

Light and strong composites for trains

Willem Böttger
NPSP Composieten



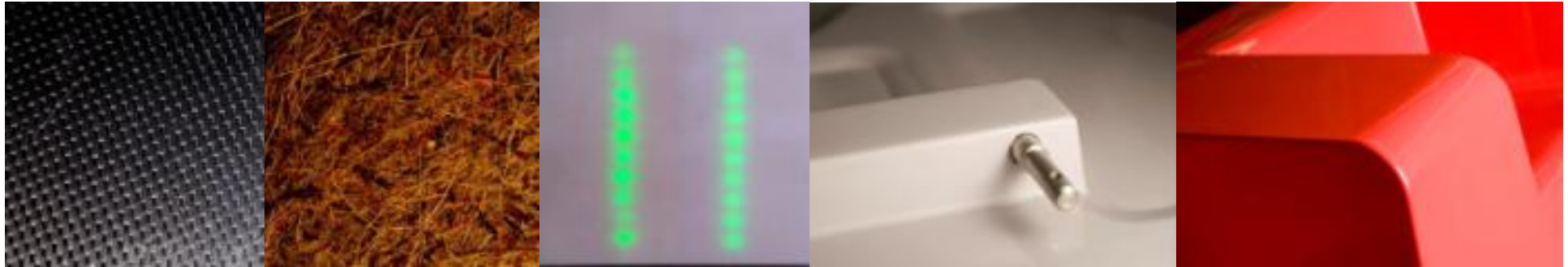
NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

NPSP Composites

- Established in The Netherlands in 1998
- Fibre reinforced thermosetting composites
- Light and Smart Materials
- VA-RTM production method



Options NPSP Composites



- Transparent resins
- Different kinds of fibres possible

- Integration of LEDs

- Use of inserts
- Details on all sides

- Double shaped curves
- Elegant products



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Products NPSP Composites

Construction & Design



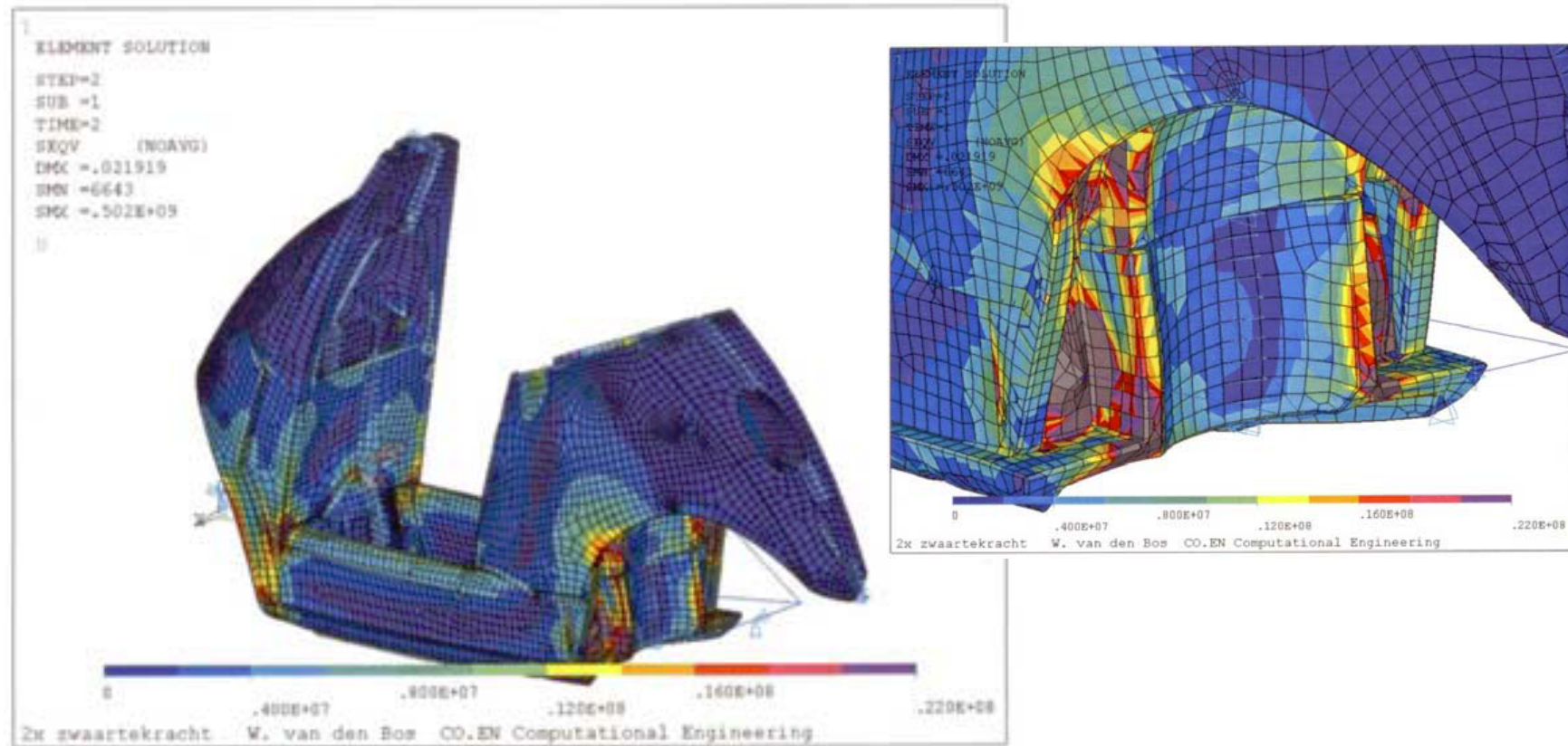
NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

The Process



FEM analysis

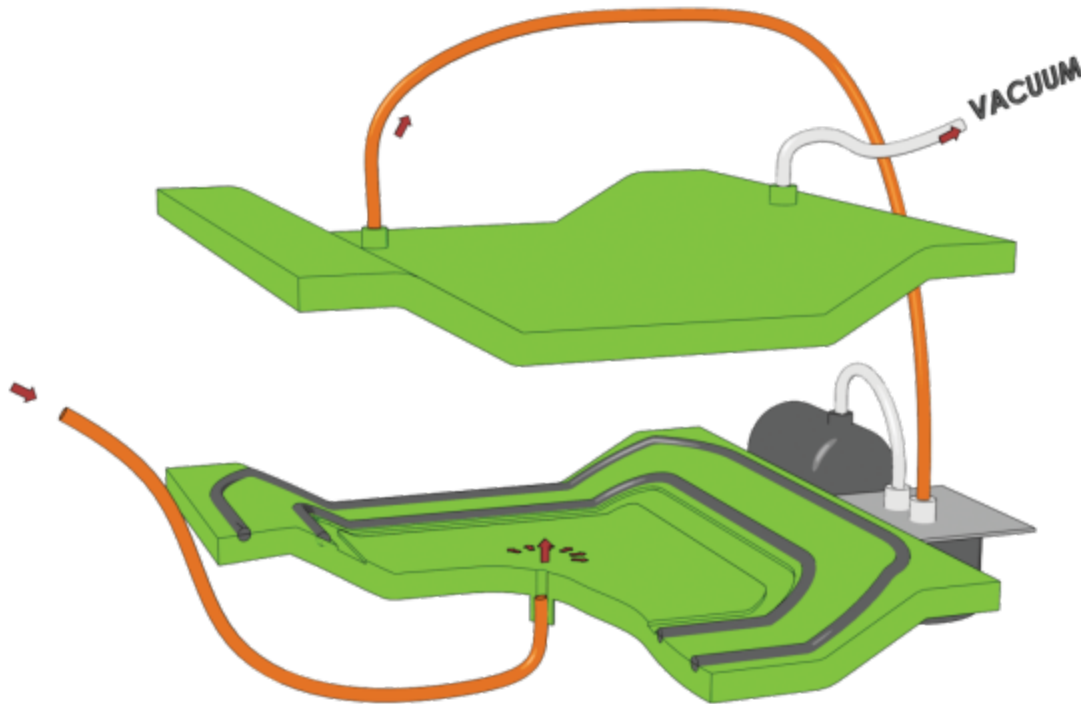
Results in laminate configuration



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

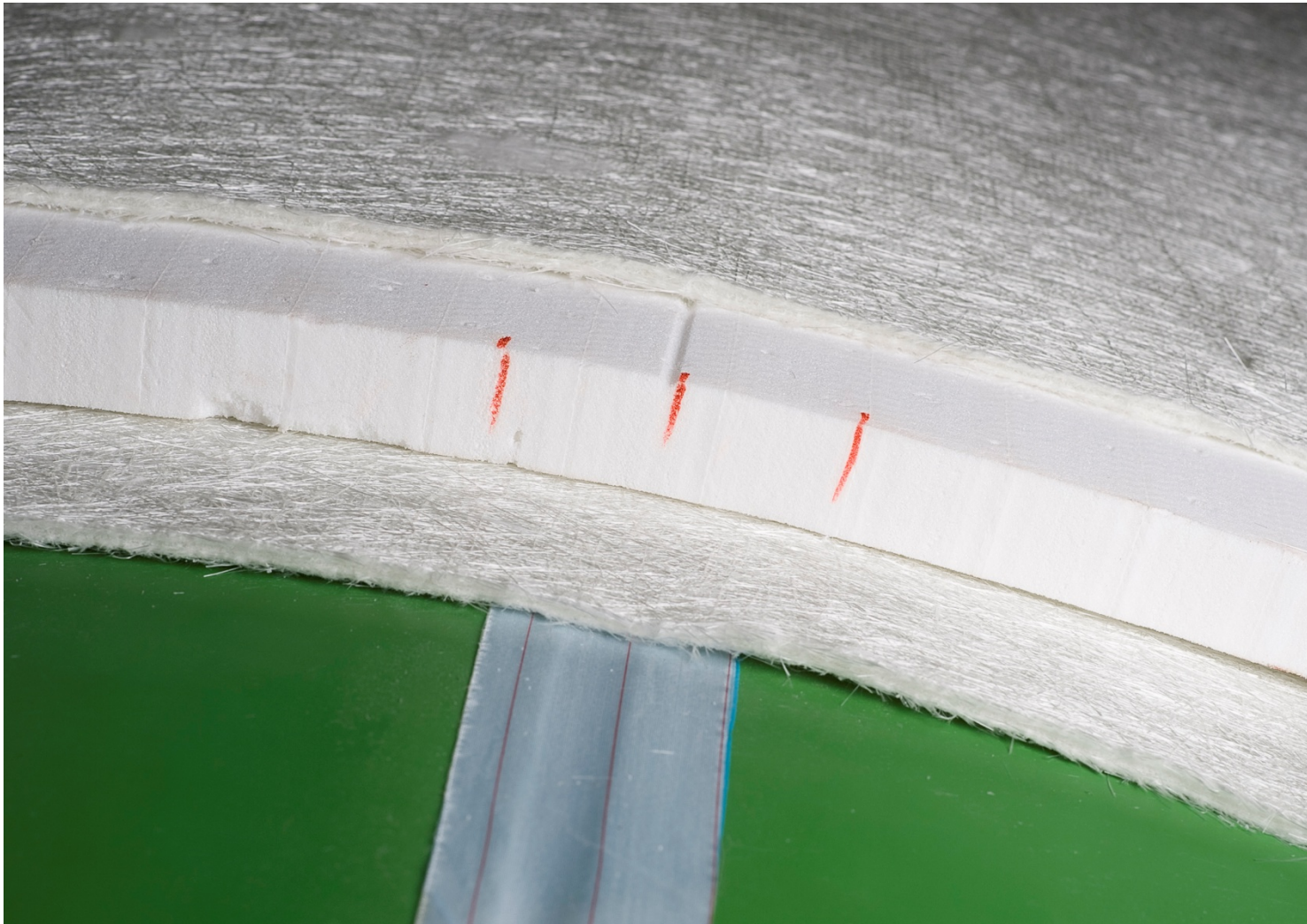
Production process

Vacuum Assisted – Resin Transfer Moulding



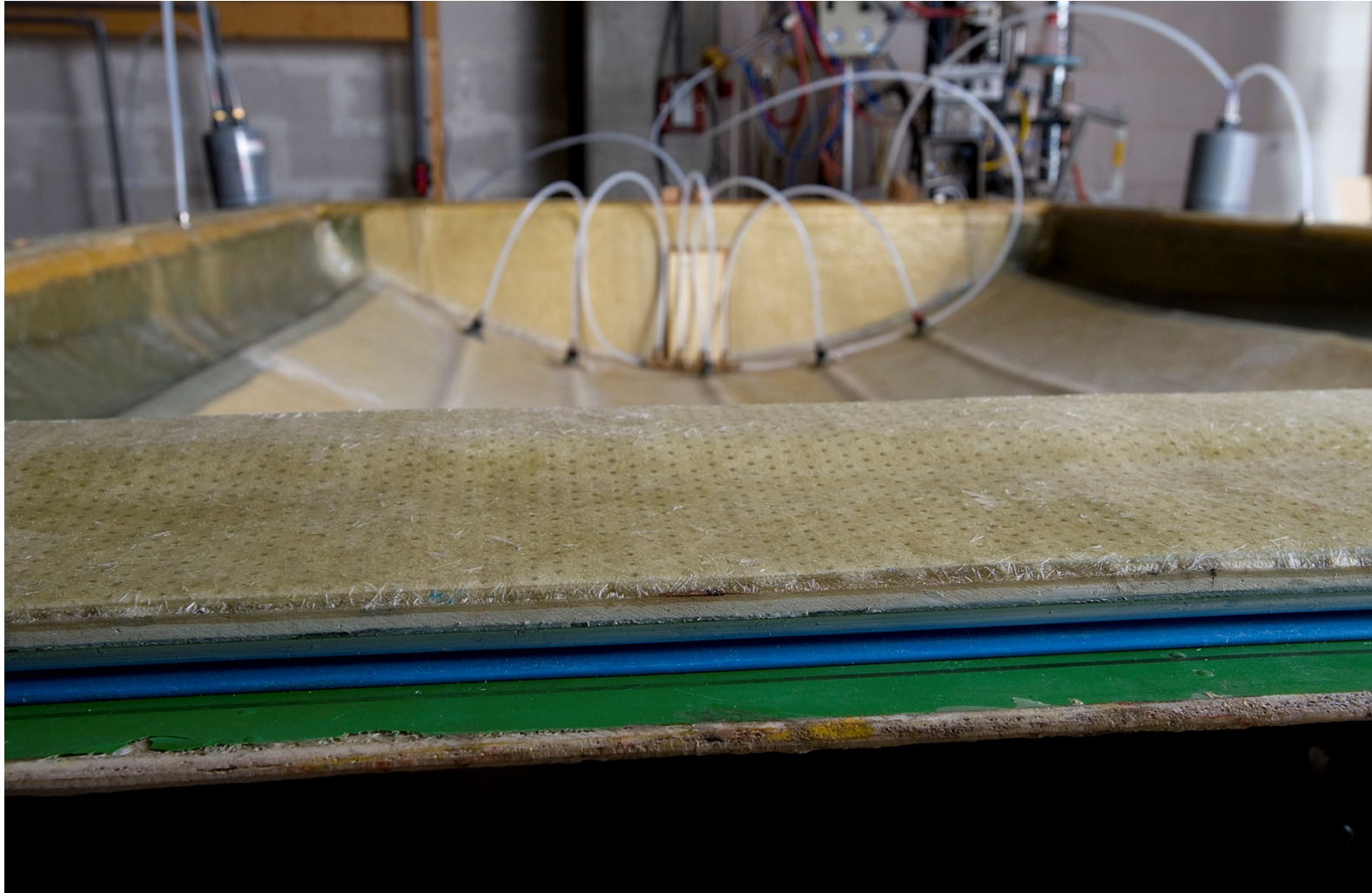
NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Production process



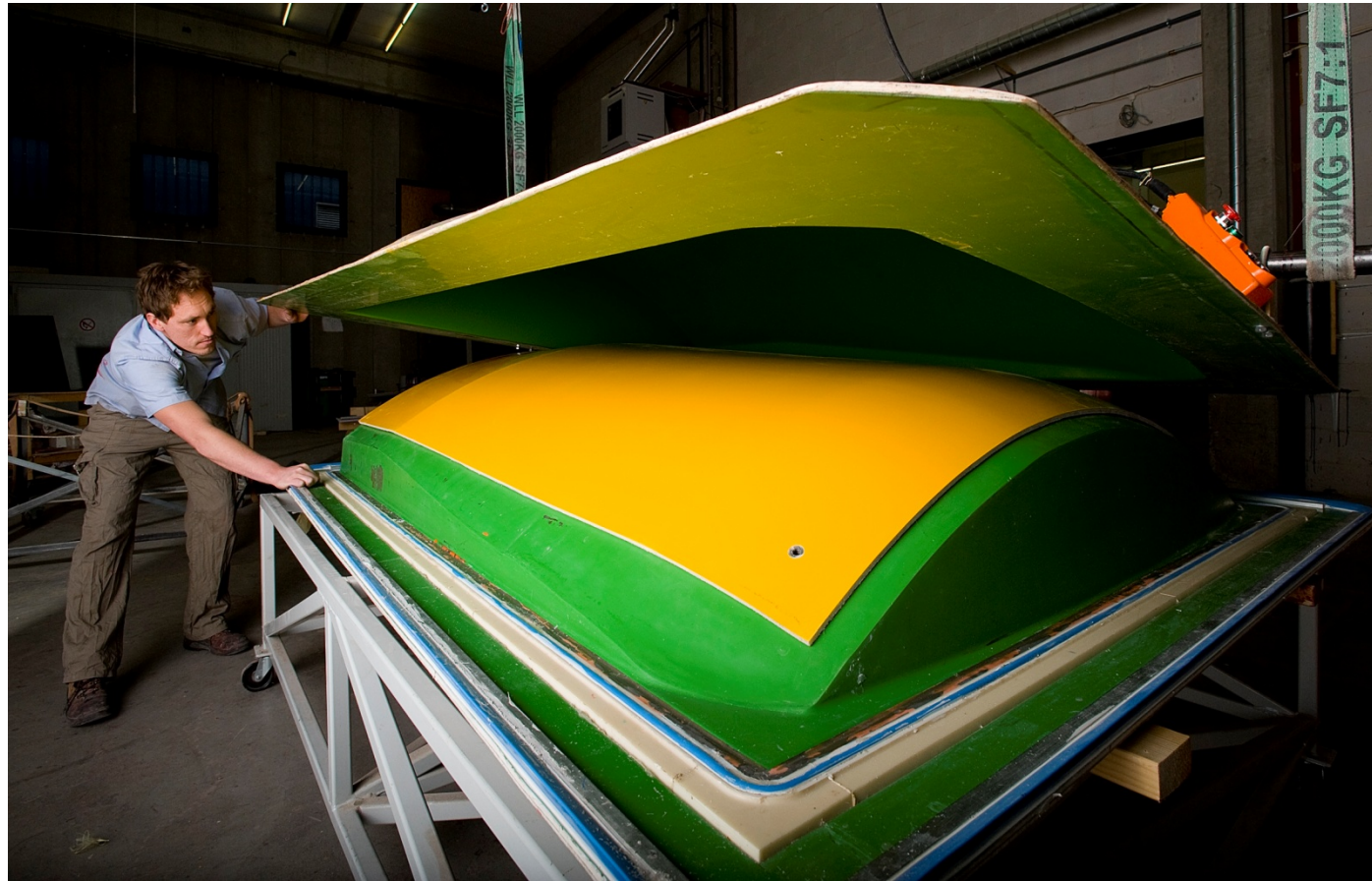
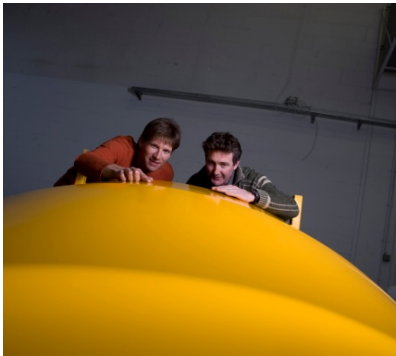
NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Production process



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Production process



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Light and stiff Bio Composites



Vision NPSP Composites

composites



Biocomposites



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Nabasco

Design Chair for Pastoe



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Natural fibres

Reasons to apply natural fibres:

- Acoustics
- Radiance permeability
- Aesthetics
- Sustainability
- Weight



Datasheets



N-1010

- Glass fiber with polyester



N-3010

- Natural fiber with polyester

N-5010

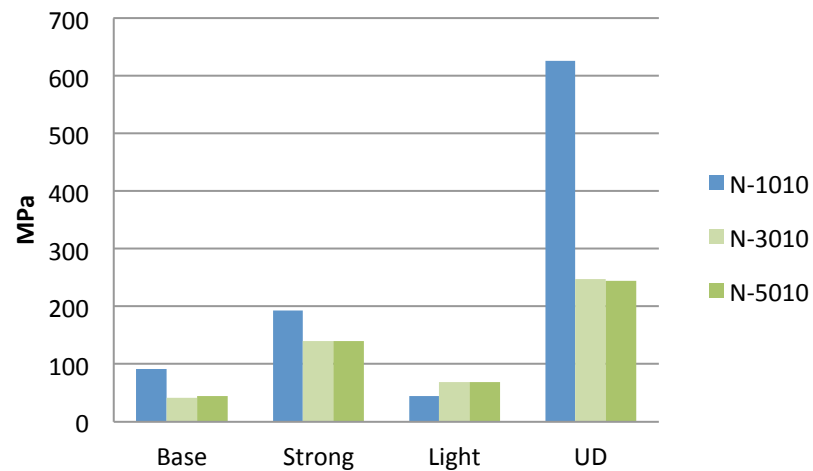
- Natural fiber met partially bio-based polyester



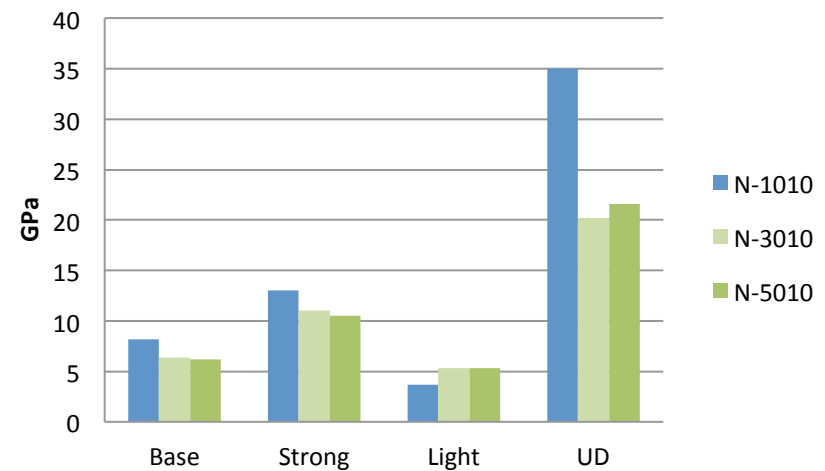
Datasheets

Tensile Tests

Strength NPSP Composites (σ^f)

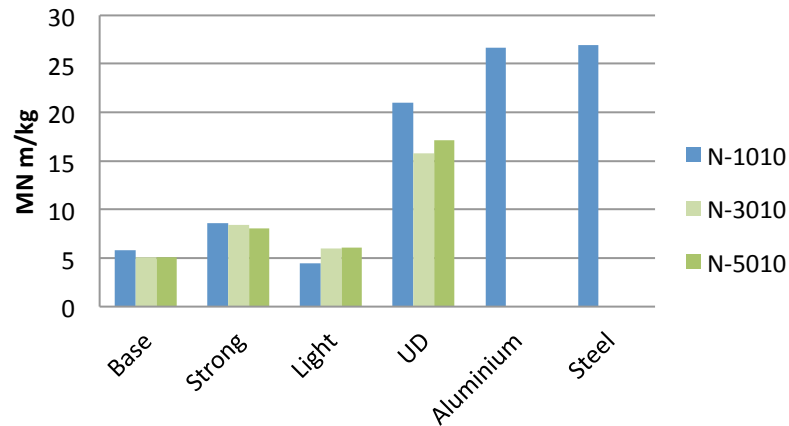


Stiffness NPSP Composites (E)



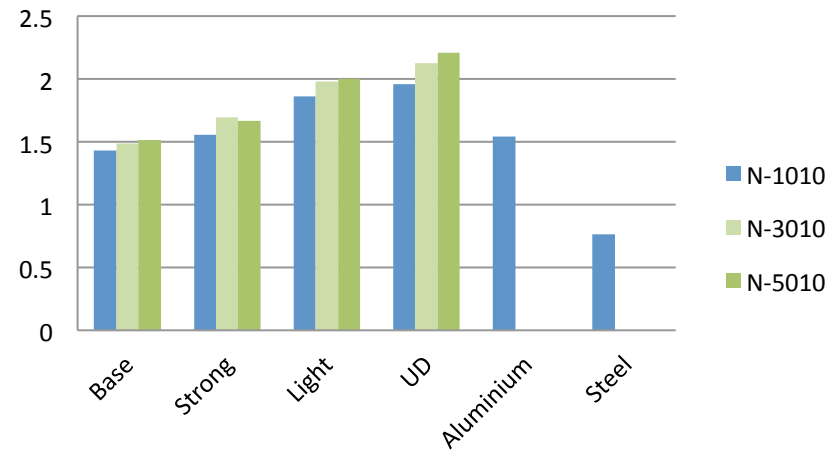
Datasheets

**Specific Stiffness NPSP
Composites (E/ρ)**



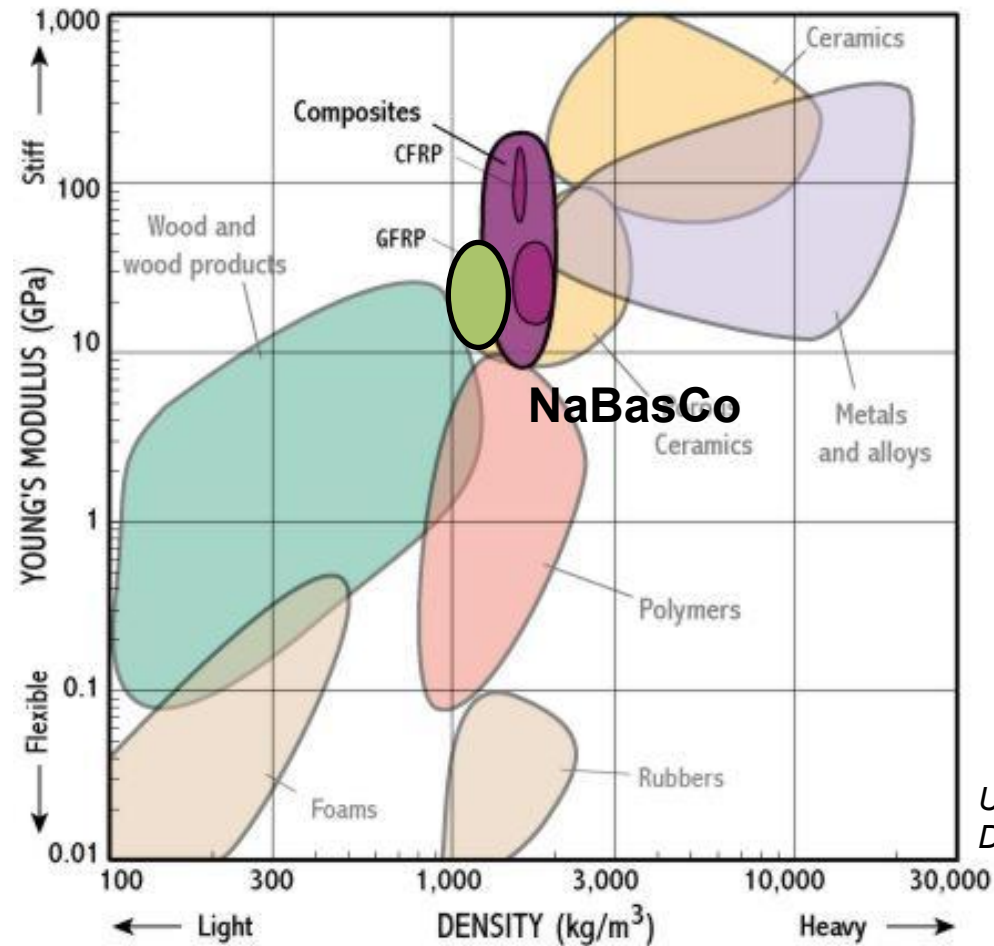
- Stiff and Light

**Sp. Plate Stiffness NPSP
Composites ($E^{1/3}/\rho$)**



- Stiff and light plates

Resulting composites



University of Cambridge,
Department of engineering



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Front plate ICM train Dutch Railway's

- Refurbishment of 285 trains
- From steel to double bended composites front plate
- 2,00 x 1,50 x 0,08 [m] plate's
- Fire, hail, mechanically requirements
- According ISO 9001 standards
- European Tender



Front plate ICM train Dutch Railway's

- Double bended sandwich panel
- Weight reduction 1000 kg per train
- Energy reduction 5 MWh per year
- Cost reduction on electricity 500 euro per train per year and 700 euro on maintenance per year
- CO₂ reduction of 2,5 tons per year per train
- 95% lower styrene exhaust than hand laminating
- Nominated UIC Sustainability Award

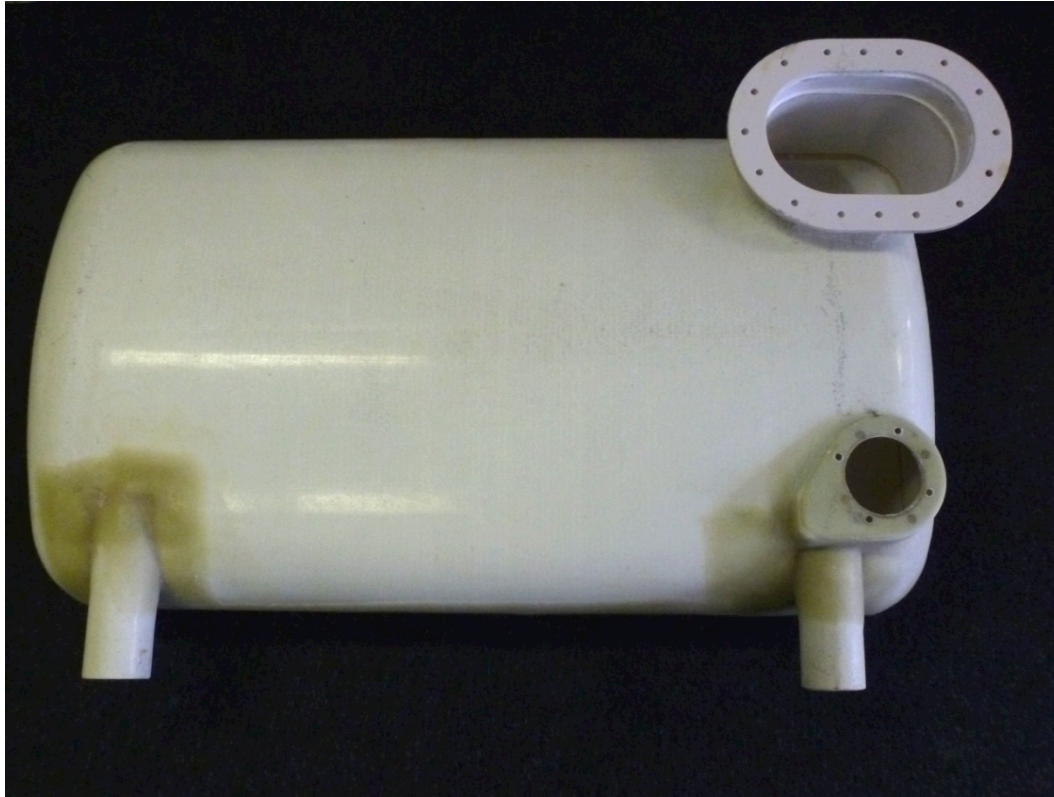


Front plate ICM train Dutch Railway's



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Water tanks ICM train Dutch Railway's



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Tables DDAR train Dutch Railway's



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Arm rest and chair panels DDAR train



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Interior panel Dutch Railway's



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger

Questions or suggestions?

Contact:

NPSP Composieten BV

Willem Böttger

+31 23 55 123 28

Willem.bottger@npsp.nl



NaBasCo; natural fibre reinforced composites in structural applications – W. Böttger