



LIGHTer

International
Conference

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19

Powder resin system – a new way of composites manufacturing

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Swiss CMT AG



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Sustainable Reinforcement – our interpretation of Lightweight Engineering

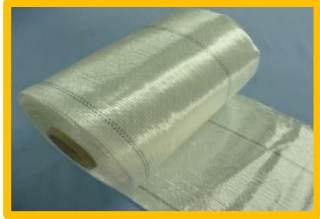


- lightweight engineering office
- founded 2013
- acting global (worldwide projects)
- initiator of **Powder Resin Systems**
- feasibility studies
- application support
- new developments



our passion

unique technologies for sustainable composite applications



reinforcement



powder resin



- innovative
- solvent-free
- none-hazardous
- infinite shelf life

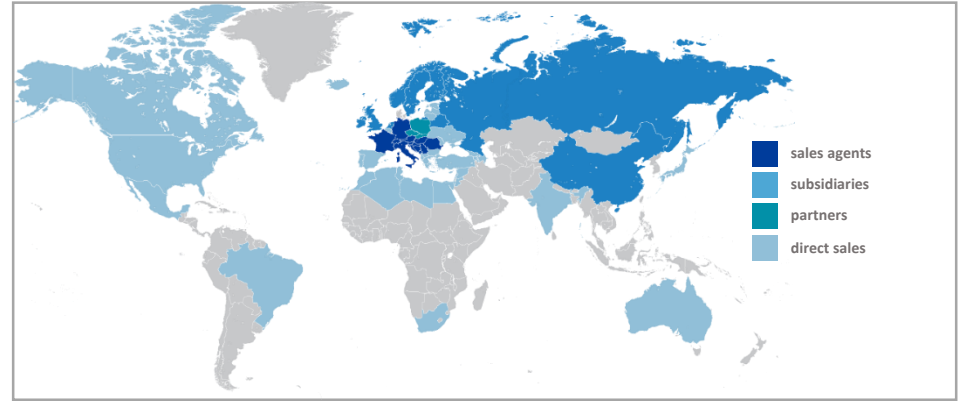


applications in...

mobility, automotive, industry,
renewables, construction, building

our key partner

Emil Frei GmbH & Co. KG, Germany



FreiLacke:

- founded 1926
- approx. 600 employees
- global presence
- Specialist in System Coatings (powder, liquid, e-coat, gel-coat)

joint Composites activities:

- development of powder resins
- application development @ CMT
- development of system solutions

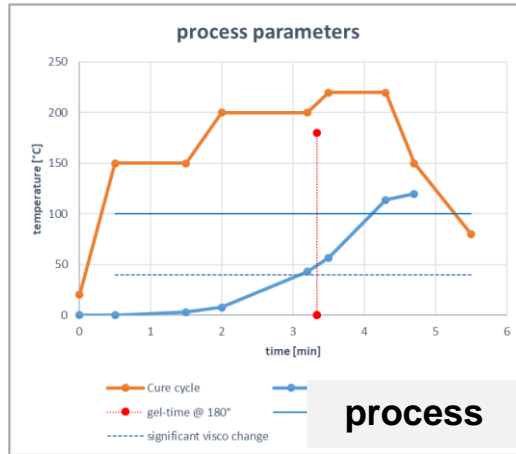
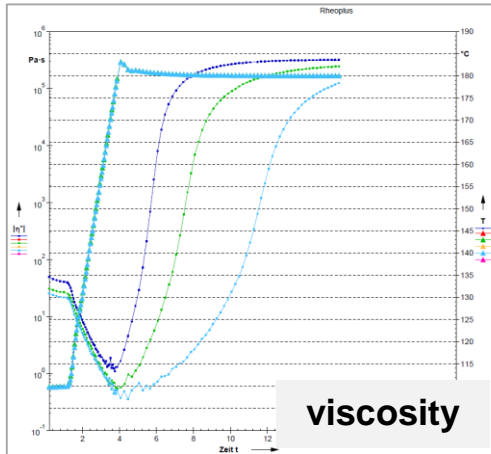
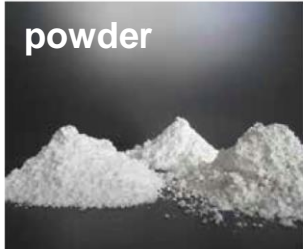


powder resin systems

manufactured at FreiLacke, GER



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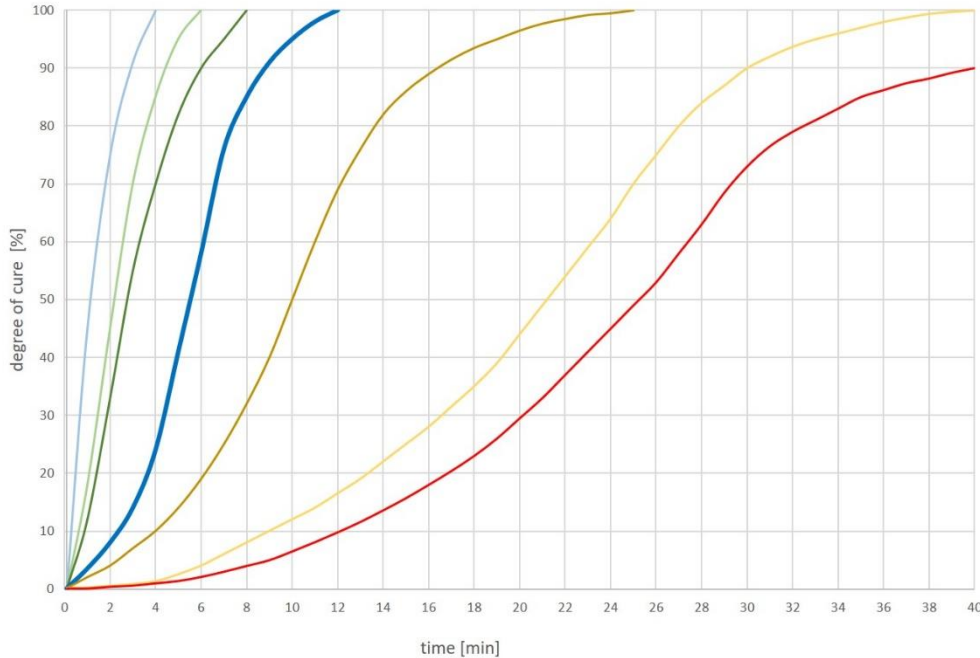
Resin Characterization

- + solid @ RT
- + “infinite” shelf life
- + storable $\leq 25\text{ }^{\circ}\text{C}$
- + epoxy based
- + heat curable
- + solvent free
- + none hazardous
- + adjustable cure speed
- + adjustable viscosity
- + “compound able”
- + colors
- + ...

powder resin systems

heat driven system

cure PE6205



curing conditions

- + min 150 °C to start reaction
- + best window 170-210 °C

Performance PE6205

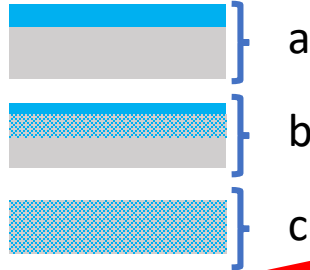
- + Powder T_g = 42-46 °C
- + Cured T_g = 106-113 °C
- + Viscosity < 1,0 Pa.s
- + Tensile strength: 76 MPa
- + Tensile modulus: 3,15 GPa
- + Elongation @ break: 5%

powder resin systems

...from Powder to PrePreg to Part...

PrePreg Characterization...

- + solid at room temperature
- + extremely long shelf life
- + storable $\leq 25\text{ }^{\circ}\text{C}$
- + solvent free, none hazardous
- + almost any fiber possible
- + impregnation grade adjustable
- + resin content adjustable



- applying...**
- scattering
 - doctor-blade



- converting...**
- fully impregn.
 - semi impregn.
 - rolls, sheets
 - masking



- molding...**
- hand layout
 - automated
 - hot-fixing
 - b-stage



- forming...**
- PreForm, stacks
 - QC
 - comb. w in-mold coatings
 - insert placements



- curing...**
- one-shot or multi-steps
 - hybrid materials
 - continuous or step wise

PrePreg manufacturing

example with Double Belt Press (DBP)



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fibers



powder



«powder» PrePreg

working w powder resins

feasibility study – spiral weave (1/2)



TechTex Sample

- CF spiral weave ($\approx 600 \text{ g/m}^2$)
- Resin PE6405
- 19 layers
- CF vol% >60 (\approx CF wt% 69)
- $p = 7 \text{ bar}$
- $t_{\text{eff}} = 10,7 \text{ mm}$



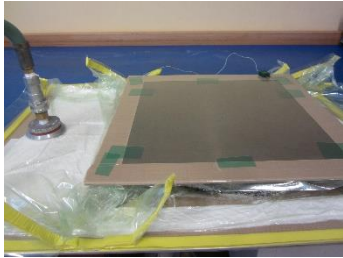
powder scattering by hand



finished stack / ready to cure

working w powder resins

feasibility study – spiral weave (2/2)



curing

- vac.bag to stabilize
- press cure



finished part/disc

- $d_o = 315$ mm
- $d_i = 155$ mm

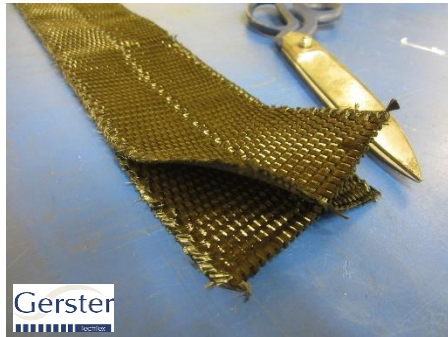


visual inspection

- surface ok
- impregnation ok

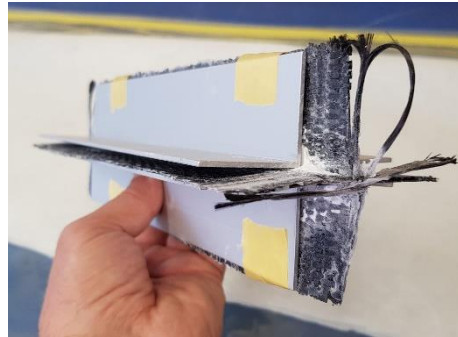
working w powder resins

feasibility study – cross profile weave



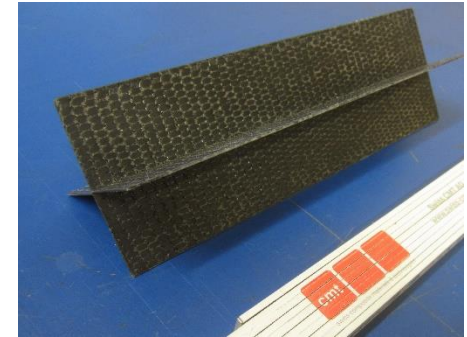
TechTex Sample

- CF Cross Profile Weave
- Resin PE6405
- 1x layer each leg
- vac-bagging, oven cure



molding/bagging

- aluminum profiles
- vac.bag to stabilize
- oven cure



visual inspection

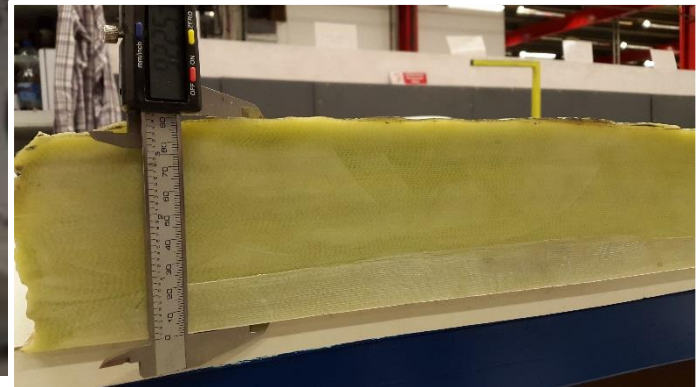
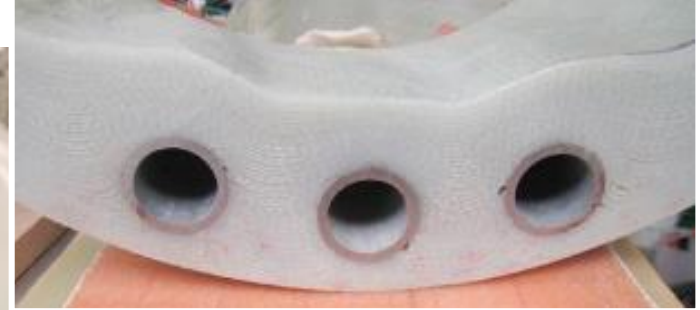
- surface ok
- impregnation ok

vacuum bagging

made with “powder PrePreg”

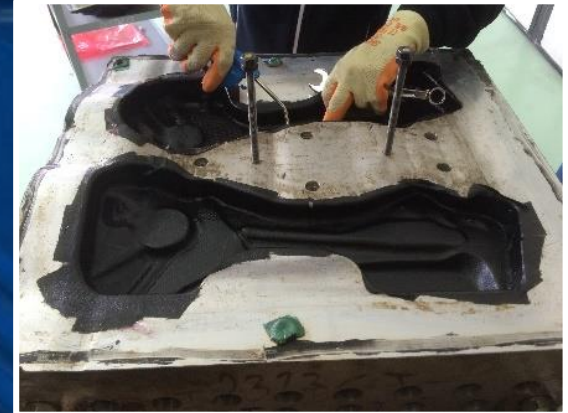


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press molding

molded with “powder PrePreg”



continues lamination

manufactured w powder resin



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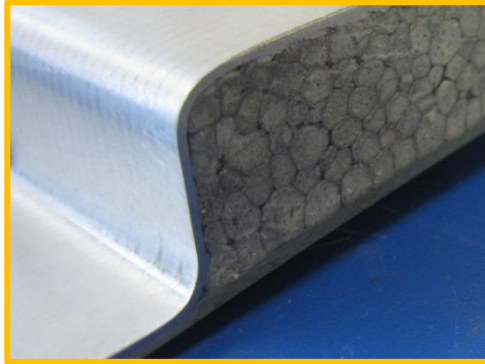


inspirations

Hybrid Material Solutions

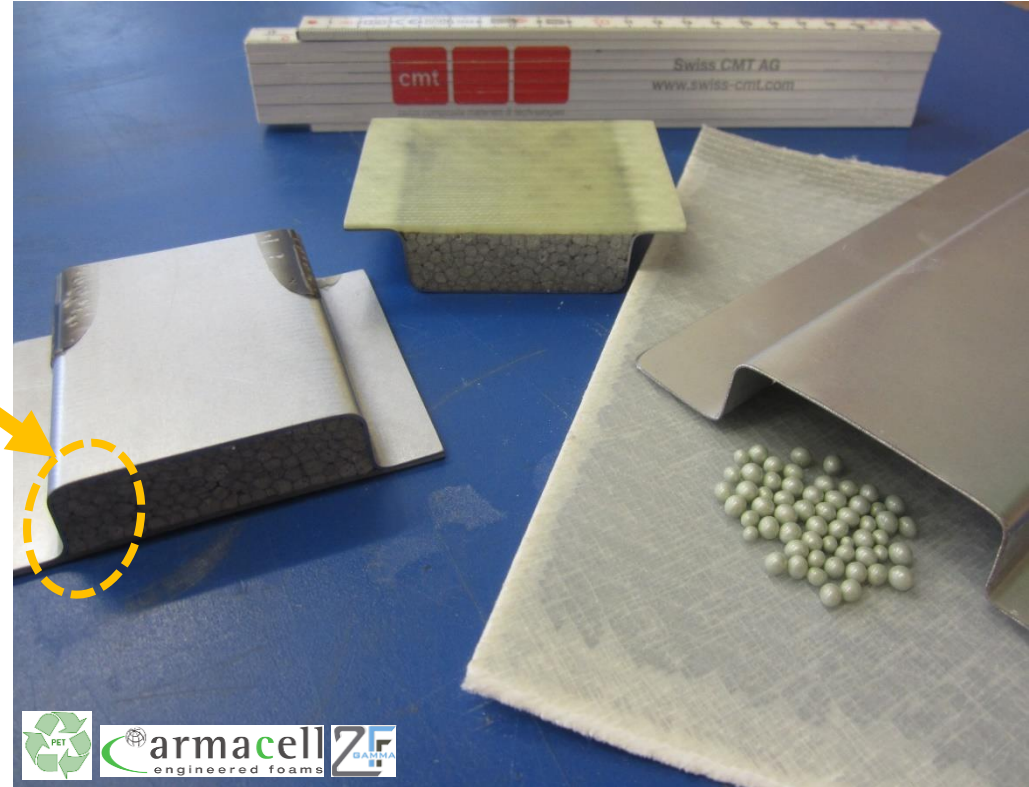


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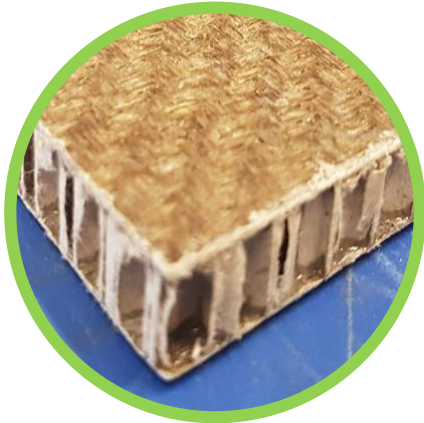
Press Molding @ 180°C

- Steel Profile (t 0,8 mm)
- Armacell ArmaShape (d 2mm)
- bonding agent (special)
(reactive, solvent free)
- Powder PrePreg G2 BX600-60t
(4x Layers PrePreg w Powder Resin System)



inspirations

Hybrid Material Solutions

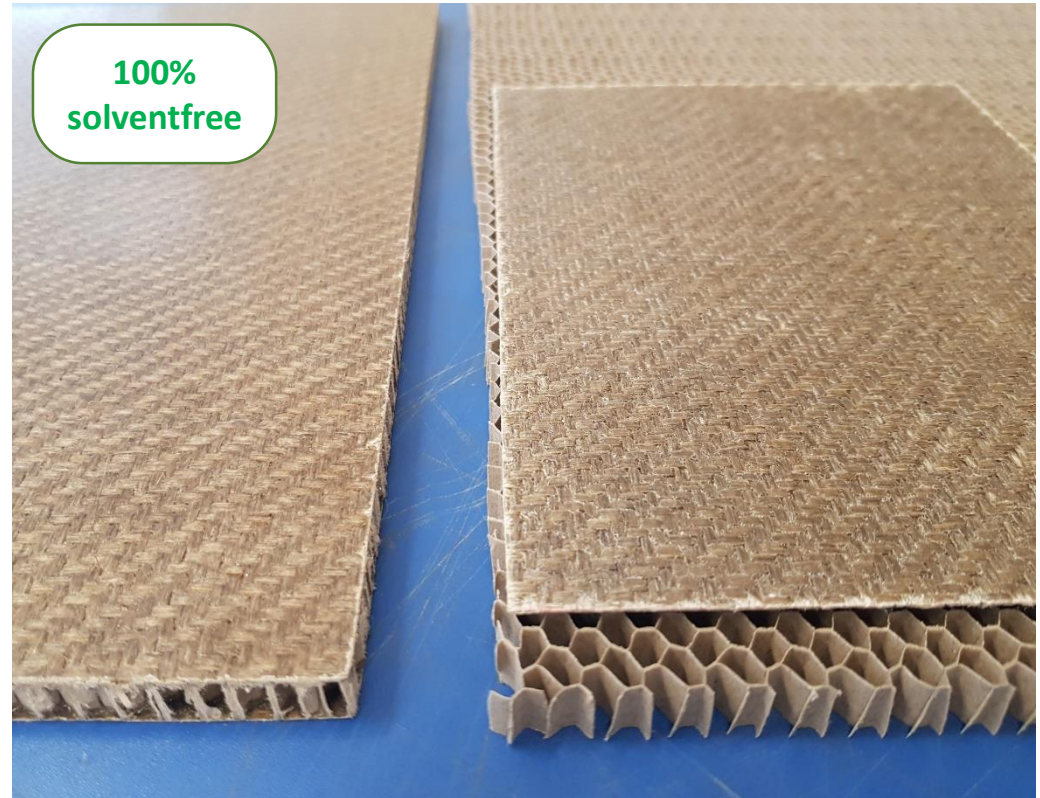


press molding @ 170°C

- powder PrePreg NF 350TW
(flax fiber weave, 1x layer per side)
- Paper HC RG-120-6 / 10mm
- Powder Resin System
(impregnating NF and bonding HC)



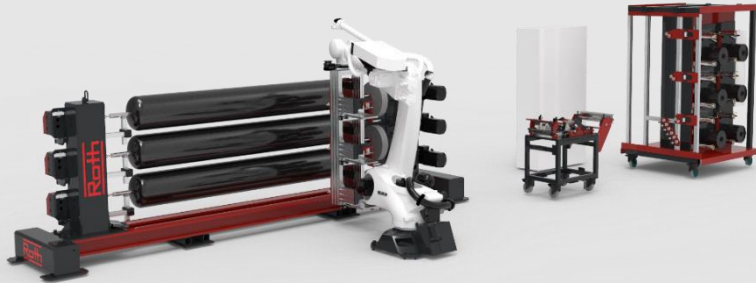
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new projects...

low-cost H2 Tank

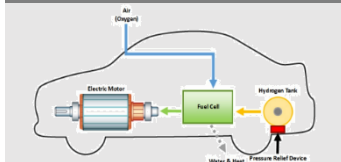
picture: Roth Composites, Germany



symbolic picture: Toyota Mirai H2-Tank



symbolic picture: www.firehouse.com



high pressure vessels (70 MPa) for H2 storage:

- low-cost due to higher productivity
- high fiber volume content (less material)
- high-speed TowPreg winding (faster manuf.)
- solvent free, none-hazardous resin
- TowPreg storable at RT
- better QC monitoring
- etc...

interested?

the project “LCHTP” is open to participate; we have a highly skilled project team with H2 experts. Anticipated start of feasibility study: 01.01.2020 (18 months)

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conclusions

working with powder resin systems

- reactive powder resin systems (EP based)
- solvent free, none-hazardous ingredients, “infinite” shelf life
- temperature driven process (usually 160-210 °C)
- enabler for new manufacturing methods
- stabilizer for complex (fiber) structures
- impregnating thermostable fibers/fillers (multi-material)
- bonding capabilities (thermoplastics, metals, wood, paper...)
- thin and thick sections (low exothermic reaction)
- semi-finished products
- one-shot technology
- ...

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...inspired?

let's create **your** next generation of
innovative, sustainable & clever lightweight solutions!



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