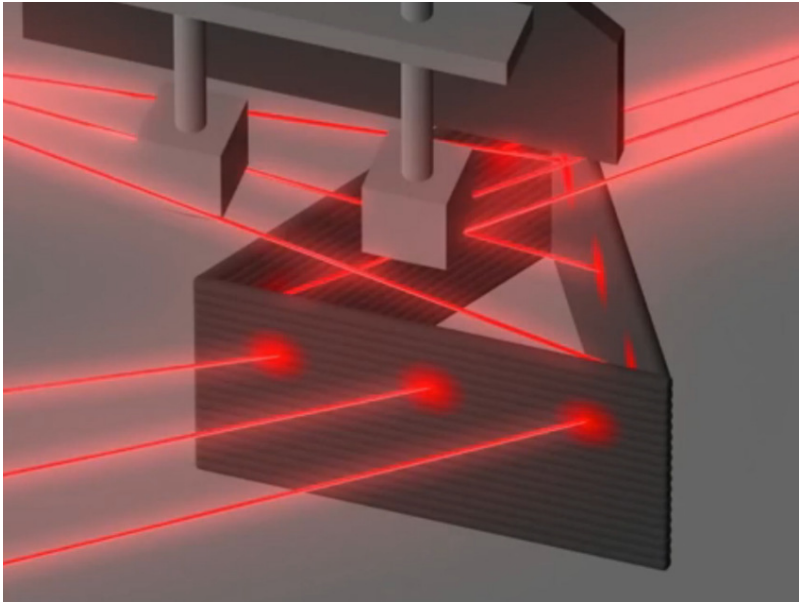
<https://all3dp.com/warp-finally-theres-way-measure/>

<http://www.3ders.org/articles/20151130-kai-parthy-develops-low-bondage-warp-index-for-3d-printing-filaments.html>

<https://3druck.com/3d-druckmaterialien/kai-parthy-veroeffentlicht-white-paper-zum-thema-warping-5239934/>

WARP-fighting CONCEPT

REDUCE DEFORMATIONS

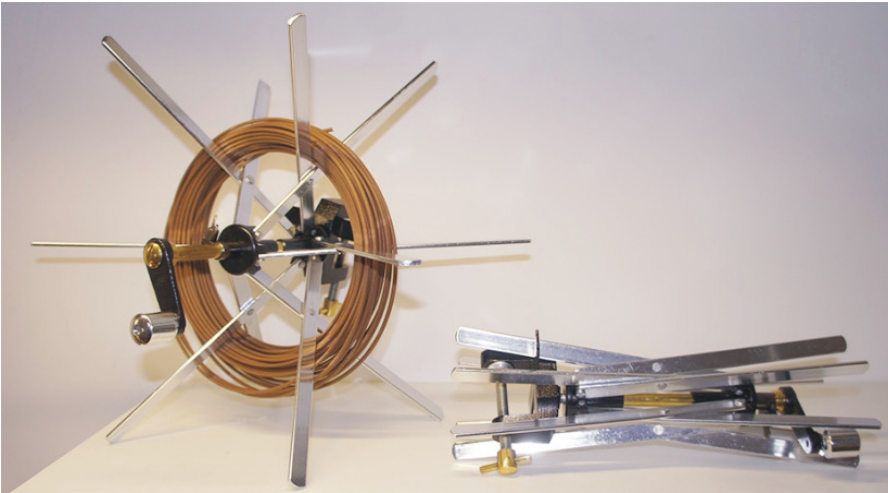


animation:

<https://youtu.be/xgWQPULul-U>

FILAMENT EQUIPMENT

HELPFUL



universal filament holder with extra long arms

EDU-KITS

FOR SCHOOLS



low priced pack of 2 coils combined = 0.250 Kg

Kai Parthy . CC-Products . Koeln . Germany
Productdevelopment & Innovations
kp@cc-products.de

LAY
FILAMENTS