MITSUBISHI CHEMICAL

A fully integrated and independent Supply Chain – for the Automotive Industry

PRODUCT OFFERINGS	GROUP COMPANY OF MITSUBISHI CHEMICAL
Engineering Plastics (PC and PC Blends, PBT, POM, mPPE, HP-PA)	Mitsubishi Engineering-Plastics Corp.
PET Films	Mitsubishi Polyester Film GmbH
Bio Polymers, TPEs, PVC Compounds, Adhesives, 3DP Filaments	Mitsubishi Chemical Performance Polymers Europe B.V.
Glass Mat Reinforced Thermoplastic Composites	Mitsubishi Chemical Advanced Materials Composites AG
KyronMAX™ Short Carbon Fiber Reinforced Thermoplastics	Mitsubishi Chemical Advanced Materials AG
Engineering and Simulation of CF/GF reinforced Parts	Mitsubishi Chemical Advanced Materials AG
Engineering and Simulation of CF/GF reinforced Parts	Gemini Composites LLC
Carbon Fiber Forged Molding Compounds (FMC) – Prepregs (PCM)	Mitsubishi Chemical Carbon Fiber and Composites GmbH
Polycrystallin Alumina Fiber (MAFTEC), Bio Based Polymers	Mitsubishi Chemical Europe GmbH
Pressure Sensitive Tapes / EVOH / PVOH	NIPPON GOHSEI Europe GmbH
MMA for PMMA Resins, Coatings, Lubricants, Adhesives	Lucite International
Formulated Electrolytes for Li-Ion Batteries	MC Ionic Solutions UK, Ltd.
Production of Carbon Fiber reinforced applications	Wethje Carbon Composites GmbH
Polypropylene (PP) Compounds, Long Glass Fiber Polypropylene (LGF-PP)	MCPP Germany (Japan Polypropylene Corporation)

Mitsubishi Chemical Corporation
www.m-chemical.co.jp

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

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2019/9

Concept and Design: www.viva-mediale.de

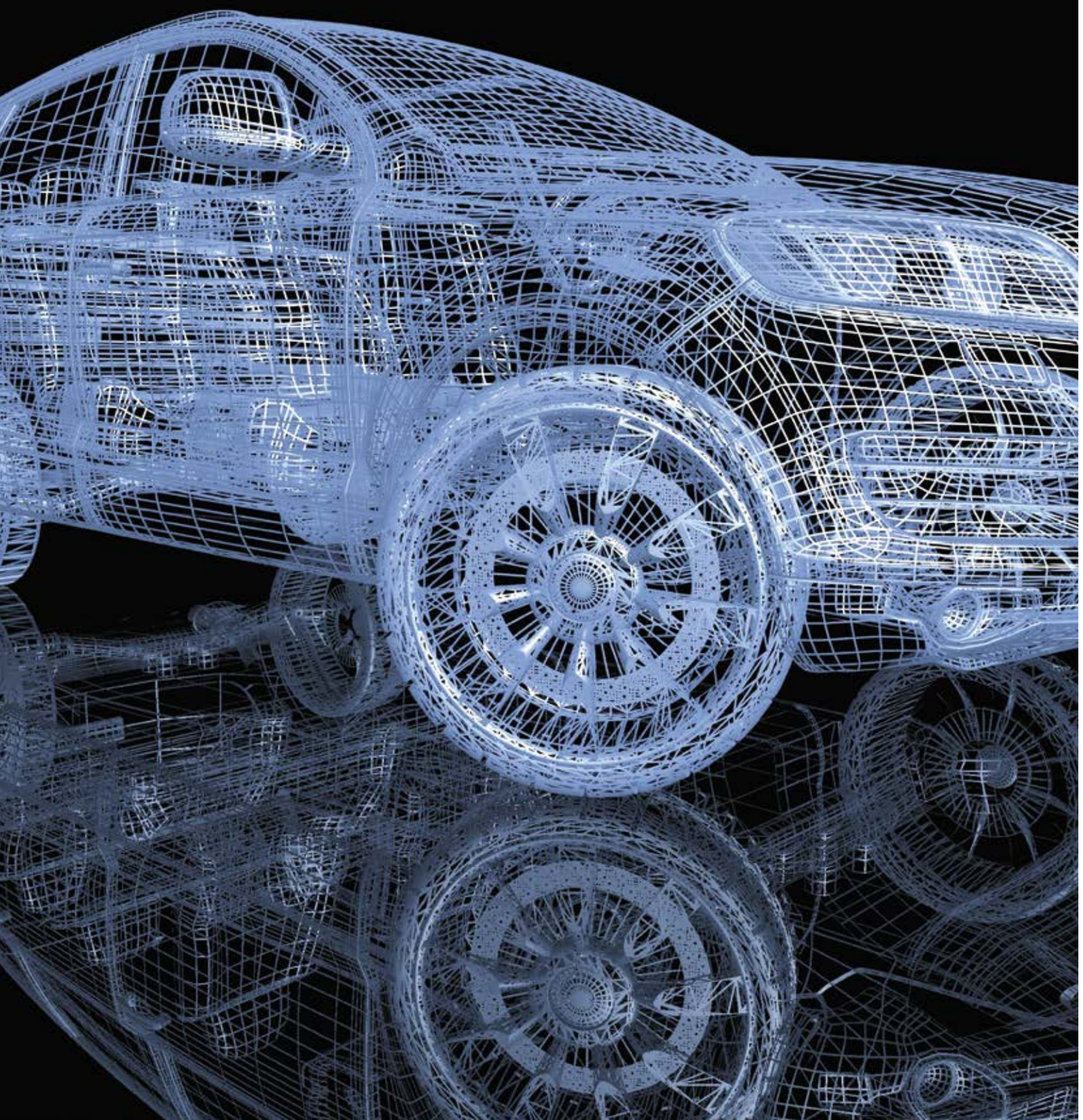
MITSUBISHI CHEMICAL

Automotive Solutions | Exterior
Vehicle Lightweighting and Sustainable Materials

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Automotive Solutions

Exterior



Material. Products. Solutions.
– To the Automotive Industry.

Mitsubishi Chemical and its group companies are dedicated to the automotive industry with R&D aimed at interior, exterior and functional applications, as well as solutions for autonomous and electrified vehicles.

Our focus is on developing and bringing to market lightweight, sustainable materials for today's and future automotive industry needs.

Lucite International

MITSUBISHI CHEMICAL ADVANCED MATERIALS

mcpp Power to Perform

MITSUBISHI CHEMICAL CARBON FIBER AND COMPOSITES

GEMINI

NIPPON GOHSEI Europe

MITSUBISHI CHEMICAL EUROPE

MC Ionic Solutions

Mitsubishi Engineering-Plastics Corp. *

WETHJE Carbon Composites

MITSUBISHI POLYESTER FILM

Japan Polypropylene

*Mitsubishi Engineering-Plastics is a joint venture between Mitsubishi Gas Chemical (50%) and Mitsubishi Chemical (50%)

Exterior

Product Overview

Automotive has been an integral industry for Mitsubishi Chemical, with a long history of partnership and development with the top OEMs. R&D and growth in high performance composites aimed at interior, exterior and functional applications is at the core of our corporate strategy. Our focus is on developing and bringing to market lightweight, sustainable, high value and premium aesthetic solutions.

Mitsubishi Chemical and its group companies offer an impressive portfolio ideal for automotive lightweighting such as carbon fiber, composites, high performance TPOs and PPs, TPEs and TPVs and engineering plastics. As a solution-driven partner, Mitsubishi Chemical is bringing together high performance MATERIALS, engineering PROCESSES and innovative DESIGN expertise to allow automotive exterior and tailgates to achieve bold, distinctive styling and new levels of functional integration.

Exterior

Trims and Covers

Acrypet™ – The Standard Material

With a tailor-made approach, we offer to you as the customer acrylic grades providing the right final aspect and colour you are looking for in your acrylic trim. So optimizing the performance and processing characteristics of the acrylic polymer to meet your requirements

- Acrypet VH PTN 0070 (Piano Black) |
- Match to OEM black colour L*a*b* targets
- Other shades of black possible
- High Gloss | High Opacity
- Weatherability (maintains gloss and colour)
- Paint replacement
- Suitable for 1 k and 2k moulding types
- Suitable for ABS over-moulding

TufCoat™ – A Special Scratch Resistant Material

A new generation of acrylic polymer technology from Lucite International, specifically designed to provide proven enhanced scratch and abrasion resistance for your injection moulding applications. The introduction of TufCoat™ demonstrates our continued willingness and technical ability to provide bespoke acrylic polymer grades to meet the requirements of our customers in providing the following benefits:

Testing confirms improved scratch resistant PMMA

QUV (400 hrs)
Scratch Tip: 1 mm Diameter
Speed: 80 Strokes/Min
Load: 5N|10N|15N|20N|25N

Abraison effects (250 strokes)
Abraison Material:
AATCC Crockmeter Cloth
Speed: 120 Strokes/Min
Number of Strokes: 250

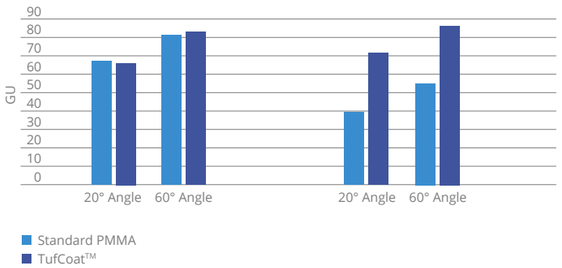


Photo credits | Mazda

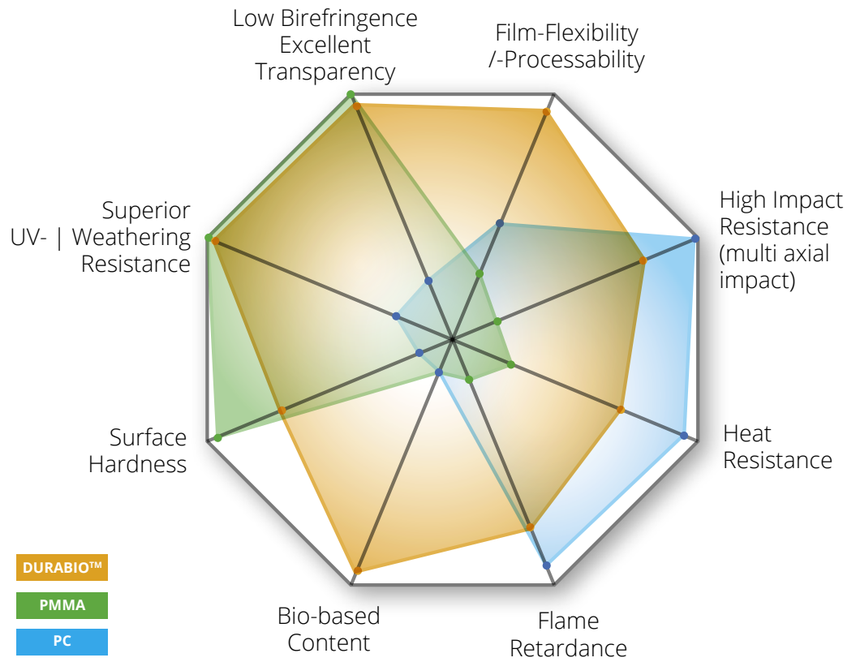
DURABIO™ – A Special Bio Based Material

DURABIO™ is partially bio-based and truly durable engineering plastic, combining the most advantageous properties of PC and PMMA. DURABIO™ is particularly designed for applications needing scratch and impact resistance, requiring exceptional durable transparency and visual appearance, such as automotive radiator grille, rear spoiler and pillar panels, paintless decorative parts achieving piano black color and finish.

Conventionell pillar

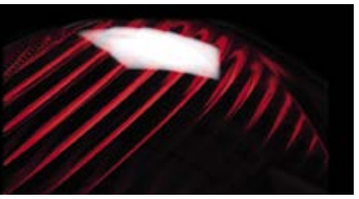
Alternative pillar

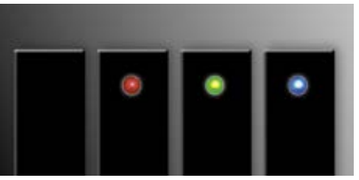
- Highly transparent
- Brilliant optical properties
- Excellent high gloss surfaces
- Better scratch resistance vs. other polymers
- High chemical resitance (e.g. sunscreens)
- Great UV resistance
- Impact resistance
- No hardcoat necesarry
- Mold in color – cost reduction
- Easy to process – high flow
- BIO based polymer (>50%)



Exterior

Lighting





Lighting

Acrypet™ and Diakon™

Evolving from purely functional lighting requirements, the design and ever increasing complexity of headlight and taillights parts are now dictated by the type of LED light sources available to designers. LED allows higher design flexibility thanks to the use of acrylic materials which are now compatible with the low temperatures of the light source. This allows designers the ability to provide unmistakable design features and brand recognition for the automotive manufacturers. Providing proven types of PMMA for taillight and indicator light applications as well as headlight inner lens applications.

Iupilon™ XANTAR™

Solution for Headlamps: Building on an extensive track record, the Mitsubishi Engineering-Plastics portfolio covers various headlamp applications in order to support the industrialization of customer's projects. Our high performance grades use state of the art technology.

Iupilon™ for Cover Lenses
Compliant with SAE J576 and AMECA | Low YI (Yellow Index)
Good anti-static property

Iupilon™ for Metalized Bezels
Excellent mould release | Low pinholes generation | Direct metalizing compatible

XANTAR™ for Non-metalized Bezels:
Various colors available | High impact strength and temperature resistance

Light Diffusion, Edge Lighting, Light Guides

Acrypet™ PDA Series

Utilising unique edge lit technology to create bespoke light diffusion design effects for automotive applications.

- Diffuses light when the LED is turned on
- Appears clear when light is off
- Suitable for injection molding
- Ease of processing
- Functional Colour PMMA: Optical Diffusion

Iupilon™ for light guides
Very high Flow | Thermal-mechanical stability – compatible with LED

Selective Light Transmittance

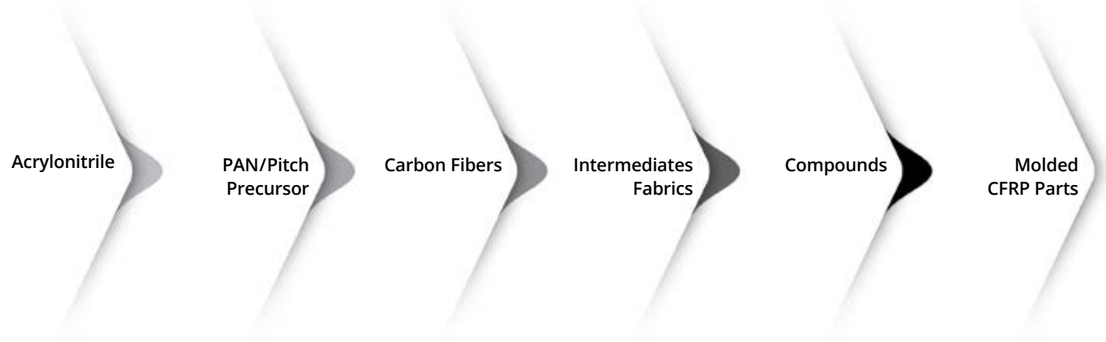
DURABIO™ Piano Black – Colored Illumination

DURABIO offers deep piano black appearance when the light is turned off but when turned on, a selective color illuminates through the backside, offering a unique aesthetic appearance.

- Allows a selected light wavelength transmit through the panel
- Looks deep piano black when not lit from the backside
- Brings good scratch resistance as well as chemical resistance
- Eliminates painting process, offering total cost reduction
- Cost reduction by part consolidation
- Design Freedom
- MCC can control the wavelength to pass through Durabio

Carbon Fiber Materials for Mass Production

Mitsubishi Chemical is uniquely positioned to be able to provide a fully integrated material supply chain for Carbon Fiber Reinforced Plastics (CFRP) - from Precursor, the raw material of the Carbon Fiber to molded Composite parts.



Carbon Fiber Forged Molding Compound (CF-FMC) is a compound of chopped Carbon Fiber and resin. Mitsubishi Chemical's CF-FMC combines unique mechanical properties. Strength and modulus are comparable to aluminum alloys. But, it has short molding cycles with excellent moldability and ultimate design flexibility with complex shapes. Mitsubishi Chemical's CF-FMC technology provides the customer the opportunity to use carbon fiber composites in volume applications.

Variability of properties are minimized with our material formulations utilizing precise manufacturing process control. Therefore, molded parts have consistent material properties throughout the molded panel. Also, our technology provides excellent appearance properties. Incorporating our design knowledge, material knowledge and processing knowledge; Mitsubishi Chemical's CF-FMC is an ideal choice for Lightweighting, primary & secondary structural applications, closure panels and even visual CFRP applications. Strength and modulus are comparable to aluminum alloys. The compound is developed for complex composite structural parts produced in a volume production.

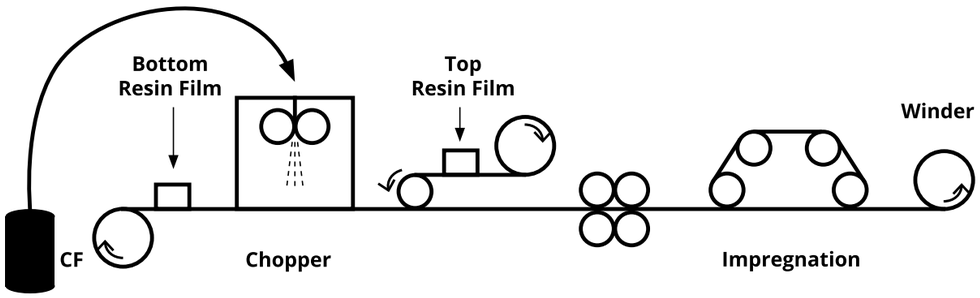


Photo credits | Toyota

Exterior

Tailgate and Doors

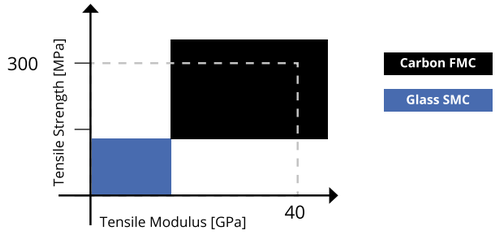
Carbon Fiber FMC – an ideal material for higher volume structural automotive applications

- Enables production of large, 3-dimensional complex parts
- Significant weight saving over Steel / Aluminum
- Fewer molding steps compared to Steel / Aluminum – Design more flexible
- Suitable for unique surface appearance
- Parts integration reduces processes and costs
- 3 min cycle time

Carbon Fiber FMC – for structural applications like tailgates trunk lids, door inner panels and exterior CF-FMC design parts

- Integration of functions (ribs, metal inserts)
- Short cycle time (curing ~1 mm/min)
- Can pass through E-coat process – Hybrid metal parts possible
- Enables production of large, 3-dimensional complex parts
- Part consolidation reduces process time and costs
- Fewer molding steps compared to Steel / Aluminum – Design more flexible

Mechanical Performance



Based on plate properties 80% coverage

CF-FMC properties can be modified by carbon fiber (CF) content
CF Filament count | Resin System to generate a maximum of customer benefit.

Mitsubishi Chemical can offer specialized engineering support for CF-FMC (Design, Process, Material)

Composite Part Performance will be enhanced by

- Part design
- Mold coverage / CF-FMC charging pattern
- Process conditions (curing time, temperature, pressure, ...)

Pressing Process

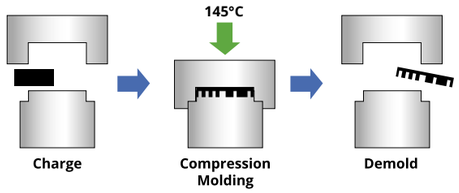


Photo credits | Lexus

Exterior

Tailgate and Doors

FUNCSTER™ LGF-PP

Pultruded, long glass reinforced injection molded grade PP has long been known for structural applications. Recently FUNCSTER™ has also become the trusted appearance-grade LFGPP material in the automotive market due to the unmatched glass dispersion.

FUNCSTER™ has been instrumental in the technological advancements and development of inner liners for composite tailgates in the automotive industry, where the material is colored and visible. Because of the advancements in the technology, manufacturers can now achieve better cost structures with weight reductions, part number reductions and cycle time reduction for key functional and structural parts.

Benefits and advantages

Two years of development in optimizing dispersion has resulted in excellent dispersion to allow molded-in color while maintaining LGF-PP properties in the interior first surface. FUNCSTER LGF-PP used for the inner and structure of liftgates brings the strength of a steel replacement with no visible bundles of glass. In addition to the injection molding styling flexibility.

Thermoplastic Polyolefins

From development and testing to manufacturing high performance polymer solutions, Mitsubishi Chemical sets the standard for consistancy, quality and innovation. Within the automotive industry, we have a strong history of proven performance compounding high performance engineered polyolefin.

- Bumper fascia
- Roof racks
- Trim panels
- Sill plates
- Pick-up truck bed rails
- Tailgate outer skin

DYNAFLOW TPOs

Unfilled and filled polypropylene materials that offer the latest technologies while ensuring cost-effective performance

DURAFLEX

High-gloss, high-surface-durability materials for both injection molding and extrusion.

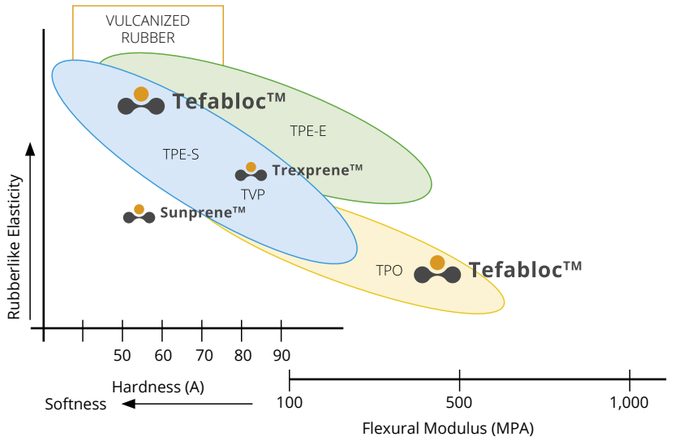
METAFORM

High-melt-strength solution for demanding thermoforming and extrusion applications

Exterior

Thermoplastic Seals

Automotive Sealing Solutions
TEFABLOC™ is a versatile family of thermoplastic elastomers (TPE) offering a wide range of product specifications tailored to each functionality of automotive seals with various technologies including TPS,TPV, TPO and TPC.



TEFABLOC™2.0
- Low odor and VOCs emissions
- Excellent surface appearance
- Excellent UV and weather resistance
- 100% recyclable
- Wide range of gloss and coloring
- Very good processability (High flow grades for injection molding and low MFI for extrusion grades)
- Good compatibility to other polymers (ABS, ASA, DURABIO™, EBDM, PA, PBT, PC, PE, PP, PP/GF...)

TEFABLOC™ TOEF 248
- Auto foaming grade for core extrusion
- Weight saving up to 40%
- Hardness Shore 70A & Shore 30D available

TEFABLOC™ TOSE 848
- Extrusion grade for sealing lip
- Weight saving up to 20%
- Excellent UV and weather resistance
- Good compatibility with co-extruded slip coats

TEFABLOC™ TOSL 340
- Lubricated injection molding grade
- Weight saving up to 10%
- Excellent UV and weather resistance

Exterior

Roofs and Hoods

Applications for Prepreg Compression Molding (PCM)
Developed for light weight body panels like high quality visual Carbon Fiber roofs and body color painted front hoods, trunk-lids, fenders and doors.

Photo credits | Audi

Advantages of PCM Technology
- Short Cycle times – quick cure resin systems
- Passes climate cycle test (e.g. PV1200)
- Suitable for inline painting process at OEM
- Less investments cost for tooling compared to metal solutions
- Process automatization for volume production

Customer Benefits and Advantages
- Light weight – 33% weight saving vs. aluminum
- Lower center of gravity / superior driving dynamics
- Individualization and special geometry like power-dome possible

Photo credits | Audi

Exterior

Assembly | Masking | Transport Protection

Nichigo G-Tape™

is a hand tearable, residue free and highly weather resistant tape. These features offer many solutions to automotive industry and after markets.

- Innovative pressure-sensitive tape
- Hand-tearable, requiring no knives
- Leaves no residue on most surfaces
- Can easily be removed from itself and reused, unlike standard duct tapes
- Higher tensile strength and dimensional stability than conventional gaffer tapes or duct tapes

Technical Data

Property	Unit	Masking and Protection			Waterproof and Airtight		Doube Sided	
		1003	1008	1009	3030	3040	9206	9030
Thickness	mm	0.14	0.16	0.16	0.17	0.22	0.24	0.22
Adhesion Strength	N/25 mm	3	8	9	30	40	20/6	30/30
Holding Power*	mm	0.1	0.1	0.1	0.2	0.9	0.1/0.05	0.6/0.6
Tensile Strength	N/50 mm	230	350	280	380	400	400	400
Elongation	%	15	17	15	16	21	21	21

Note: Above figures are measured values based on test method of JIS Z-0237. The technical information and data are typical values for reference, not specifications. *The measure of slippage in 1 hour while holding a metal plate.

Benefits and Advantages

- Easy to tear, no tools needed
- Clean removable, no residue after removing
- UV and water resistant
- Different colors
- Different adhesion strength