



Science.
Value.
Life.

Feuer und Flamme für Compounds

Electrics, Electronics and Energy solutions from Mitsubishi Chemical Group

Grässlin Tech Day
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1) Introduction of Mitsubishi Chemical Group

2) Introduction of Tefabloc™

3) Applications with Tefabloc™ or Olefista™

- TPE for communications devices
- ESD and conductive TPE
- Injection Solutions for E+E

4) Sustainability with Tefabloc™



Introduction of Mitsubishi Chemical Group

Overview of Mitsubishi Chemical Group



Mitsubishi Chemical Group Corporation

Head office 1-1 Marunouchi 1-chome, Chiyoda-ku, Tokyo 100-8251



Number of employees
(consolidated)

69,784



Consolidated sales revenue
(IFRS)

¥3,976.9 billion

*All figures are for the year ended March 2022 (FY2021)

Group Concept



We lead with innovative solutions
to achieve KAITEKI,
the well-being of people and the planet.

**Science.
Value.
Life.**

Solution

Performance Products



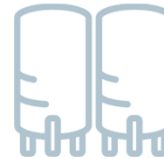
Polymers & Compounds / MMA
Advanced Solutions

Chemicals



Petrochemical & Coal

Industrial Gases



Industrial Gases

Healthcare



Pharma
Regenerative Medicine

Performance Polymers – Product Portfolio



PREMIUM DESIGNED SOLUTIONS

- Sustainable R&D development
- Services & technical support
- Production
- Quality and Compliance

A CUSTOMER CENTRIC APPROACH

- Highly skilled human and technical resources for meeting rapidly changing environment and society requirements
- Uncompromising on safety, compliance and quality
- Expert in polymer sciences and applications

| 3D Printing Materials | | |
|---|--|--|
| With a full range offering including the industry's most used materials such as ABS, PLA, PP and PET, as well as proprietary materials such as PRIMALLOY flexible rubber and BVOH water soluble support materials. | | |
| Functional Polyolefins | | |
| LINKLON™ is a silane crosslinkable polyolefin based resin. The post crosslinking reaction dramatically boosts material performance in terms of heat resistance and creep behavior at elevated temperature. | MODIC™ is a unique tie-layer resin offering excellent adhesive performance to a variety of materials, covering various applications and requirements for automotive, food/non-food packaging, industry and building/construction. | OLEFISTA™ are Halogen Free Flame Retardant (HFFR) olefin based compound with low smoke solutions (LSZH) |
| PVC Compounds | | |
| VINIKA™ utilizes superior compounding technology to achieve excellent surface appearance, stable processing, and excellent colorability across a broad range of hardness. | SUNPRENE™ utilizes high performance raw materials to provide flexible PVC with excellent abrasion resistance, low compression set, excellent color-ability, and low gel count in a broad range of hardness. | MARVYFLO™ is high flow PVC powders designed for the production of instrument panels, door panels, glove box and other automotive interior surfaces. |
| Thermoplastic Elastomers | | |
| TEFABLOC™ incorporates several technologies including TPE-S, TPO and TPE-E. Among the large scale of possible properties, some are boosted in process by reactor or dynamic cross-linking. | THERMORUN™ products offer excellent physical properties and durability. In critical safety applications, offers consistent performance across automotive interior temperature range. | TREXPRENE™ TPV is a series of Vulcanized PP/EPDM based thermoplastic elastomers (TPEs) that are heat and UV stabilized, ranging in harnesses from 45 Shore A to 50 Shore D. |
| Materials for Medical applications | | |
| | ZELAS™ are polymers designed for medical applications including R-TPO, specialty TPE compounds and tie layer resins. Specific solutions designed for film, tubing and injected molded components for the medical industry. | |

Introduction of Tefabloc™



Thermoplastic Elastomer Technology



RAW MATERIALS PRODUCERS

COMPOUNDER

DISTRIBUTOR

TIERS

OEMs



Thermoplastic Elastomer (TPE) compounds with a broad range of COMPOUNDS & tailor made SOLUTIONS to offer a wide range of PROPERTIES

PERFORMANCE

Wide range of properties available:

- Hardness range : 5 ShA to 50 ShD
- Opaque / Translucent/ Transparent versions
- Easy colouring
- Heat stability up to 100-120°C
- UV resistance
- Wide processing range

HAPTICS

Haptics:

- Appearance
- Flexibility
- Comfort
- Color
- Soft touch & Dry touch

FUNCTIONALITIES

Functionalities:

- Sealing
- Grip
- Adhesion to plastics
- Durability
- Use indoor/ outdoor
- Easy to use, easy to assembly
- Recyclable

COMPLIANCE

Regulatory:

- RoHS & REACH
- Euroclass & UL94
- Low VOC
- Drinking water
- Food certificates
- ISCC + certified products



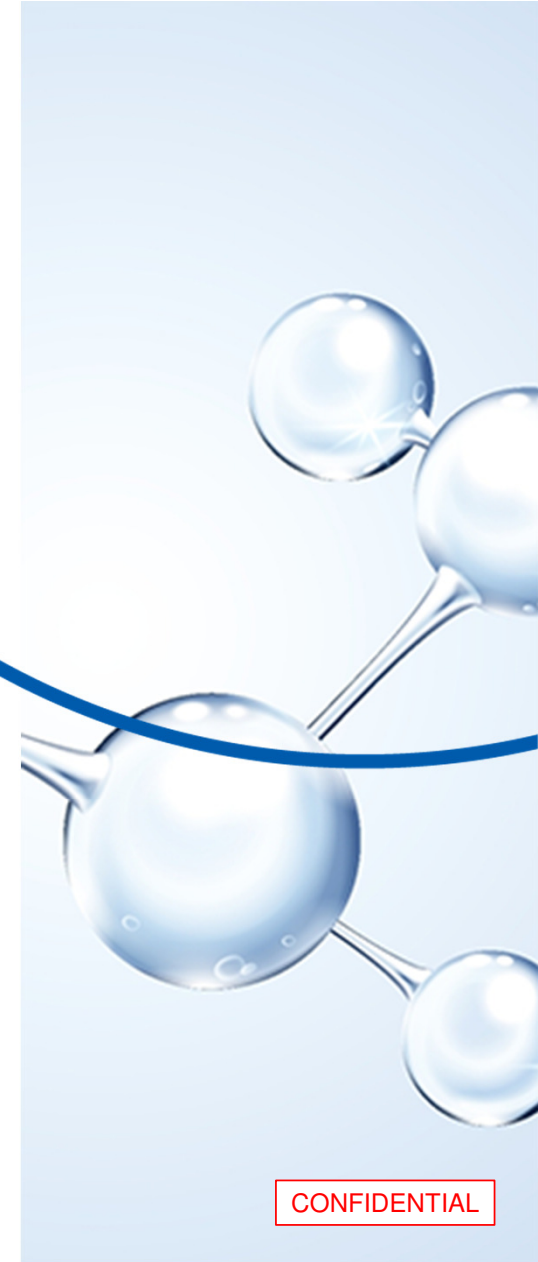
Our house

Considering a house, there can be many applications
made of TEFABLOC™ TPE



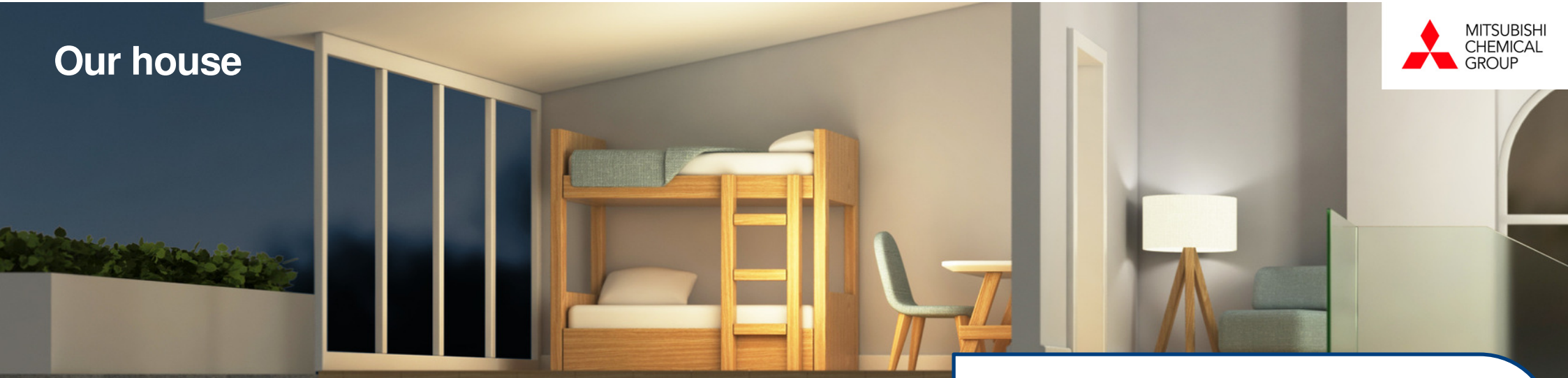
Applications with Tefabloc™ or Olefista™

Product portfolio and new developments



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Our house



Concentrate on
Kitchen, Living Room, & Playing/bed rooms...
but also automotive

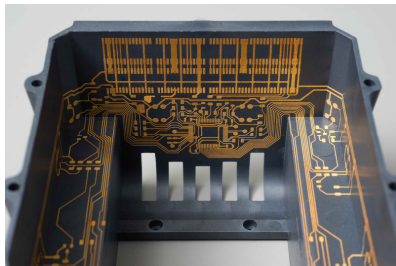


TPEs for communication devices eg. antennas

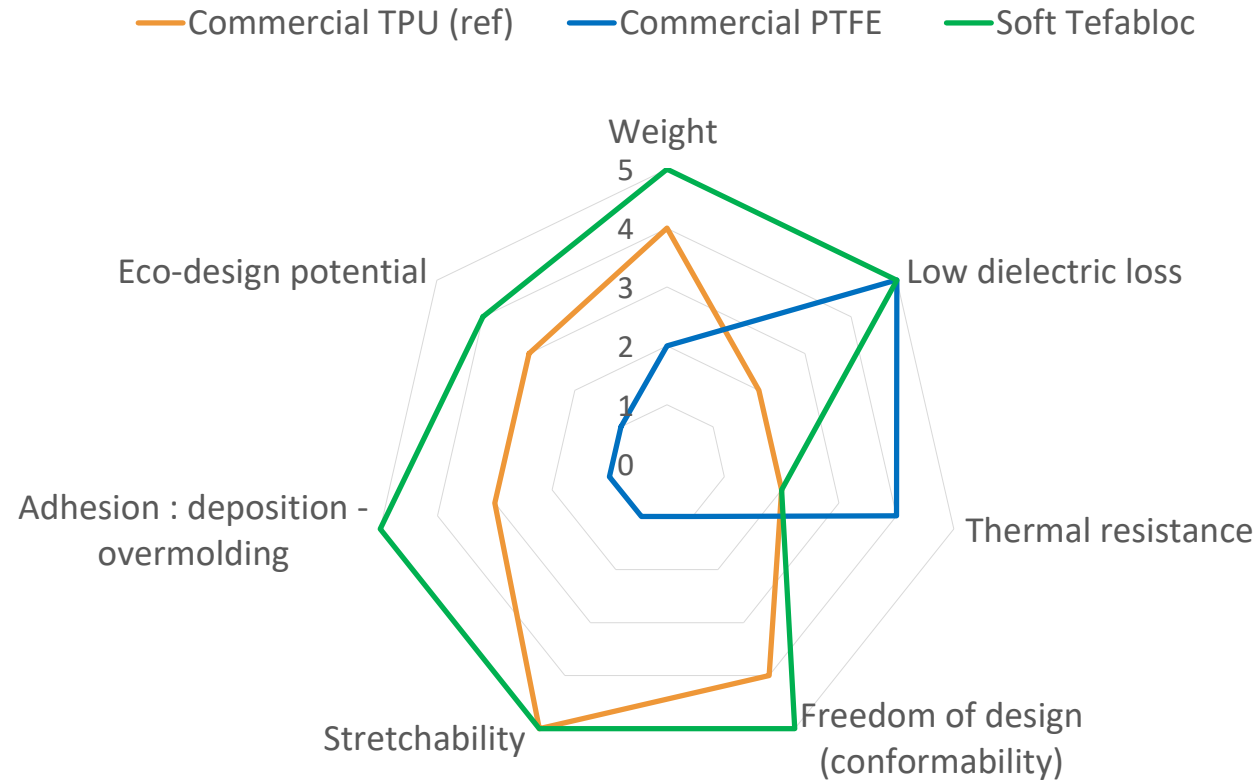
Connected objects like IOT can be found in a kitchen and home appliance Devices.

Sensors and antennas can be Integrated into IOT.

- TOLB 669 as a soft material with Hardness around 80A
- Tefabloc™ CP as a more rigid material with Hardness around 70D



TPEs for communication devices eg. antennas



- ✓ Most suitable for high frequencies: 5G and 6G
- ✓ Recyclable
- ✓ Not toxic
- ✓ Soft and rigid solutions

Scale performance : 5: best – 1: lowest

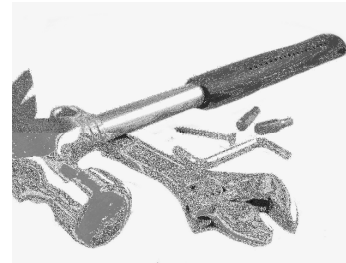
Our house



Concentrate on parts normally stored in a garage

ESD and conductive TPE

Static electricity prevention on US gas stations

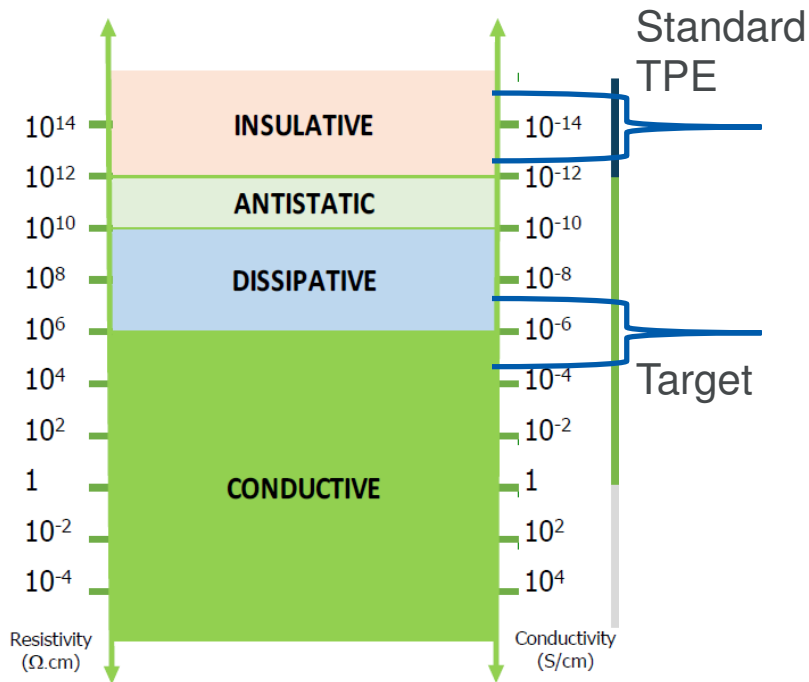


Conductivity on TPE is needed

- ✓ To conduct or dissipate static electricity buildups
- ✓ To avoid electric sparks/arcs which might lead to a fire or explosion
- ✓ To prevent electromagnetic interferences which might lead to electric devices failure or blackout

Example applications: Shoes and clothes, wheels, screwdrivers, handles

ESD and conductive TPE



| ESD TPE | Conditions | Unit | TOLB 888/26 | TOLB 888/12 |
|---------------------|----------------------|---------|--------------------------------|----------------------------|
| Hardness | ISO 868 23 C, 15 s | Shore A | 85A-90A | 70A -75A |
| Surface Resistivity | ASTM D257 | Ω/sq | 1.00E+05 (compressed sample) | - |
| Surface Resistivity | ASTM D257 | Ω/sq | 1.00E+06 (injected sample) | 1.96E+07 (injected sample) |
| Process | | | Injection Moulding + Extrusion | Injection moulding |
| Color | | | Black | Black |

Development of natural colorable, soft conductive TPEs with adhesion to PP/PE and ETPs ongoing with a hardness of 50A or higher

Our house

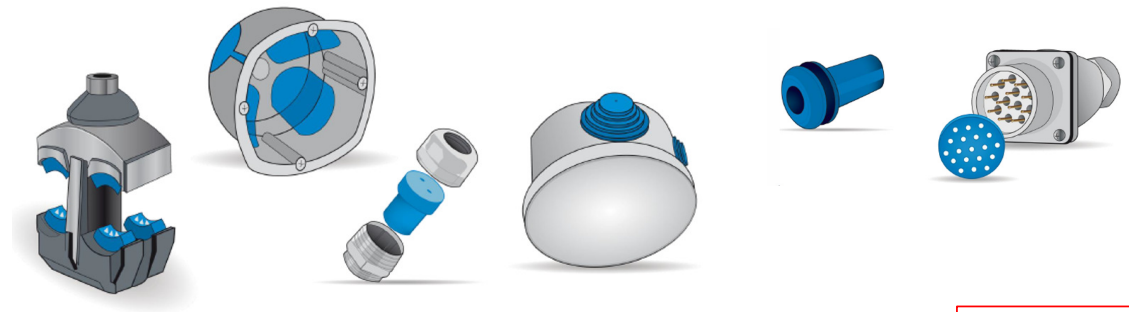
Concentrate on electrical and energy devices,
which can be everywhere in the house



Injection Solutions for E&E - Tefabloc™

| Injection process | Standard / No Flame Retardant | | | | | Flame Retardant | | |
|------------------------|-------------------------------|----------|---------|----------|--------------------------|-----------------|----------|----------|
| | TPSD 203 | TOSI 213 | TO.823 | TESI 744 | TESI 817 | TOSI 034 | TOSI 035 | TOSI 036 |
| Hardness – Shore A (*) | 15<>40 | 40<>90 | 30<>90 | 50<>90 | 40<>90 | 40<>90 | 40<>90 | 40<>90 |
| Zero Halogen | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Glow Wire test | 650 ° C | 650 ° C | 650 ° C | 650 ° C | 650 ° C | 750 ° C | 850 ° C | 960 ° C |
| UL 94 (3.12 mm) | HB | HB | HB | HB | HB | V-0 | V-0 | V-0 |
| 2K compatability | PP | PP | PP | PP PA | PC ABS PBT Durabio | PP | PP | PP |
| Sealing at max | RT | 70° C | 100° C | 70° C | 70° C | 70° C | 70° C | 70° C |

- TPE is mainly used as sealings in E&E devices, but can be also a top cover or a grip
- Good colorabilities
- Good injection mouldability
- Good elastomeric recovery



HFFR Injection solutions for E&E – HFFR Olefista™

NEW HFFR Injection Range - Olefista

| Injection process | NEW HFFR Range |
|------------------------|-----------------------------|
| | TOLB 600 (development name) |
| Hardness – Shore A (*) | 60<->85 |
| Zero Halogen | ✓ |
| Glow Wire test | 850 ° C |
| UL 94 (2 mm) | V-0 |
| 2K compatibility | PP |
| Sealing at max | 70° C |

- 60 to 85A
- Low smoke and fumes
- UL94- V0 (2 mm)
- GWT 850° C
- LOI >30%
- Low heat release (cone calorimeter)
- Good UV stability
- Good aesthetics
- Good colorability



Sustainability with Tefabloc™

How to bring circularity to Tefabloc™



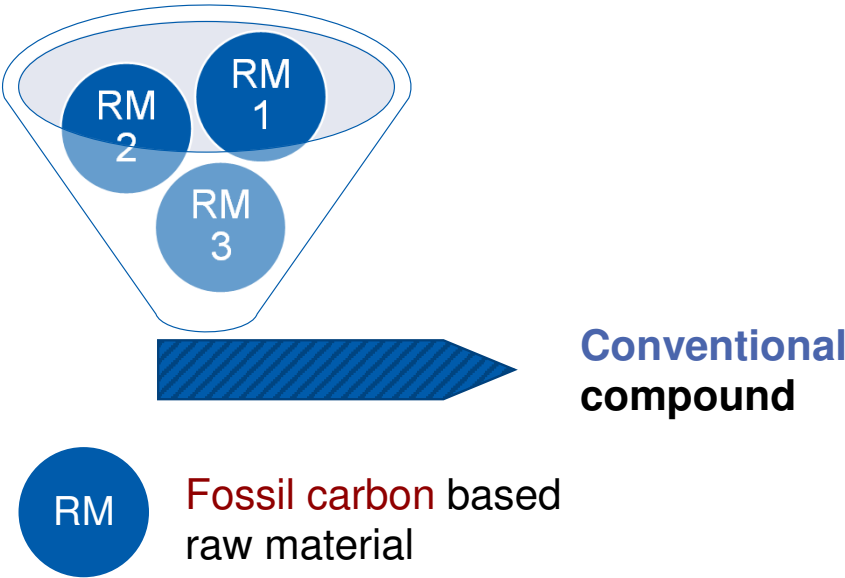
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Circular TPE compounds

Progressive introduction of alternative feedstock

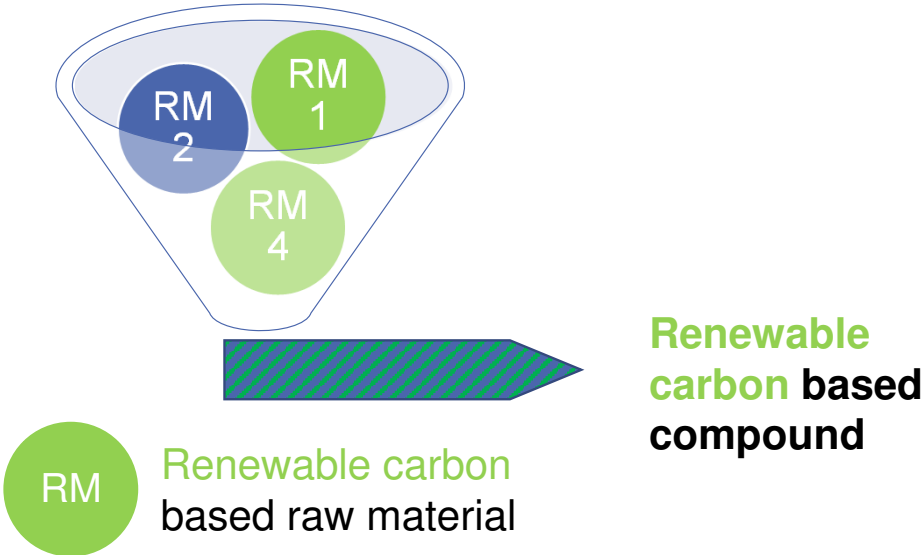
Conventional compounds / Fossil feedstock

- ✓ Compounds = blends of various Raw Materials (RM)
Elastomers, polymers, plasticizers, fillers, additives etc...
- ✓ Possibly up to 10+ ingredients for a single formulation in order to reach customers specific needs.



Alternative compounds / Renewable Carbon Feedstock

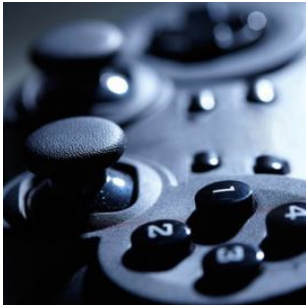
- ✓ **Substitute a conventional ingredient** by another one issued from biomass or recycling streams (renewable carbon based)
- ✓ Or **add/use a new renewable carbon based material**
- ✓ **Increase step by step the content of Renewable carbon** in the compounds (availability, technical ability etc...)



Circular TPE compounds



| | Loop TPE TGSi R02/R03 | Range upgrades TG01 ... | Biobased TPE TGSi A06 | NEW TG |
|-----------------------------------|---|---|---|--|
| RENEWABLE CARBON FEEDSTOCK | Circular (PIR/PCR) | Circular (PIR/PCR) | Biomaterials | Biomaterials – Circular – Biocircular |
| USAGE | Physical Segregation | Physical Segregation | Physical Segregation | Mass Balance |
| MAXIMUM R.C. RATIO | Up to 70% | Up to 20-30% | Up to 40% | Up to 55% |
| KEY FEATURES | <ul style="list-style-type: none"> General Purpose Hardness 45-80A Easy colourability Skin contact PE/PP overmolding | <ul style="list-style-type: none"> Performance similar to conventional and corresponding range | <ul style="list-style-type: none"> General Purpose Hardness 60-80A Skin contact PE/PP/ETP overmolding | <ul style="list-style-type: none"> Performance similar to existing range Food contact possible Easy colourability |
| STATUS | Commercial | Commercial & Development | Commercial | READY TO START |



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Circular TPE compounds



- Sustainability Solution must be considered specifically
- Clear targets to be defined
 - environmental impact, performance, functionality, value...
- Mitsubishi Chemical Group can support designing and optimizing your solutions for sustainability and circularity:
 - Prototyping, Process & Tool Design
 - Material Innovation
 - Environmental Impact Measurements
 - Support for Certification of Environmental Claims
- Contact us

We can support with offering diversified expertises and solutions, maximizing sustainability experience for our customers

Thank you for your attention