

Introduction of polypropylene base unidirectional tape “TAFNEXTM” and the composites materials of Mitsui Chemicals.



Corporate Planning & New Business Development
MITSUI CHEMICALS EUROPE GMBH
October 4th, 2018

Contents

1. Mitsui Chemicals Group corporate profile
2. Background of CF/PP UD tape development
3. Properties of CF/PP UD tape “TAFNEX™”
4. Feasible study of the application of “TAFNEX™”
5. Potentials of “TAFNEX™”
6. Other Mitsui’s Composites Solutions

Mitsui Chemicals Group Corporate Profile

Company Name ; Mitsui Chemicals, Inc.

Founded ; Originally in 1912

Head Office ; Tokyo, Japan

Representative ; President & CEO Tsutomu Tannowa

Paid-in Capital ; JPY 125B

Employees ; 17,277 (consolidated / as of March 31, 2018)



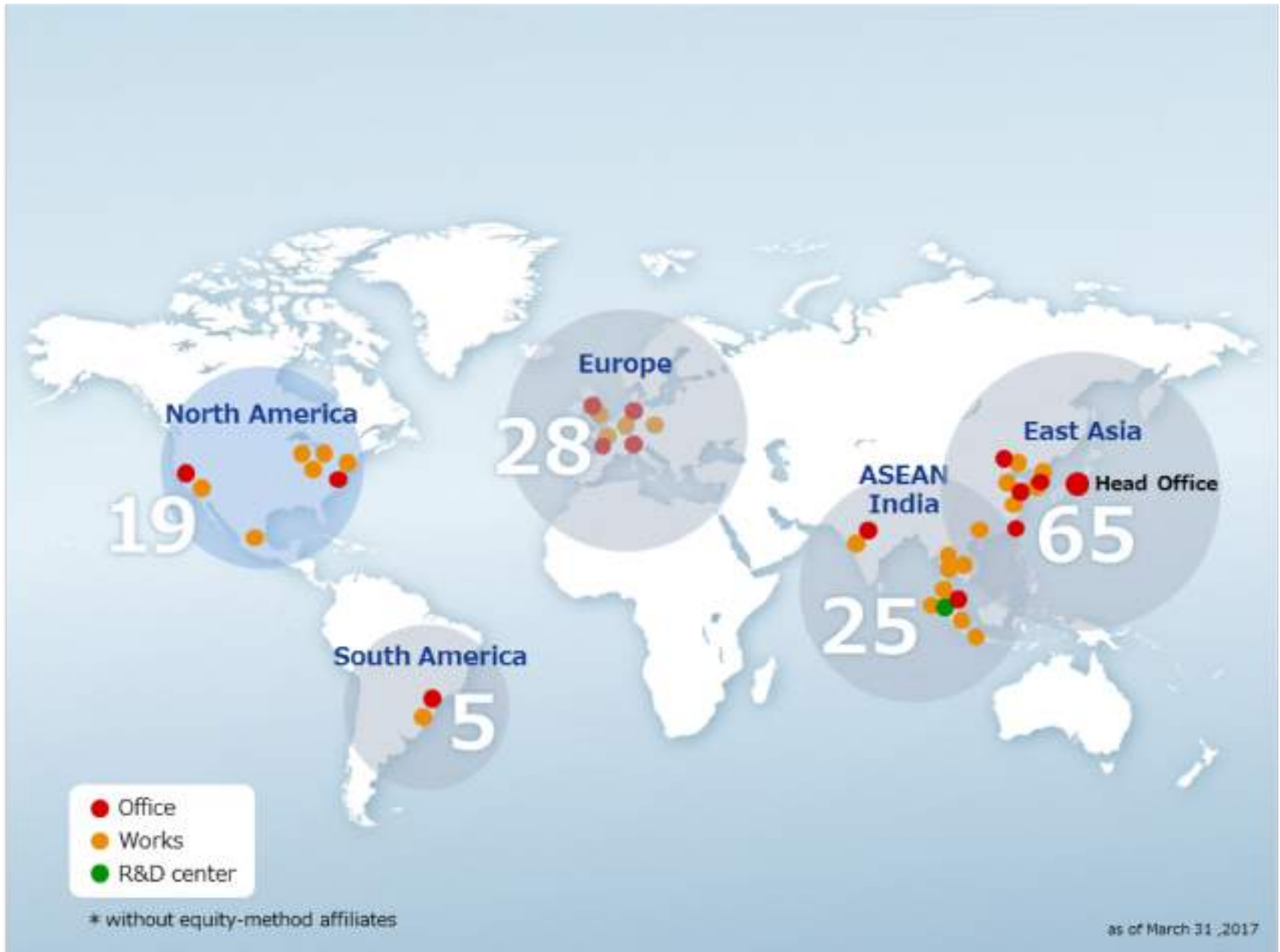
【Our Mission】

To contribute broadly to society by providing high-quality products and services to customers through innovations and the creation of materials and products while keeping in harmony with the global environment.

Mitsui Chemicals Employees



Overseas Subsidiaries & Affiliates



European Region

Europe



MITSUMI CHEMICALS EUROPE GmbH
Regional HQ & Sales Office
(Germany)



SUN ALLOYS EUROPE GmbH
Compounded Polymers
(Germany)



MCNS Polyurethanes
Poly-urethanes
(Poland)



ACOMON s.r.l
Monomers for optical lenses
(Italy)



Kulzer GmbH
Dental Materials
(Germany)



Shapers
(France and Poland)

P+Z Engineering GmbH
(Germany)

ARRK|LCO Protomoule
(France)

ARRK Europe Ltd.
(United Kingdom & Spain)

SPG Pre-Series Tooling & Prototyping B.V
(Netherlands)

as of March 31 ,2017

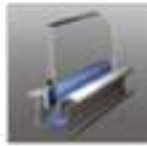
Business Area

Mobility

Elastomers, Performance polymers,
Performance compounds, Engineering
plastics

01

3 Targeted
Business Domains



Health Care

Ophthalmic lens material, Nonwovens,
Dental materials, Personal care
materials

02

3 Targeted
Business Domains

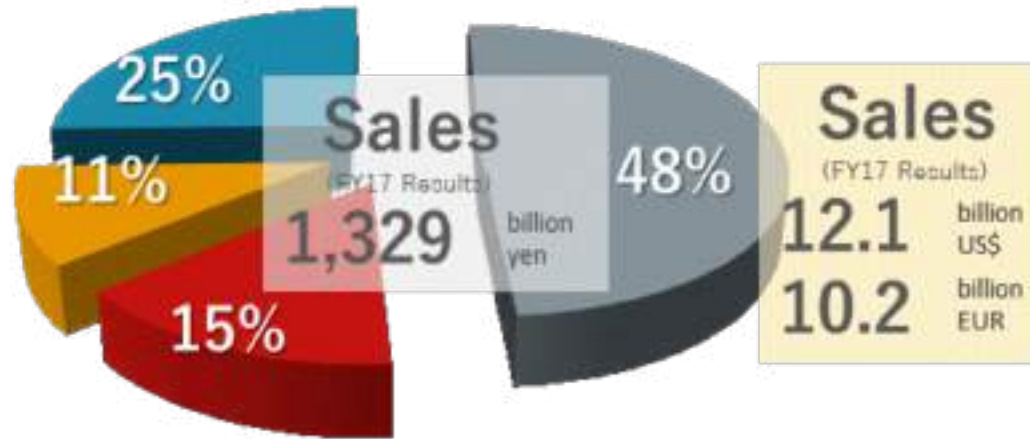
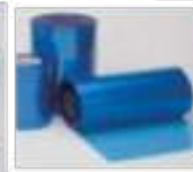


Food&Packaging

Packaging material, Coatings
Agrochemicals, Seeds

03

3 Targeted
Business Domains



Next Generation

Energy, Medical, Agri-system, and
IoT Solution

04

Creation &
Development



Basic Materials

Phenol, PTA/PET
Polyolefin, Polyurethane, and others

05

Strengthen
Competitiveness



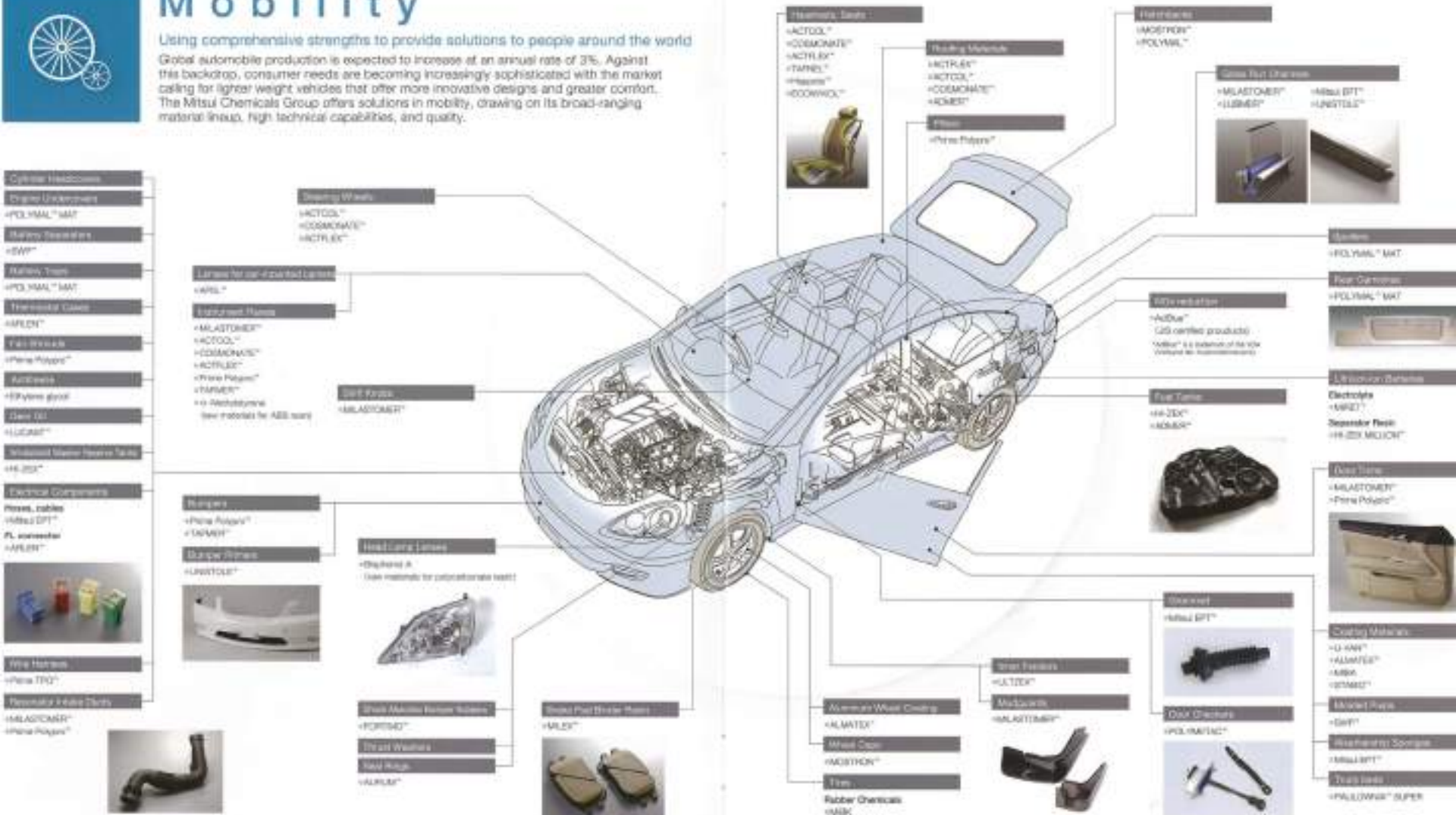
Overview of MCI Products (Mobility)



Mobility

Using comprehensive strengths to provide solutions to people around the world

Global automobile production is expected to increase at an annual rate of 3%. Against this backdrop, consumer needs are becoming increasingly sophisticated with the market calling for lighter weight vehicles that offer more innovative designs and greater comfort. The Mitsui Chemicals Group offers solutions in mobility, drawing on its broad-ranging material lineup, high technical capabilities, and quality.



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Why PP? Why Mitsui?

Benefits of PP

- + Low Density (0,90 g/cm³)
- + Water resistance
- + Chemical resistance
- + High workability
- + Low cost



Disadvantages of PP

- Low thermal resistance
- Poor impact strength
- Poor adhesion
- Poor weatherability

Mitsui Chemicals Material Technologies

Fillers & Fibers Compound

- Talc, GF, CF, Silica, etc.

Copolymerization PP composition

- Blocked PP (EPR)
- TAFMER™ (Impact modifier)

Modified PP composition

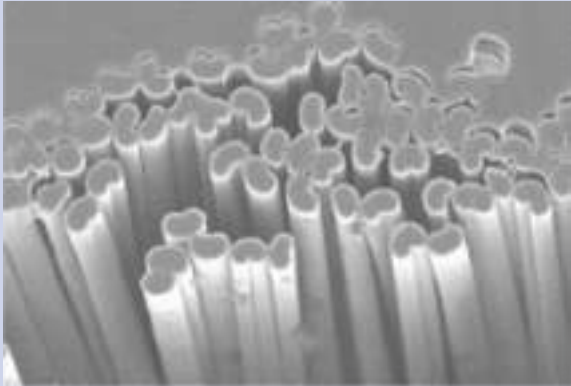
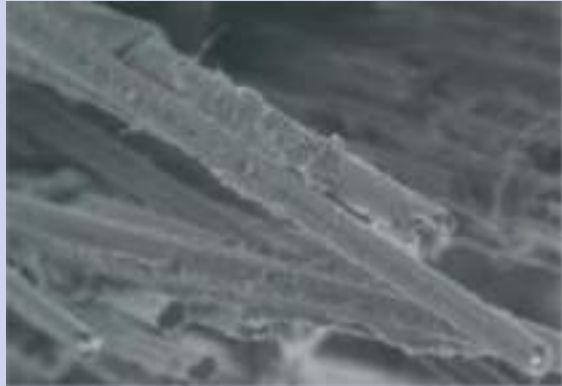
- Based on Mitsui Chemicals' modification and compound technology

Weathering stabilizer

- HALS
- Ultraviolet absorber
- Antioxidant

Mitsui Chemicals can maximize the potential of PP compound by special modification.

Mitsui's Core Technology of CF/PP

Matrix	Sizing	
	Epoxy Sizing	MCI Sizing
Interfacial Shear Strength (Single Fiber Fragmentation Test)	Not good	Excellent
Photo of the boundary between CF and PP		

Mitsui's technology could improve the adhesiveness of CF/PP boundary and the shear strength.

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TAFNEX™ CF-PP UD Tape -Appearance-

Sheet roll UD Tape

Wide roll



Narrow roll



Intermediate processing

e.g. tape slitting



e.g. compression moulding of tape cuts



Further processing

e.g. tape winding



e.g. thermoforming



e.g. back injection molding of tape layered laminates



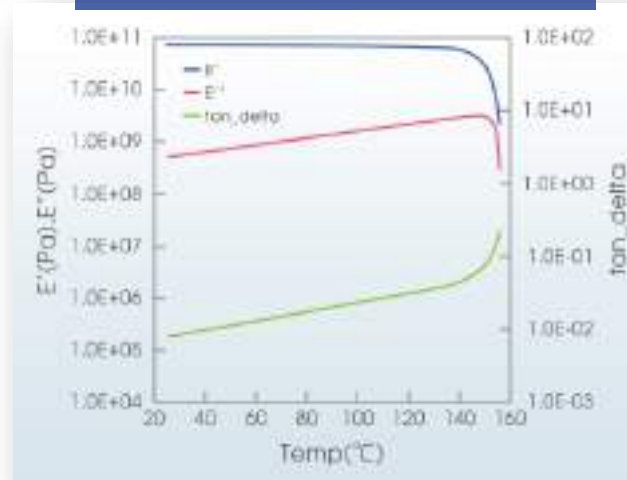
Tape width ; up to 600 mm
Tape thickness ; 0,15 – 0,2 mm (Usual; 0.15mm)
Fiber Volume Content ; 36 – 50 % (Usual; 50%)

TAFNEX™ CF-PP UD Tape –Properties (1)-

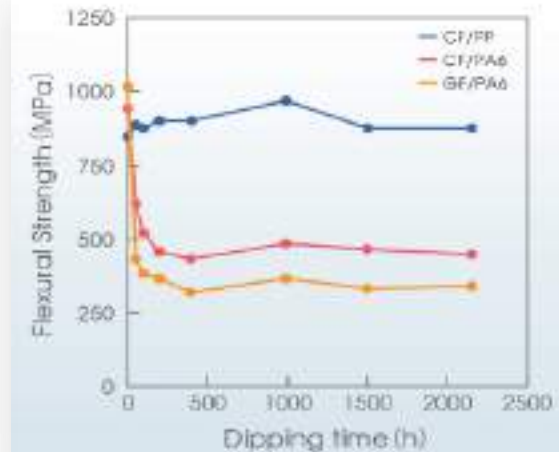
SEM



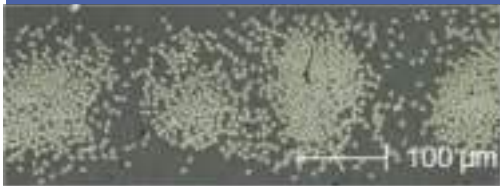
DMA



Water dipping test



Microsection



- Good impregnation of PP into CF.
- Keeping high young modulus until high temp.
- Good durability to water.

TAFNEX™ CF-PP UD Tape –Properties (2)-

*Other companies data is the value from their catalogue.

*ILSS; Inter-laminar shear strength

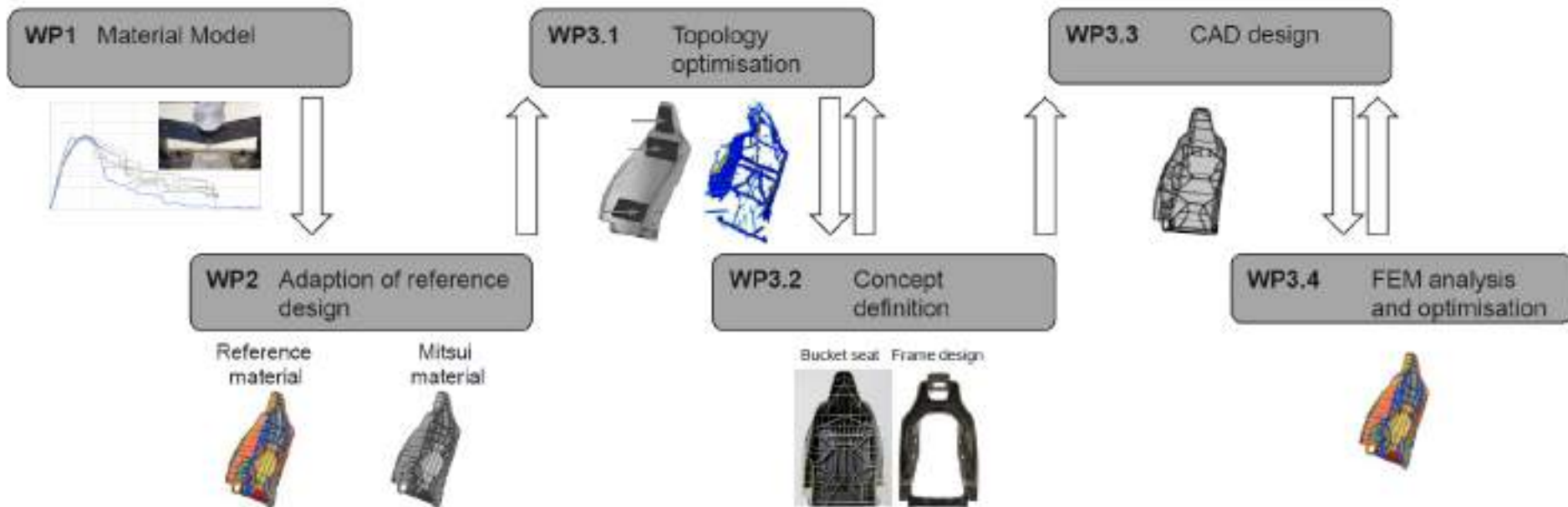
Item	Unit	Method	TAFNEX™		CF-PP Company A*	CF-PA6 Company B*	GF-PP Company C*
			Grade A	Grade B			
Vf	%	JIS K 7075	40	50	23	48	46
Density	g/cm3	Mitsui method	1.27	1.31	1.10	1.43	1.59
Tensile Strength	MPa	ASTM D3039	1200	1500	730	1900	770
Tensile Modulus	GPa	ASTM D3039	100	120	45	130	35
Flexural Strength	MPa	ASTM D790	900	960	430	940	880
Flexural Modulus	GPa	ASTM D790	85	90	45	96	37
ILSS*	MPa	ASTM D2344	31	30	24	29	27
IZOD Impact	J/m	ASTM D256	1600	2000	-	3500	3600

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Project Overview

- Demonstrate the potential of polyolefin based carbon fiber composite in automotive application.
- Comparison between reference material and Mitsui Chemicals material.
- New Seat specifically designed for specific properties of the new polyolefin based carbon composite material.
- Using the material inherent lightweight potential in a most cost effective way.

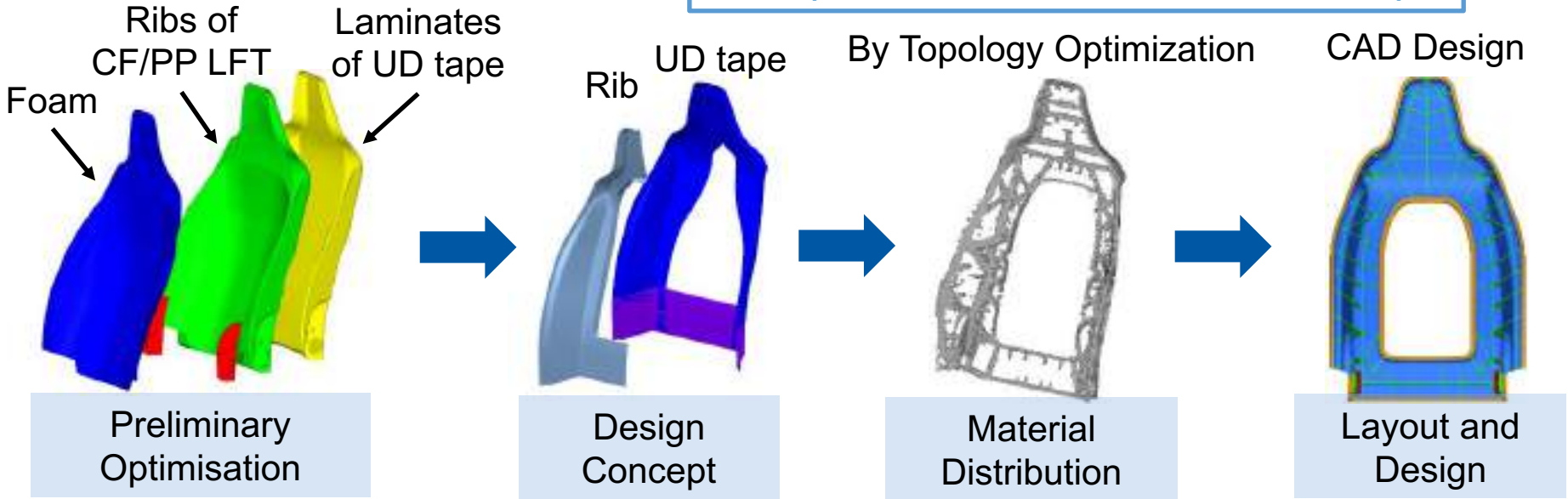


We compared the case of Mitsui's material to the case of conventional material by CAE.

Overview of CAE Analysis Outcome

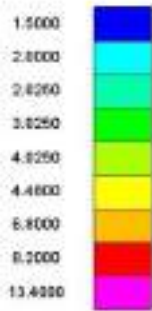
Design Flow for Analysis

CF/PP LFT ; 40wt% CF/PP
UD tape ; FVC 36% CF/PP UD tape



CAE Outcome

SHELL THICKNESS



Total=2,03 mm
Multiaxial UD tapes
(each 0,225 mm)
[0,0,60,-60,60,0,0]

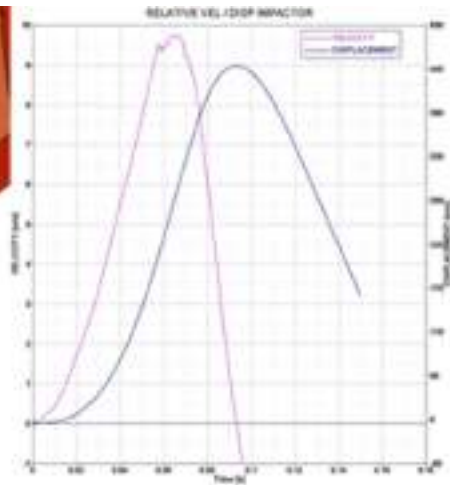
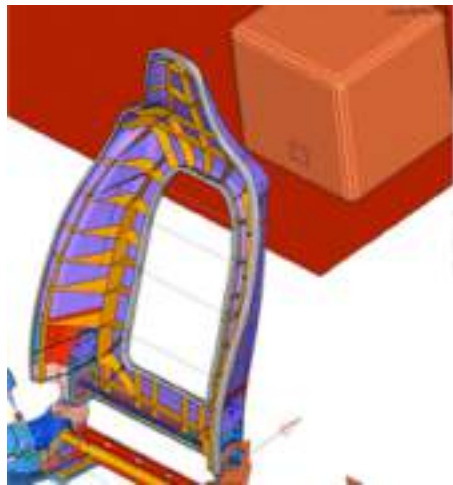
Component	New Concept [kg]
UD Tapes	0,860
Ribs + Annular Grooves	0,786
Recliner	0,209
Overall Weight	1,855

Up to 40% weight reduction against the conventional seat back (~3.0kg).

Final Concept Evaluation Results

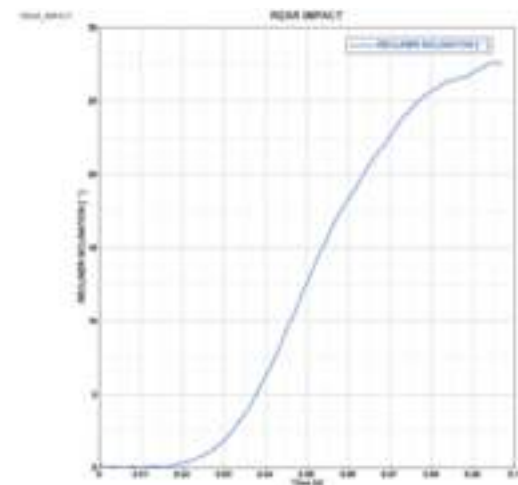
*18kg load

The case of luggage-
retention loading



*23kg load

The case of rear-
impact loading

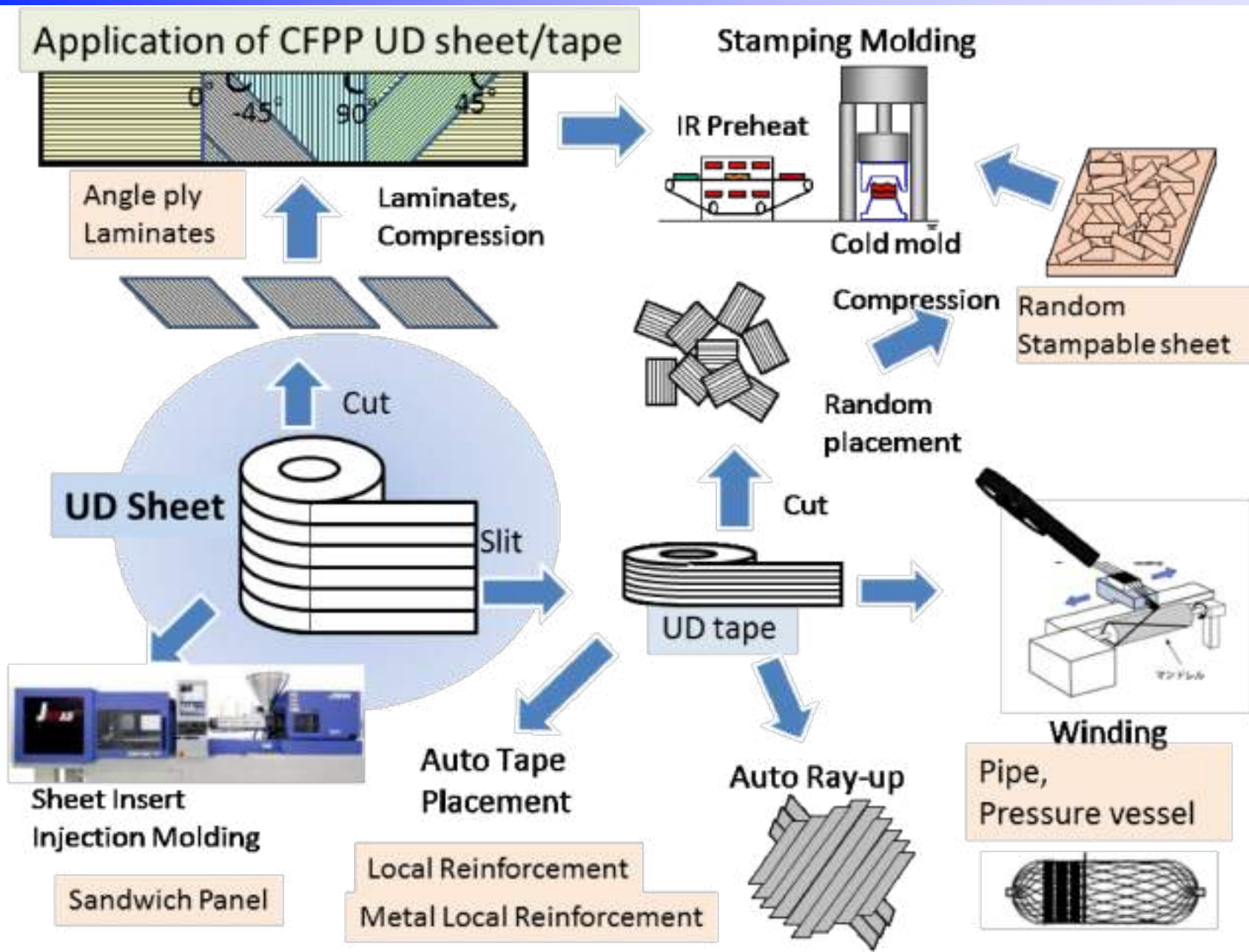


- It succeeded in retaining the impact-load in luggage-retention load-case.
- It maintained the seat rest recline angle within predefined limits of 30°.

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Potential Applications of “TAFNEX™” (1)



Potential Applications of “TAFNEX™” (2)



**Hybrid Metal
Bonding**



Tubes for bicycle frame



**Curved tube after
tape winding**



**Back injection
molded oil pan**



**Sandwich with
PP foam**



**Blades made from
random sheets**



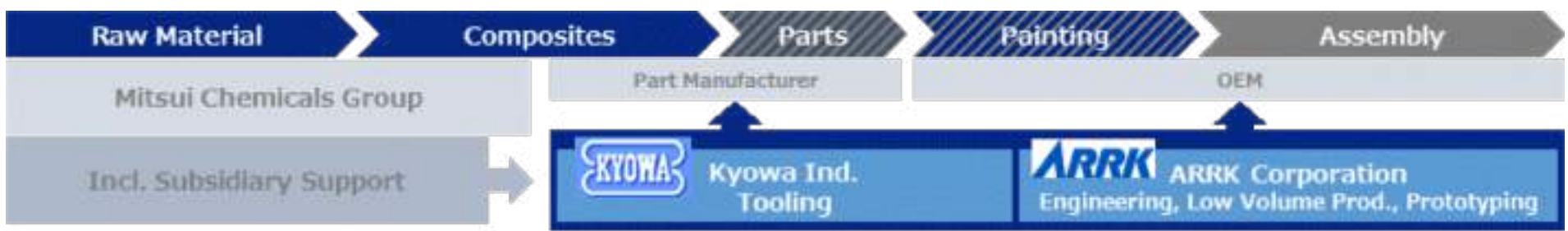
**Local
reinforced
tailgate**

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Mitsui's Composite Solutions

Value Chain



Materials

Thermoplastic Composites

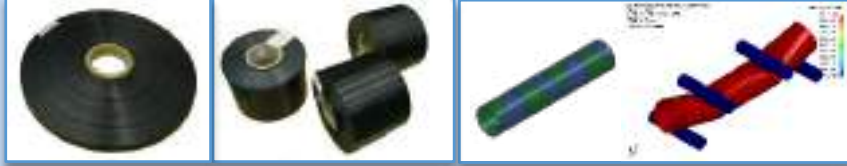
PP compounds



LFT



Unidirectional (UD) Sheets and Tapes



Thermoset Composites

Sheet Moulding Compound (SMC)



Polyurethane Matrix for HP-RTM



Topics of PP Compound Business

PP Compounds

New base in EU (Approx. 5 billion yen)

Mitsui Prime Advanced Composites Europe
(Chemelot Industrial Park, Limburg, the Netherlands)



Capacity
30KTA
(Jun. 2020)

(Image)

① Strengthen supply system

- ✓ First own production base
- ✓ Complete establishment of production, sales and R&D functions

② Strengthen initiatives with OEMs

- ✓ Approved materials in major OEMs
- ✓ Respond to lightweight needs for stricter environmental regulations
- ✓ Obtain solution capabilities with ARRK

Long glass fiber reinforced PP

Global deployment of Mostron™-L

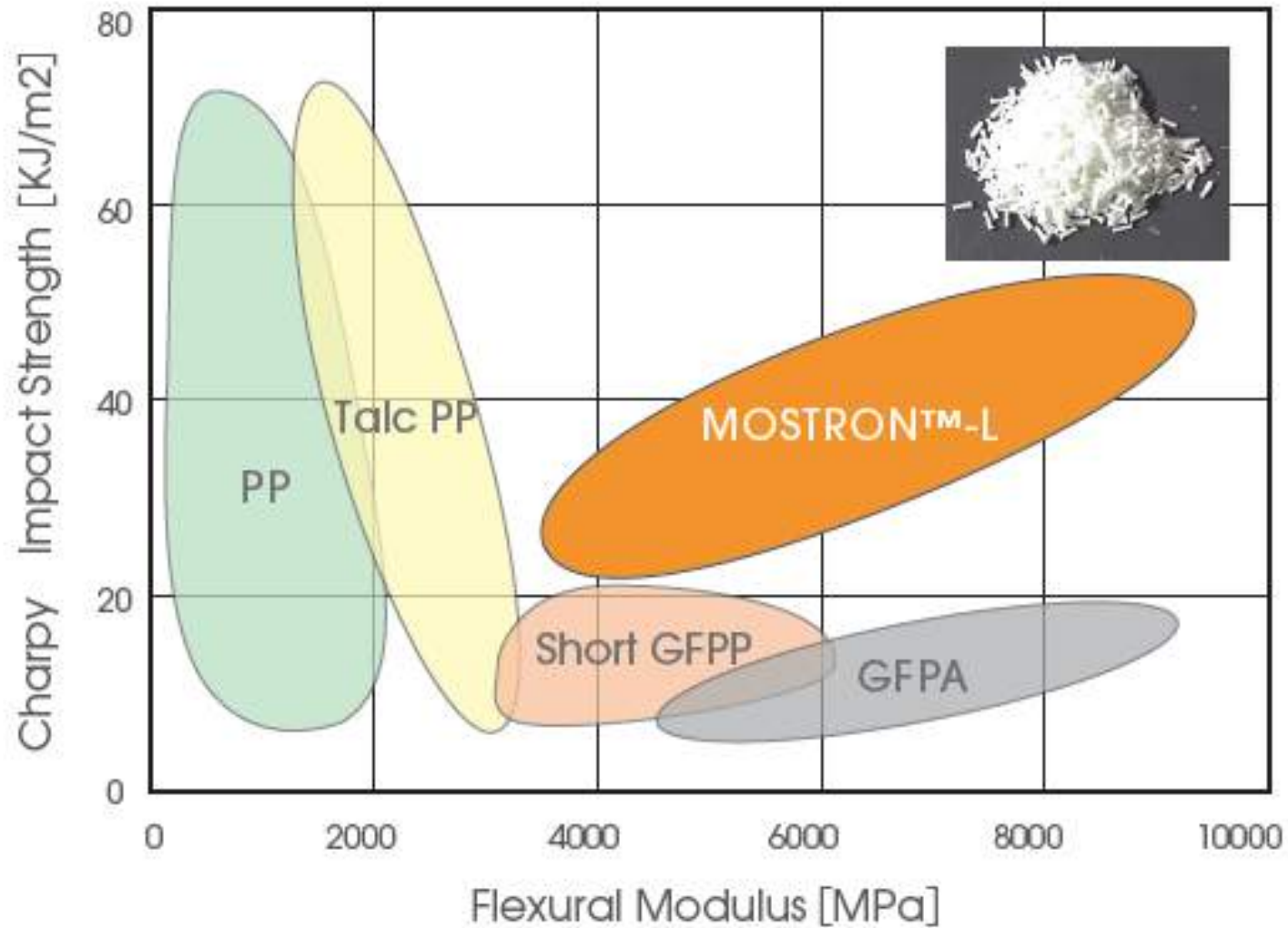
New bases in Japan, US and China
(Under F/S; total 10KTA or more)



Applied to
metal-substitute rear doors

- ① **30% lighter** than metal
- ② **Unpainted** by its good appearance
- ③ **Reduced** the number of **parts**
- ④ Contribute to **design freedom** in global SUV trends

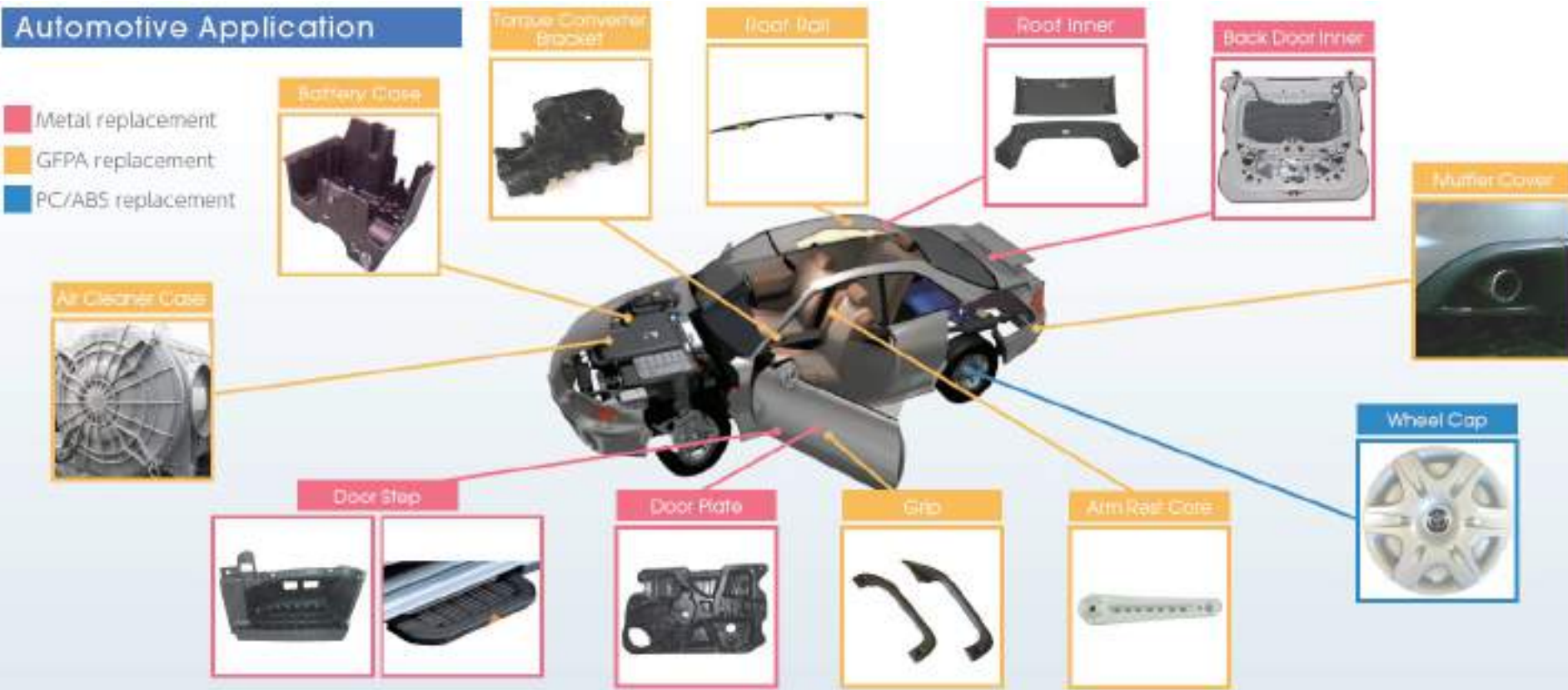
Property of LFT-PP Mostron™-L



Applications of LFT-PP Mostron™-L

Automotive Application

- Metal replacement
- GFPA replacement
- PC/ABS replacement



Thank you for your attention!!



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