

NAFILite : New lightweight solution for cars' interiors

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Journée Technique « Le Moussage des
Thermoplastiques »



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Macro-trend zoom: Green & Lite

Fuel economy demand and legislation are the main drivers

Market & consumer trends



Green & Lite FIS solutions

FIS current offer	 NAFILearn	 BIOMAT	 NAFILite	 NFPP
	 Twin techno. NFPP&NAFILearn	 LignoX	 Flaxpreg	 Ligneos
Innovation Portfolio	 M1 NAFILearn evolutions	 bio-speed CONSORTIUM BIOMAT new generation	 M1 Natural Fiber aspect	

- Part of different consortiums to improve expertise, market knowledge and built secured value chain



- To answer these huge stakes, renewable materials based concepts
→ Weight saving & positive Impact on LCA



NAFILEan

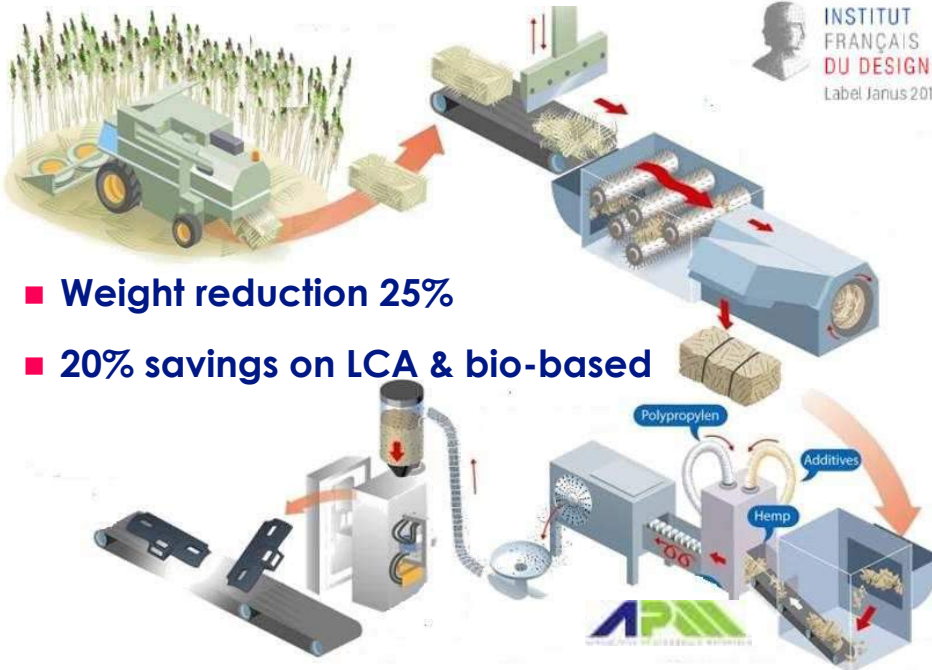
An innovative compound PP + Hemp fibers



Supply chain & interests

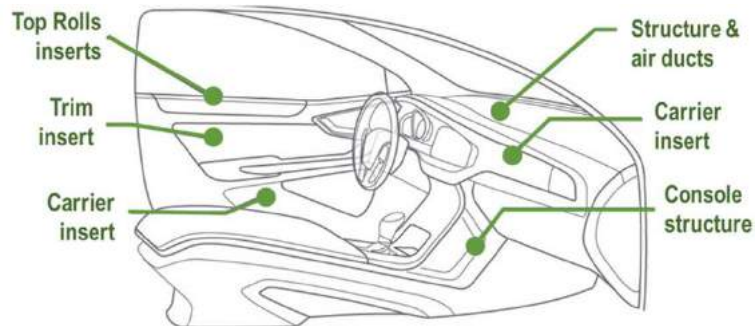


SPE award



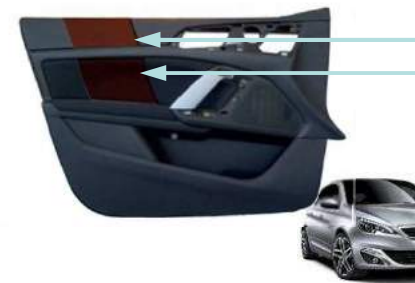
- Weight reduction 25%
- 20% savings on LCA & bio-based

Validated applications



On-road applications

- In serial production since July 2013 & in deployment on 15 WW programs



In serial production on the New Peugeot 308

1.2kg/veh: top roll + trims
→ 400g saved



In serial production on New Alfa Romeo Giulia

6.2kg/veh: carrier + structure
→ 1 050g saved



Coming soon New Renault Megane

5.4kg/veh : carrier+ structure
→ 1 260g saved (23%)

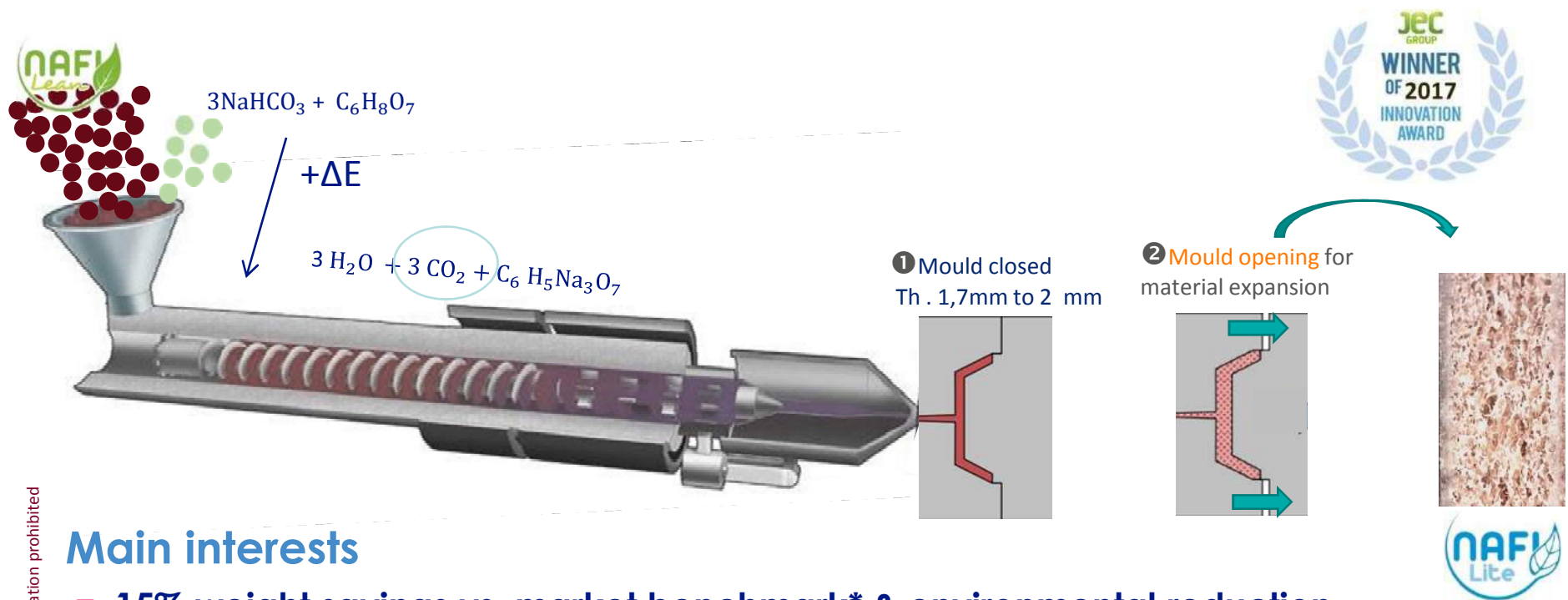
NAFILite

A microcellular foamed material reinforced with hemp fibers



Principle and target

- A microcellular foamed (with core back expansion) version of the existing NAFIlean
- Structural non visible parts : defroster ducts and IP substrates with reduced thickness



Main interests

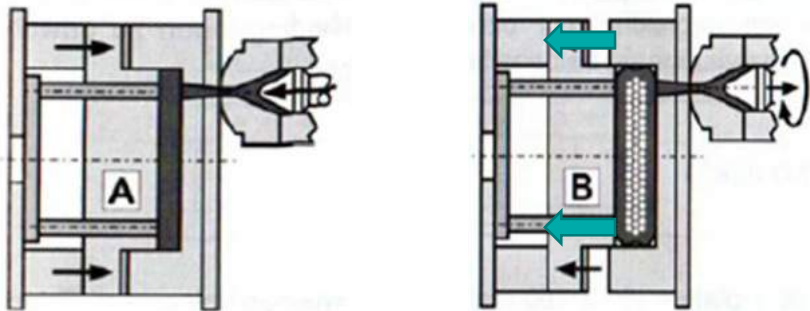
- 15% weight savings vs. market benchmark* & environmental reduction
- Warpage reduction
- 20% renewable content

*P/E LGF 20 fomaed with CBE

Microcellular foaming PP

Tooling technologies

Core Back Expansion (CBE)



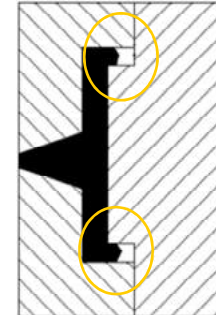
① Mould closed (1,7 to 2 mm thickness)

Filling 100%

② Mould opening for material expansion

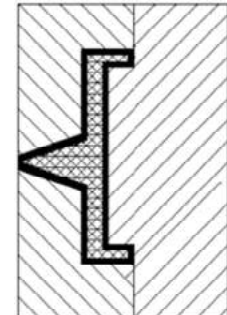
- Higher weight saving
- Higher warpage reduction
- Higher part bending stiffness

Under filling (without CBE) :



Mould under filled

① Mould closed
Filling 90-95 %



Foam expansion

② Material expansion to fill the mould

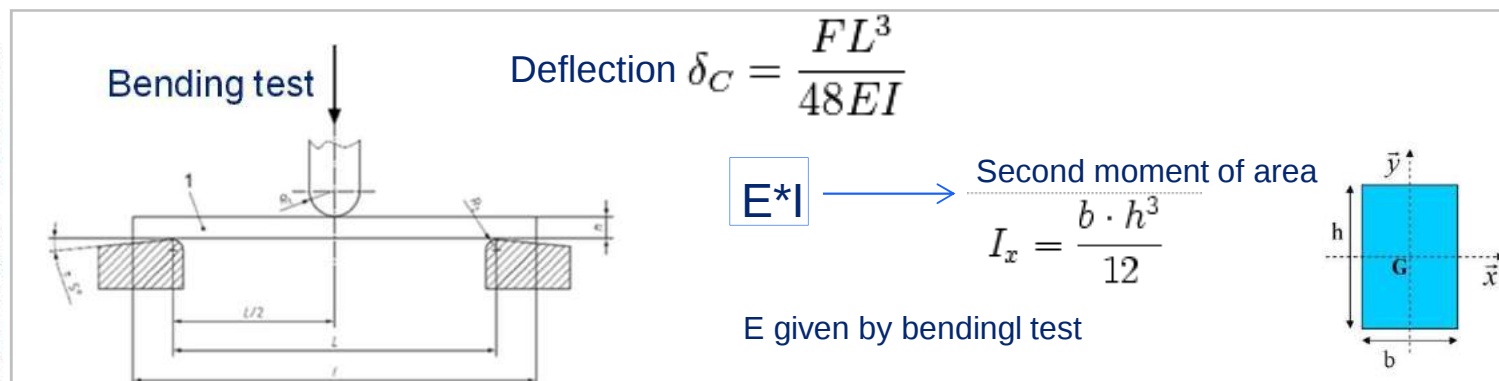
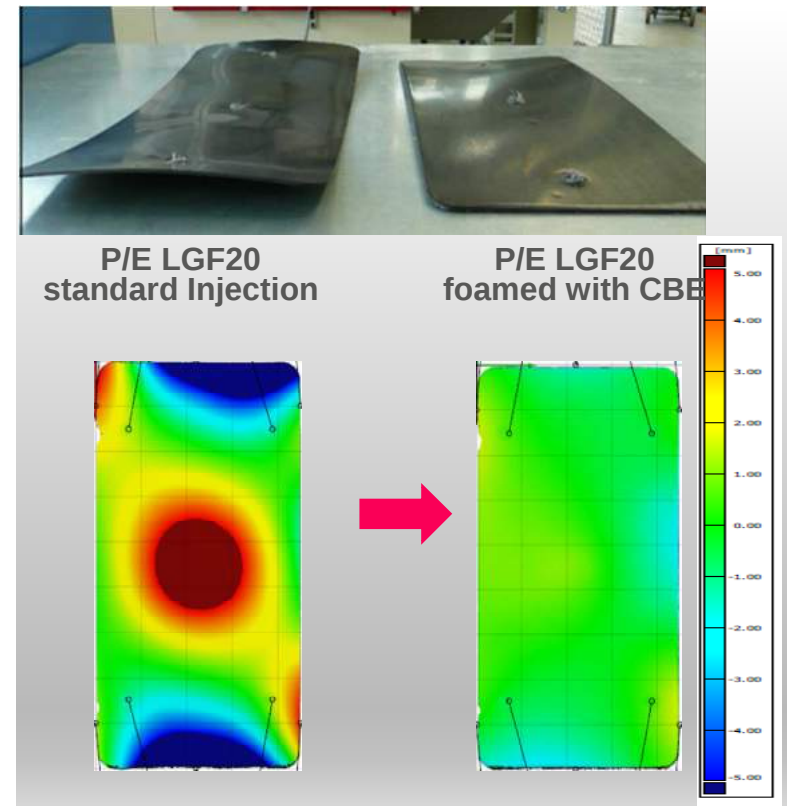
- Lower weight saving
- No warpage reduction

- Both process in production for P/E LGF20 , ABS, P/E MD10 for BMW, Ford and VW with chemical or physical foaming.
- NAFILite : chemical foaming (for worldwide deployment) with CBE

Microcellular chemical foaming with CBE

Main interests

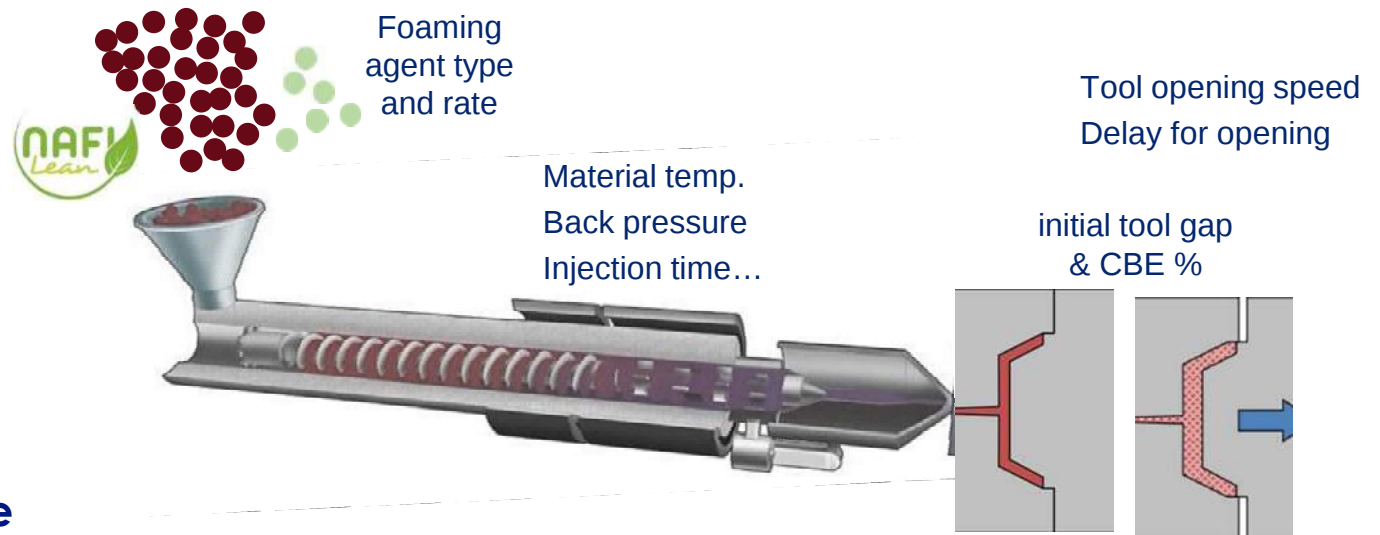
- **Higher perceived quality :**
 - Warpage reduction
 - Higher dimensional stability
 - Better surface (sinkmark)
- **Higher bending properties with CBE**
- **Density reduction and weight saving with reduced part thickness**



Microcellular chemical foaming with CBE

Main challenges and key criterias

■ Process tuning



■ Emissions

■ Impact resistance

■ Rigidity

■ Thermal resistance

■ Dimensional stability

■ Weight saving

- NAFILite process optimized and mastered
- NAFILite concept optimized for weight reduction

NAF Lite to improve weight saving and perceived quality

Scenario to validation



■ Validations support – BMW X5 IP parts

Run @rate - IMM # Engel 2700T



■ BMW X5 Multi Functional Carrier



■ BMW X5 Instrument Panel upper



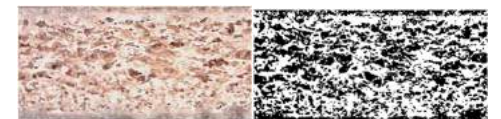
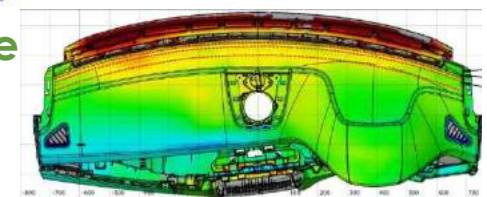
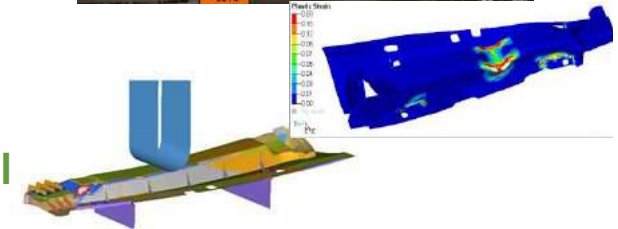
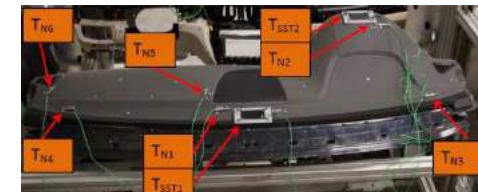
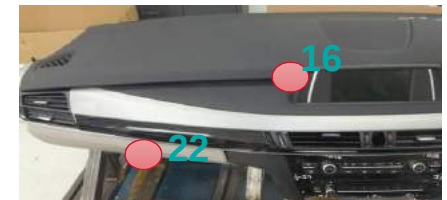
NAFILite product validation overview

System validated – Ready to be applied



Product system validations

- Airbag deployment OK
- Airbag deployment after ageing No impact of ageing
- Head impact OK
- Dimensional behaviour after climatic tests OK
- Foaming adhesion after climatic tests Better than serial
- CAE-material law validated Correlation OK
- Odor & VOC Better than serial
- Warpage CBE improves warpage
- Material properties characterization OK



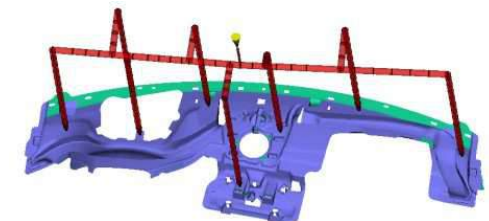
NAFILite product validation overview

System validated – Ready to be applied



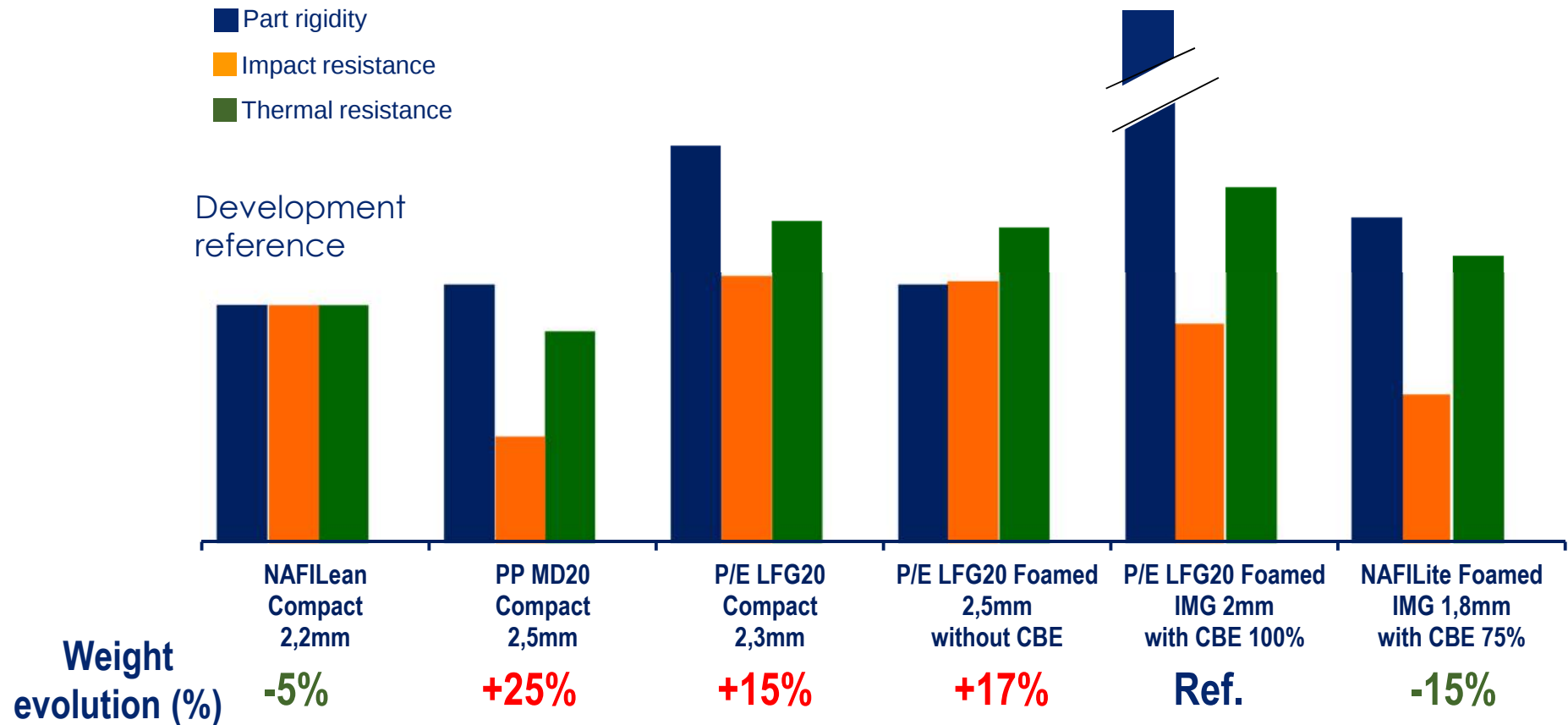
Process validations

- Injection OK
- Flaming OK
- Foaming OK
- Punching OK
- Milling OK
- Welding Vib & US OK
- Tightening OK, rules defined
- Clipping OK, rules defined
- Rheology simulation OK



NAFILite - Material characterizations

Best concept with 15% weight savings



- **NAFILite offers the best balance:** ~15% weight savings (vs. current X5 concept) with the best compromise in terms of thermo-mechanical & dimensional profile

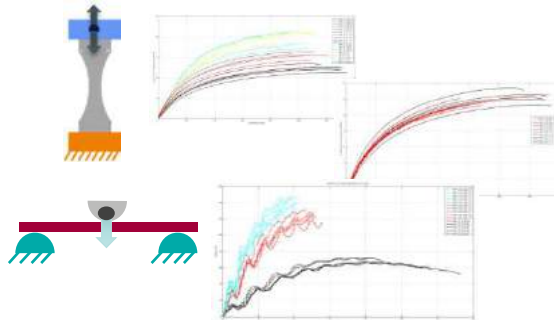
NAFILite - Product validation

Material law available & correlated

Material law creation

■ Raw material tests

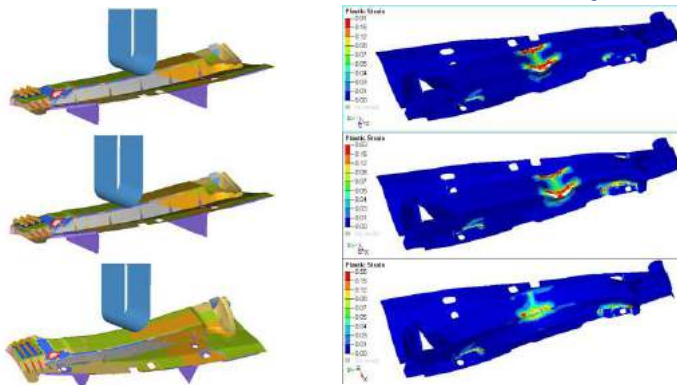
- Tensile 0°, 90°
- Compression
- Bending



■ Microscopic analysis

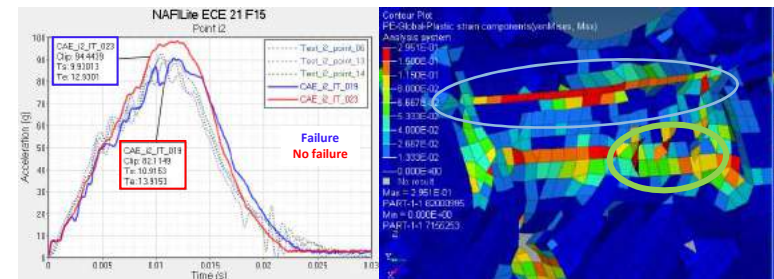


■ Drop test CAE validation with failure adjustment



ECE 21 correlation

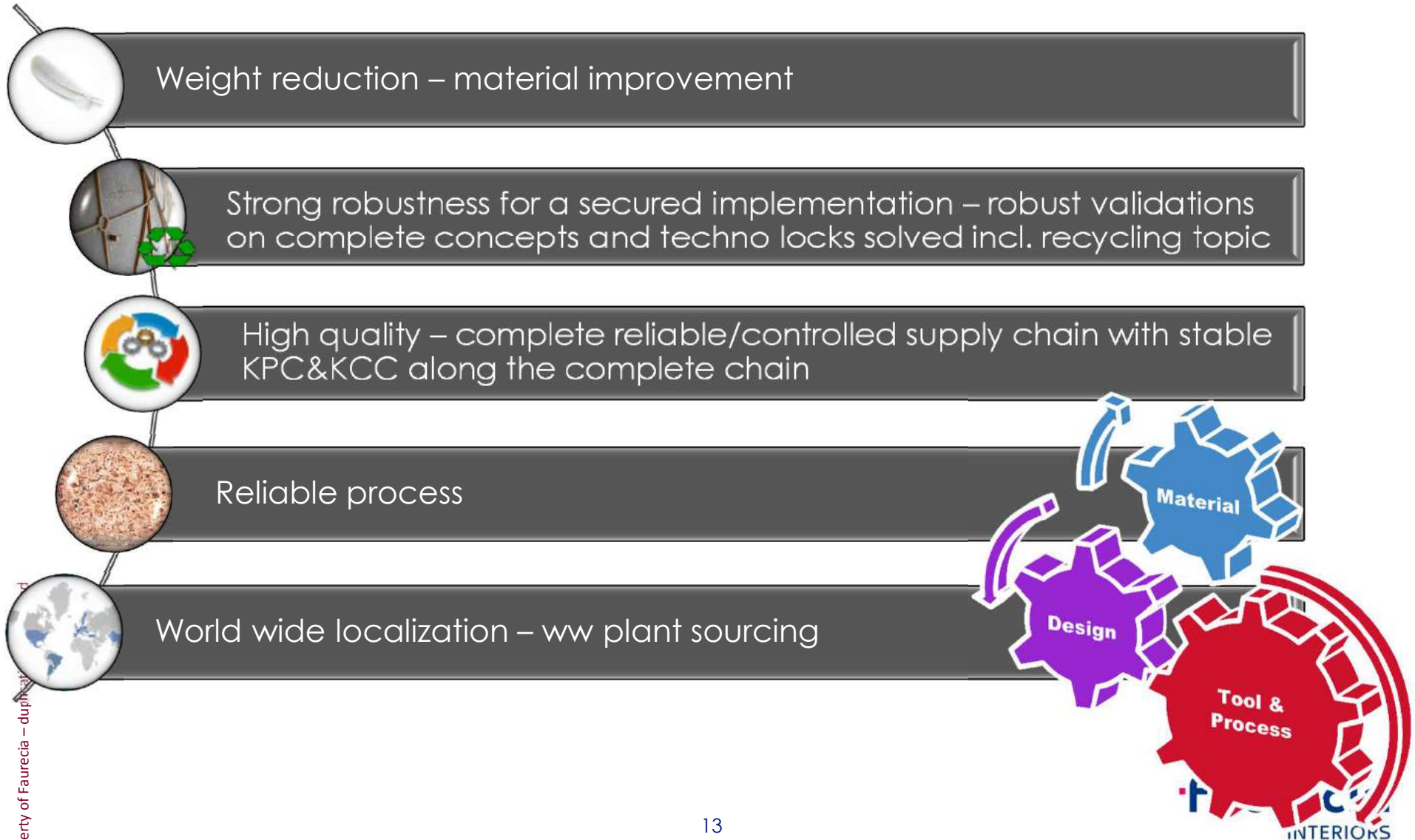
■ Correlation with physical tests



- Failure captured
- Plasticity captured
- Very good stiffness

Good correlation and prediction
Material law validated & able to
predict load vs. intrusion

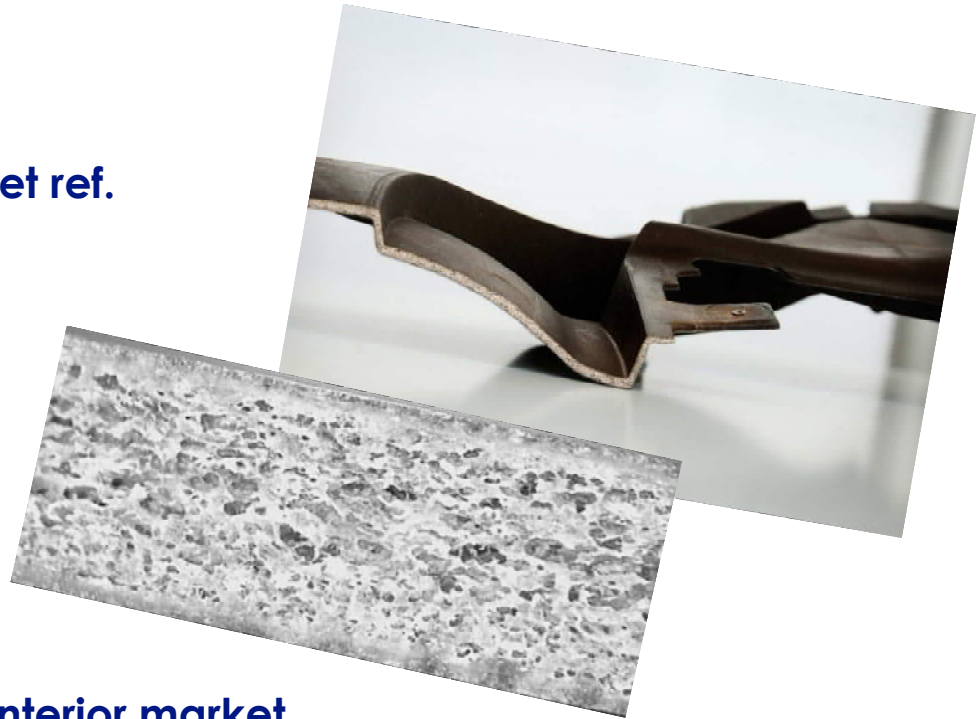
Trends and challenges for automotive business



NAFILite, the new NF answer to lightweight OEM requests

Benefits

- 15% weight reduction vs. best market ref.
- 15 % savings on LCA
- 20% renewable content
- Recyclable
- System integration maturity
- Cost aligned with market reference
- Unique solution on the automotive interior market



NAFILite is the leveraging again NF capabilities to answer two trends in automotive : lightweight concept requests, together with renewable materials.

➔ NAFILite is now validated & available on the market.



Innovation Bioteam for injection :

P. Kannengiesser - Innovation project Leader

H. Boudhani - Innovation project Leader

JMM. Monzo - Innovation project Leader

L. Dufrancatel - Innovation Materials Global Domain Manager