FiberEUse

Large scale demonstration of new circular economy value-chains based on the reuse of end-of-life fiber reinforced composites

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HOW IS MADE…

glebanite

- Glebanite is GRP (Glass Reinforced Polyester) recycled into GRP again. It is obtained from:

Grinded scraps

+

Fresh UP resin

Further to the basic mixture you can add:

- **Pigment**: to give color to your product
- **Fresh glass fiber**: to improve mechanical resistance Continuous Strand Mat (CSM), Continous Flament Mat (CFM), fabrics, milled fibers
- **Additives**: for fire protection, antimicrobical, dispersing agents, flexible behavior…
- **Other fillers**: for example you can add glass bubbles (or PU foam powder) to have a very light material that can float like the one used for Rubini's parfume (see next slide).

Basic principle

Basic principle: Glebanite grade

- **Glebanite grade**: is the percentage of powder (grinded scraps) compared to the percentage of UP resin in a mixture.

- Example:

Grade 50%	quantity	percentage
powder	32 kg	50% of resin
resin	64 kg	

Grade 150%	quantity	percentage
powder	96 kg	150% of resin
resin	64 kg	

Basic principle: Glebanite grade

- **Glebanite grade**: tells how will a product “grow” when you will recycle it again. Grade 50% means that powder is 33% on total weight, so when recycling for the second time (using same grade) you will have enough material for 3 new product equal to the old one, or a product 3 times bigger than the old one.

Depending on its **grade** the mixture can be processed in one or more technologies between:

- Open mold casting
- Wrapping & plastering on mold (hand lay-up)
- Closed mold cast and press
- Continuous cold extrusion (patented)
- Continuous lamination
- 3D printing with robotic arm
- 7 axis milling and laser engraving

Technologies: open mold

Open mold casting – Maximum grade 100%
Cheap technology suitable for single pieces and prototype. Mold are prepared using milling facilities with “soft” material like PU, PA, PP, HDPE, PET, PTFE. Metallic (steel or aluminum) mold are suitable too. Used to prepare the row material for milling processing.
Manual production.

Grey: grade 50 Black: grade 100

White and Grey: grade 50
Black: grade 100

Technologies: open mold

Display for jewellery shop: prototype 360x410x50/160 mm

Furnishings stores, cafés as potential markets.
Considering a renewal of installations every 3 or 5 years.

Wrapping & plastering on mold (hand lay-up) – Maximum grade 100%. Another easy and cheap way to produce thin wall (less than 3 mm) prototype and complex surfaces.
Manual production.

Technologies: closed mold

Closed mold casting – Maximum grade 150 (grade 200 under testing). More expensive than open mold technology but allow to grant better geometry of the piece (specially for plane surfaces). In some application is absolutely necessary. Semi automatic production.

Glebanite board for milling a mold.

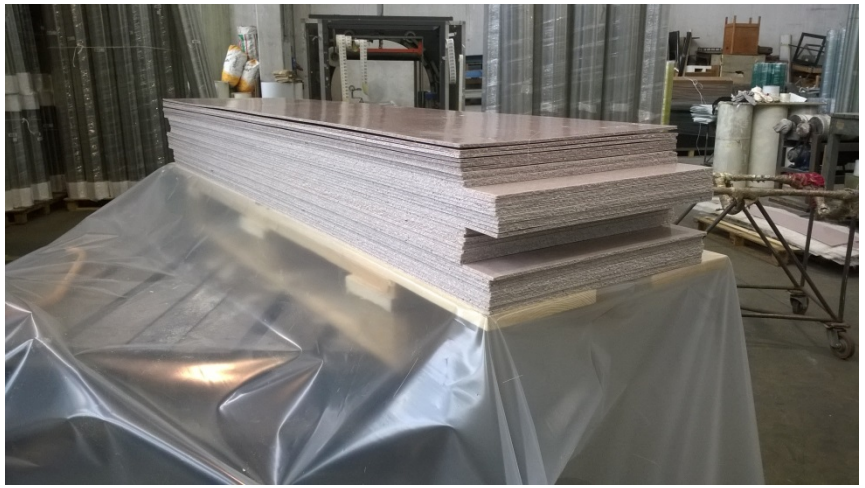
- 1580 x 1400 x 25 mm
- 66 kg
- density 1,19 kg/m^3

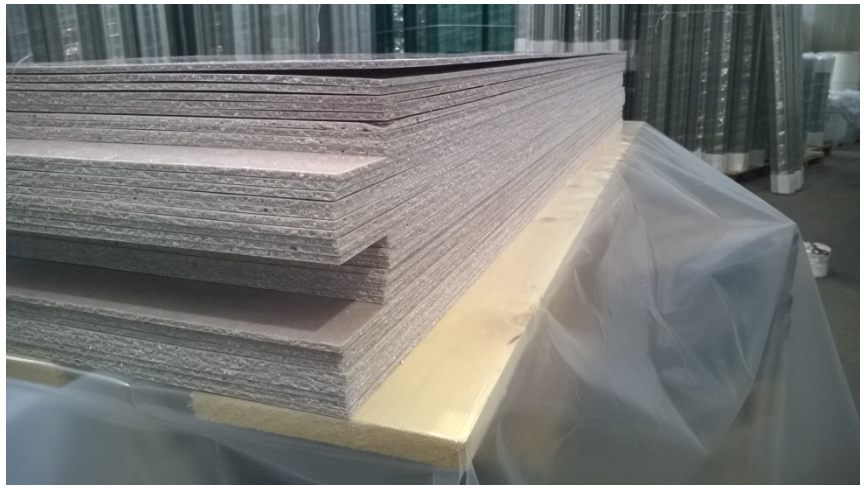
Technologies: extruson

Continuous cold extrusion (patented) – Maximum grade 163%.
Technology developed for high productivity (up to 950 kg/h) and low cost. Usefull for continous production of rod and axle.
Glebanite produced with this technology is extremely compact thanks to a vacuum camber in the equipment.

Technologies: lamination

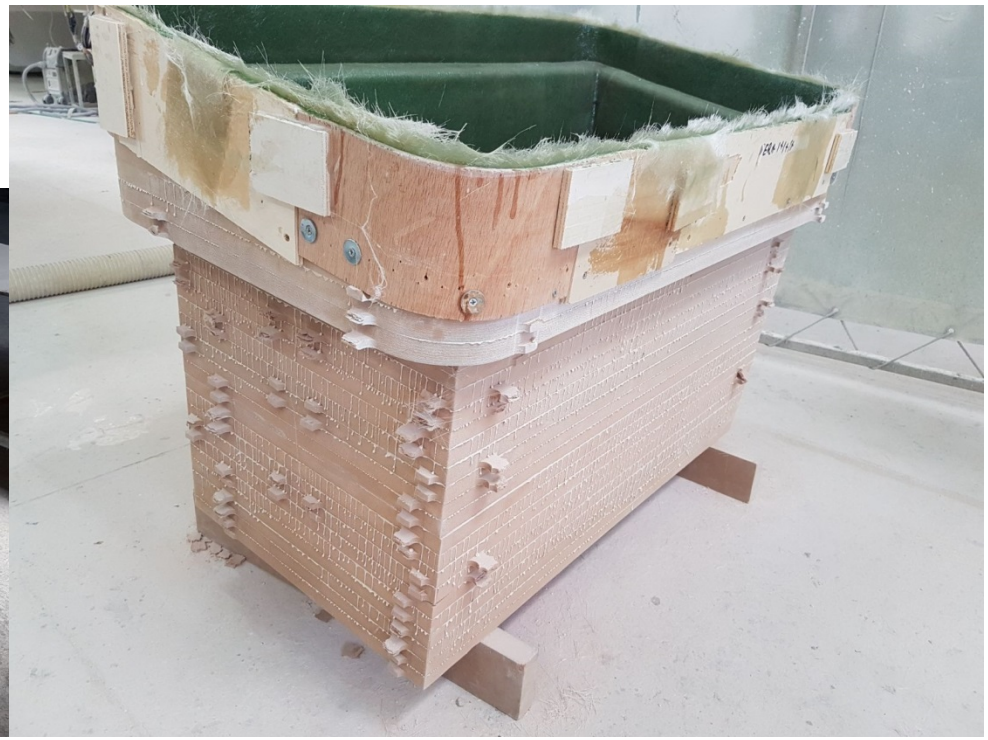
Continuous lamination – Maximum grade 50%. Good technology for high productivity. It allows flat and corrugated sheets from 3,5 to 5 mm thickness (higher thickness on test). Maximum width 1400 mm. Plant produce laminates adding glass reinforcement on top and bottom surfaces so to give good mechanical resistance. Flat laminates can be glued together.





Technologies: lamination

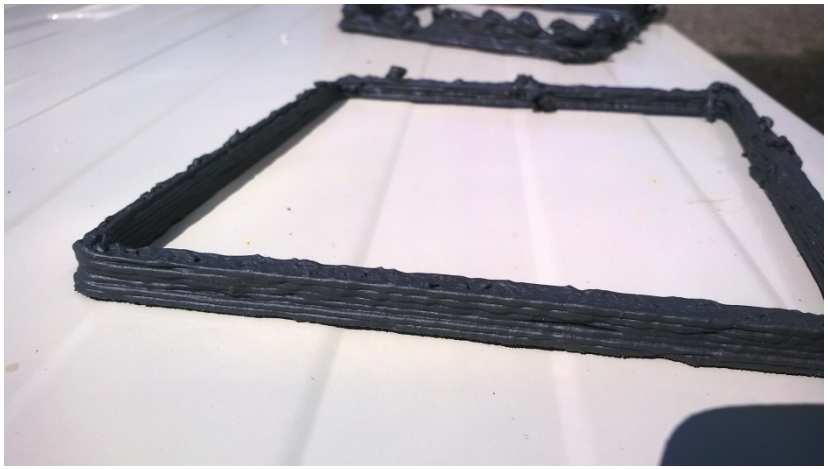
MDF (Medium Density Fiberwood) Vs. Glebanite for marine application?



Technologies: robot

3D printing (Additive manufacturing: FDM and SLA/ DLP) with robotic arm for large 3D printed objects (KUKA KR120 with spindle 7kW and laser 60W).
Powerful technology for complex pieces still needs developing (in 2017) specially for robotic arm movement and Glebanite's extruder integration.
Politechnico Milan with + Lab may boost this activity.

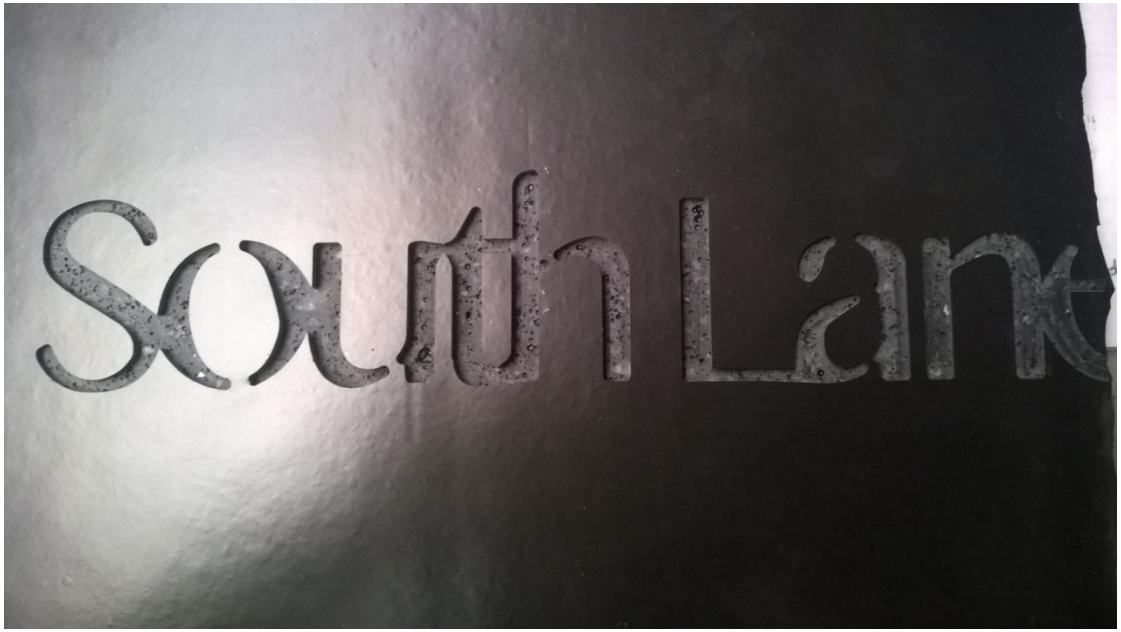
7 axis milling and lasering
Ready to use equipment



Mix technologies

Glebanite grade 50%,
laminated, milled, assembled.

Glebanite grade 50%, closed molded, milled…
for road sign

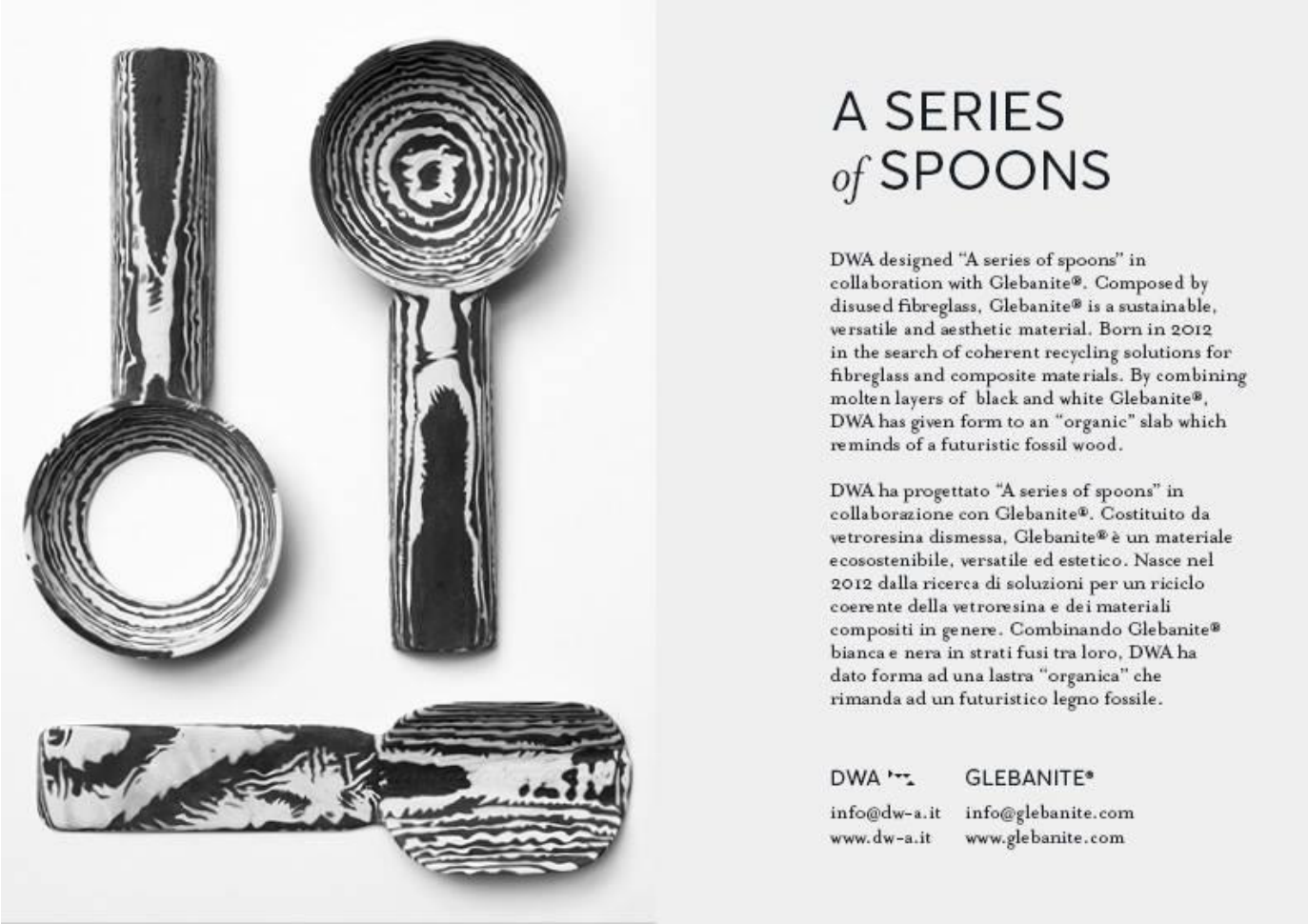


Glebanite grade 50%, cast in open mold, milled…
resembles marble for water tap

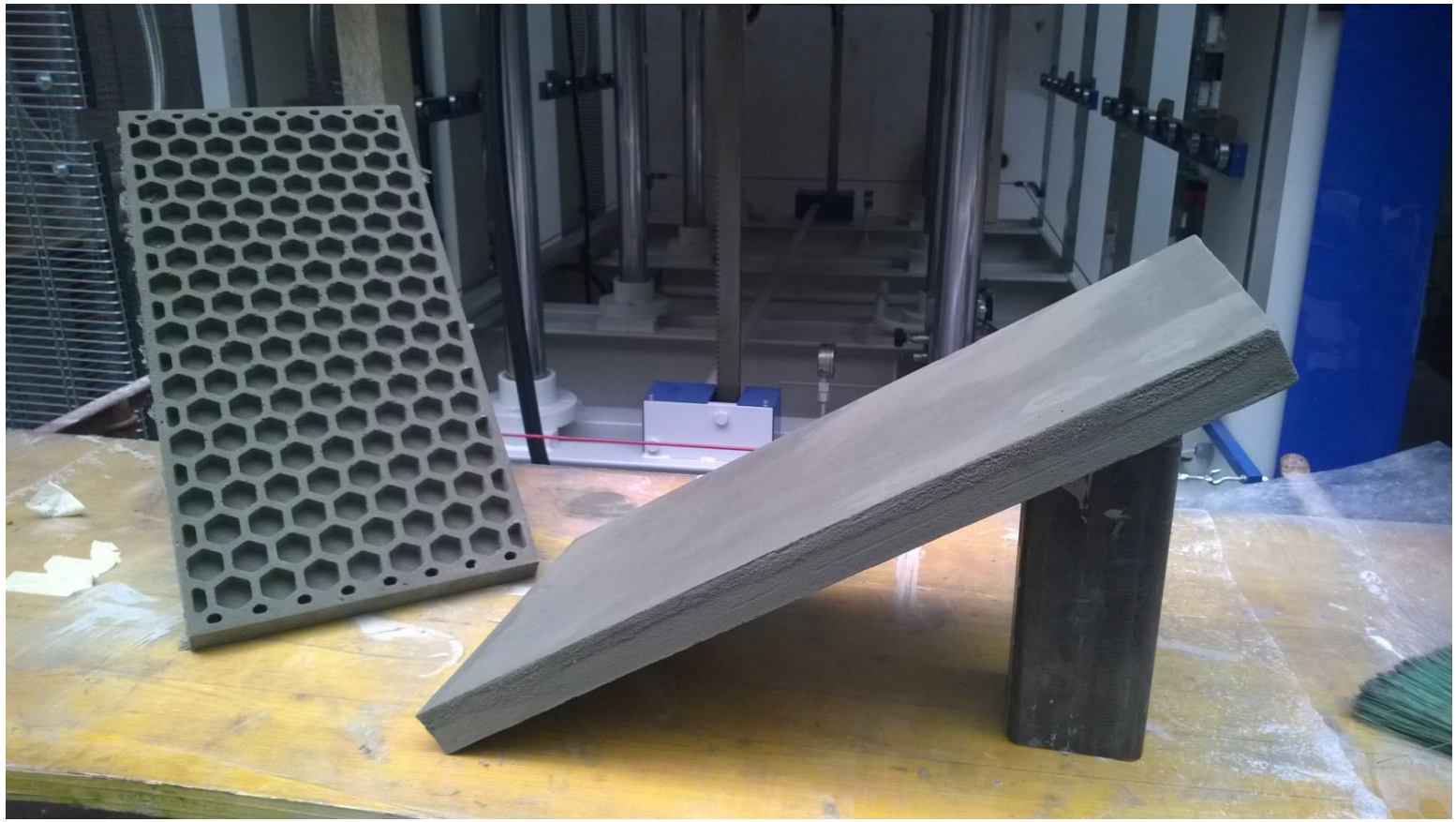
Mix technologies

Glebanite grade 50%, multilayer cast in open mold and milled.

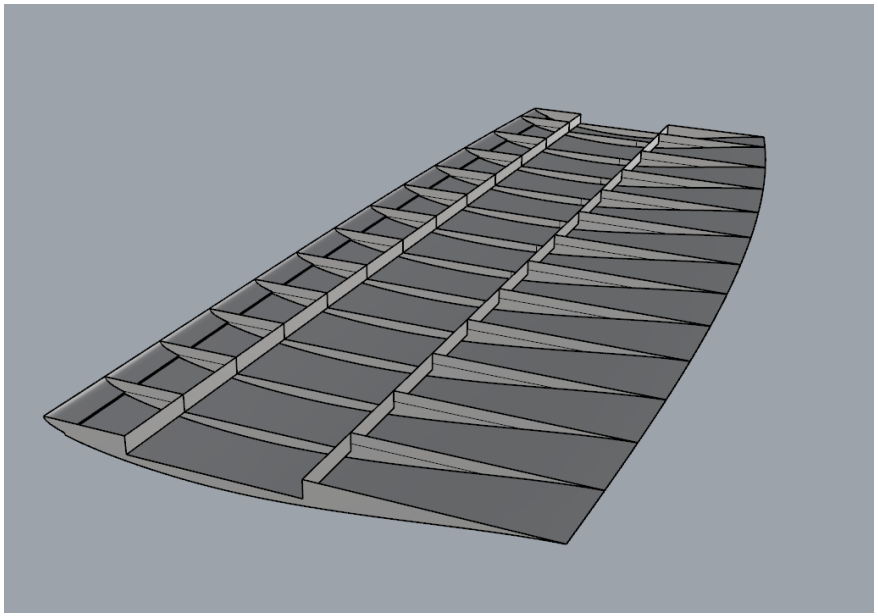
Salone del mobile Milano 2016

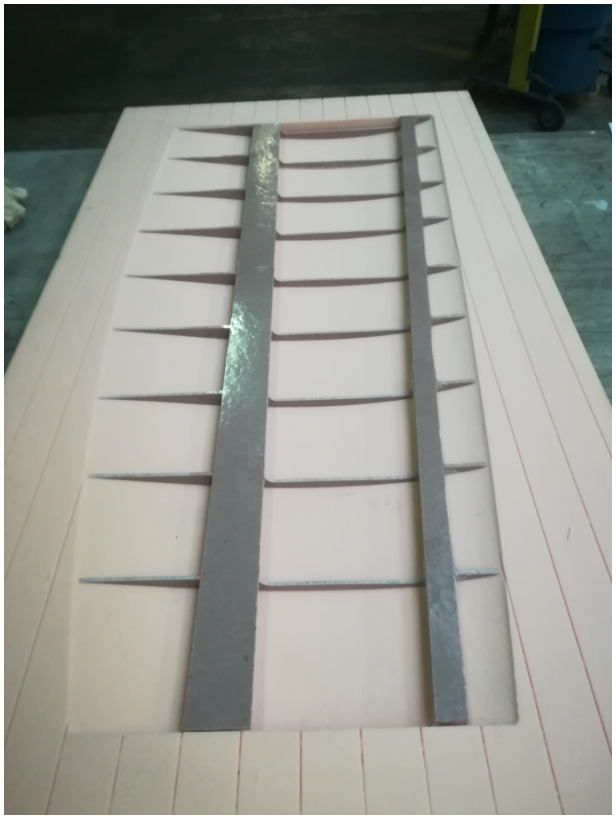


Structural laminates



Structural part: laminated grade 50%, milled, glued.
Sailing boat kneel





Properties

feature	unit	value
density	Kg dm^{-3}	0,7 -2,2
working temperature	K	40 - 110
thermal conductivity	W m^{-1} K^{-1}	0,21
tensile strenght	Mpa	12 - 48
tensile module	Mpa	2300 - 9000
flexural strenght	Mpa	20 - 140
flexural module	Mpa	2300 - 9000
electrical stiffness	kV mm^{-1}	30
Linear thermal expansion	-	$3 * 10^{-5}$
water absorption	%	< 0,4
autoignition temperature	K	408 - 480

Properties

		Flat sheet, grade 50			
		no reinforcement	2 x 150 gm2 Chopped Strand Mat	2 x 300 gm2 Continous Flament Mat	2 x 300 gm2 Fabrics 0-90
thichness (average)	mm	5,3	5,9	6,1	3,9
tensile strenght meanvalue	Mpa	15,0	18,2	26,2	36,3
tensile module meanvalue	Mpa	3550	3800	4900	8000
flexural strenght meanvalue	Mpa	20,7	55,0	81,0	135,0
flexural module meanvalue	Mpa	2700	4000	4900	9500

Note

- Technologies are differently suitable depending on what product you need to create and sell. Most of product that can be made of Glebanite are too expensive for the market but, fortunately, not all of them.

- Remember that **circularity** is needed in FiberEUse project so target application should comply with this.

Thank you…

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