

Helping to retain better EARTH

# SABIC Innovative Plastics: Environmentally Sustainable Engineering Thermoplastics Materials

Sharing our futures

# How Plastics Influence – Better Earth theme ?

## Sustainability

- High performance environmentally responsible materials
- Improve ease to recycle our products
- Enable improved fuel efficiency and reduced emissions
- Flame retardancy without halogenated additives
- Eliminate need for paints



# What will help to make EARTH better ?

## Upcycled Plastics from Recycled Materials



Upcycling PET water bottles into PBT: Valox iQ\* & Xenoy iQ\* Resins

## Conserving natural Resources



Wood Replacement for Railway seat FR Lexan\*

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## End Product Energy Efficiency Improvement

Verton\* Metal Replacement = Less weight



Noryl GTX\* resins for fenders - Automotive lightweighting

Fuel tank Xenoy\* - For lower permeability



## Reducing Material Toxicity

Replacement of halogenated materials: Flexible Noryl\* resin



Metal replacement: Faradex\*, Thermocomp\* HSG



Eco-compliant Electricals Starflam\*



Paint replacement: Geloy\* XTW / Lexan\* SLX Film



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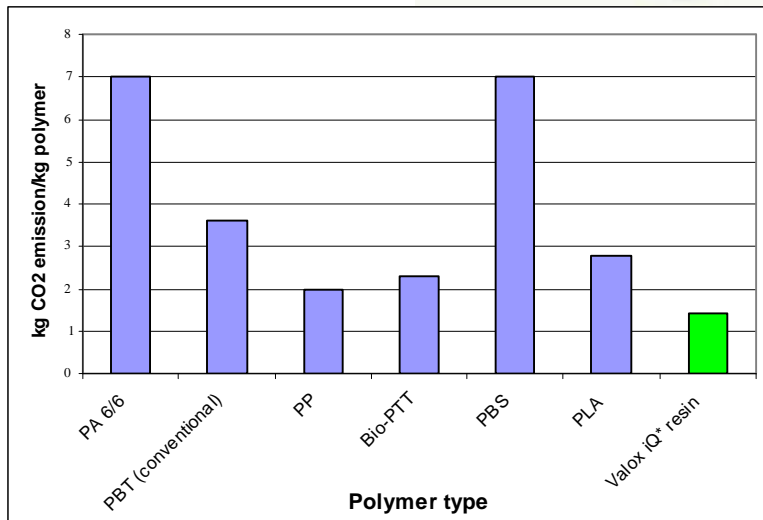
# Upcycled Plastics



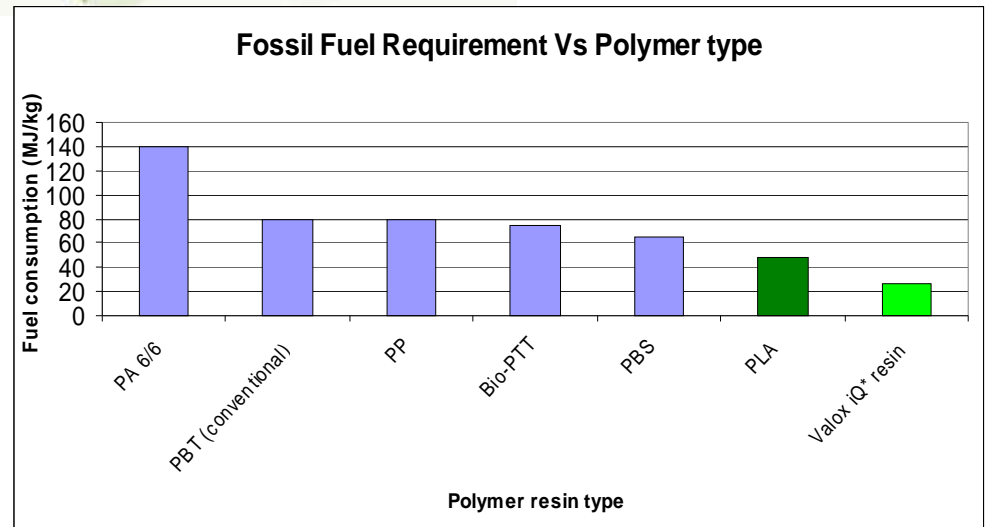
Valox iQ\* resin needs 60% less CO<sub>2</sub> emission than conventional PBT



Valox iQ\* resin enables a reduction of 8.5 barrels of crude/ton Vs conventional PBT



Claims Audited by Green Order (N.Y. USA) and Recycle One, Japan



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# Upcycled Plastics - Post Consumer Recycle Options

## Valox IQ\* PBT Resin Process



- Valox IQ\* PBT resin is made in a chemical process by upcycling solid PET waste to PBT
- Valox IQ\* and Xenoy IQ\* are drop in solutions for Valox\* and Xenoy\* products

VS

## Typical Post Consumer Recycle Process



- Post consumer recycle typically involves regrinding, and re-compounding in an extruder.
- PCR results in significant degradation (20%-30%) of properties with every heat history

# Conserving Natural Resources

## Wood Replacement in railways

- **Potential Environmental Benefits**
  - Conserve natural resources
  - Weight reduction helps in better efficiency of engines
  - Recycle Option
  - Flame retardant solution to protect human life
- **Engineering/Performance Benefits**
  - Better Impact
  - Excellent weatherability to retain gloss, colour and physicals



- Lexan\* FR material solutions for flame retardancy, better impact, no paint

# End Product Energy/Fuel Efficiency Improvement

## Plastic Fenders in Cars

- 40% Weight Reduction Compared to Steel
- Enhanced Damage Tolerance
- Lower Repair Cost (High Insurance Rating Potential)
- Engineering Solution for Pedestrian Safety Regulation (EU and Japan)

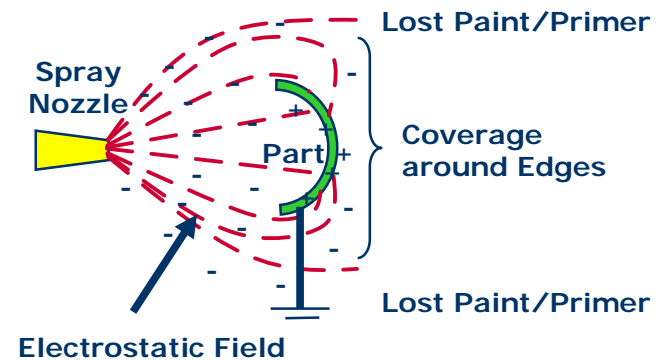


## Value Proposition

- Vehicle Front Side Weight Reduction
- Dent Resistance (Reduce Cost of Ownership)
- Styling Freedom

## Enabling Technology

- Online Paintable Product
- High Heat and Dimensional Stability
- Design and Engineering Know-How



- Conductive Noryl\* GTX solutions can be on-line painted and offers density advantage

# End Product Energy/Fuel Efficiency Improvement

## Metal replacement Challenges

- High strength requirements.
- Lower CLTE needs.
- Wide range of operating temperature.
- Creep and long term properties
- Warpage on account of fibre reinforcement.

## Long Fibre Reinforced Thermoplastics

- High Modulus
- Low warpage & excellent surface finish

## Single pellet LFRT

- Environment friendly non paint structural composite

- LNP\* Verton\* LFRT compounds are available with PP, PA, PPA, PCABS
- LNP\* Verton\* Xtreme compounds offers single pellet LFRT.

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# End Product Energy/Fuel Efficiency Improvement

## Plastic fuel tank for off road vehicles

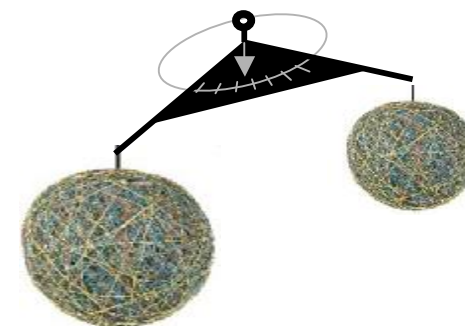
- New changes require lower fuel permeation standard:
  - New CARB regulations
  - New EPA regulations
- Fuel loss permeation < 1.5 g/sq. meter/day (test fuels: CE10, CE15)
- **Potential Environmental Benefits**
  - Low/no capital investment – no secondary operations
  - Reduced permeation by up to 200x vs. PE
  - No additives - no dispersion issues.
- **Xenoy\* 6620-GT & X6800BM fully CARB-compliant**



# Reducing Material Toxicity

- **Potential Environmental Benefits**

- Reduction of Phthalates
- Reduction of Dioxins
- Recycle Option
- Lighter Weight = Less Fuel Consumption. 25% Weight Reduction ~ 0.63 kg/car, plus Single Resin Solution for Class A, B and C
- In addition to meeting existing regulations, such as RoHS and WEEE, the material has certifications under UL1581 specification for 80<sup>0</sup>, 90<sup>0</sup>, and 105<sup>0</sup>C.



- **Engineering/Performance Benefits**

- ~55% Lower Density/Weight
- Improved Scrape Abrasion
- Bundle Size and Packaging Reduction
- Less Resin, More Favorable System Cost



- Flexible Noryl\* wire helps in PVC replacement, offering halogen free, light weight, better insulation properties

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# Reducing Material Toxicity

## Non Paint/Plating EMI Solutions

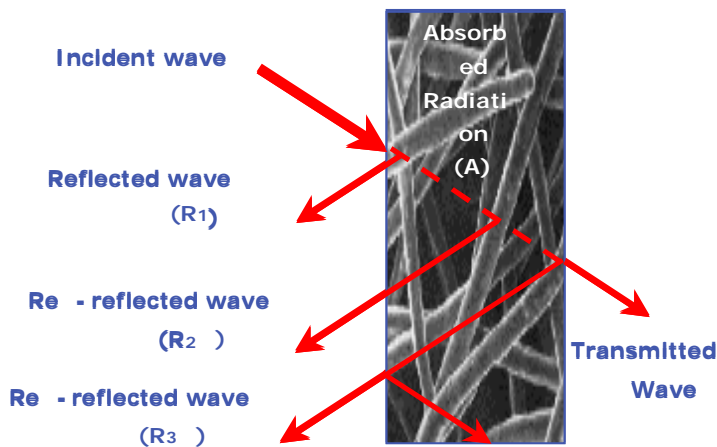
- Stainless steel fiber reinforced plastics
- No need of EMI painting/Plating
- Custom colorable
- Can be extended to Upcycled Valox IQ base resins also



Material Replaced  
FR PC with  
nickel/copper  
metallization

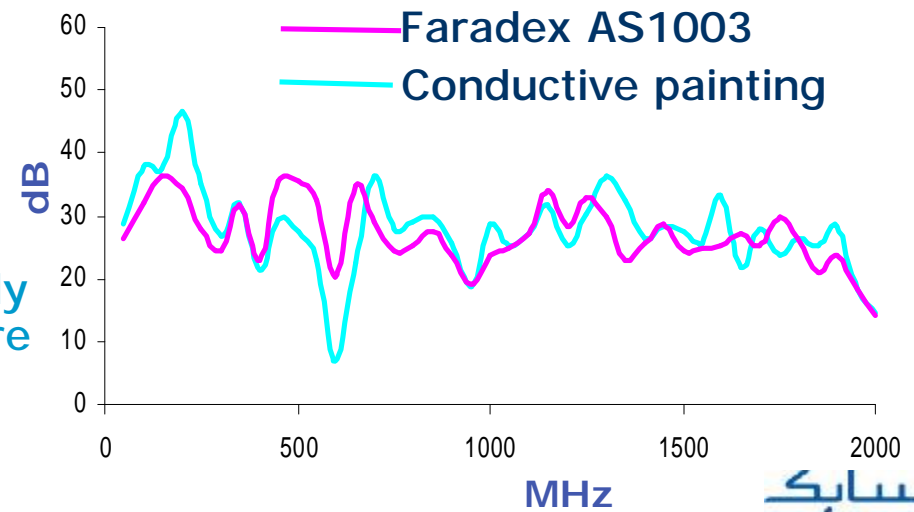


LNP\* Faradex  
DS-1003 FR HI  
Compound



- LNP\* Faradex\* compounds successfully replaced EMI painted & metal enclosure applications in telecom, consumer electronics etc

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# Reducing Material Toxicity

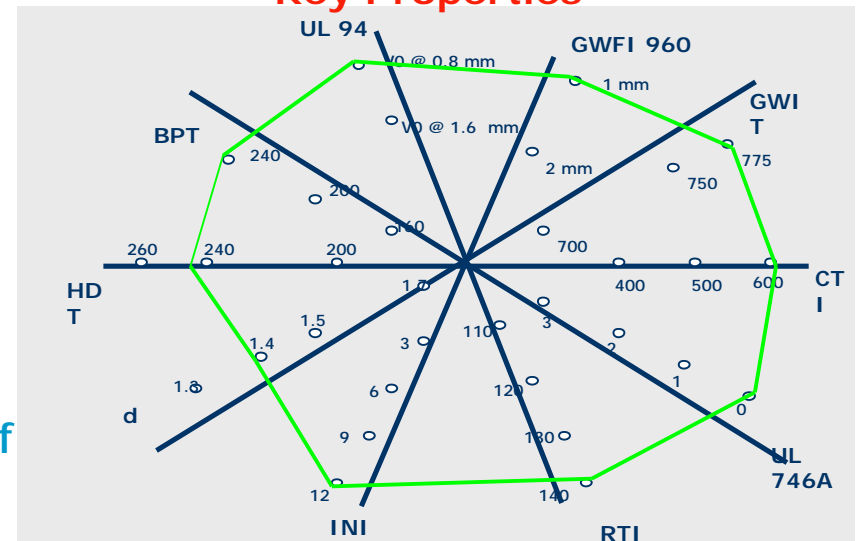
## Electrical Circuit Protection Requirements

- Halogen and Prosperous free FR Compounds.
- WEEE compliance with no need to sort
- UL Listing and meeting IEC60335 requirements
- RoHS compliant.
- Laser markable
- No Electrical contact corrosion



- LNP\*Xgen\* Starflam\* is meeting the above regulations makes it a material of choice in the circuit protection industry.

## Key Properties



# Reducing Material Toxicity

## Non PTFE Internally Lubricated Compound

- Non halogenated lubrication technology makes this product more environment friendly.
- Complaint with Blue angel, WEEE and RoHS.
- Low specific gravity.
- Noise reduction possibility.



## Lead Replacement.

- Increased specific gravity – Opportunity to replace lead for dead weight applications.
- Some of the filler technology has capability of X-ray opacity- Non lead option for health care industry.



- LNP\*Lubrilooy\* compounds: Non PTFE internally Lubricated compound
- LNP\*Thermocomp\*HSG compounds : High specific gravity material solutions



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# Reducing Material Toxicity

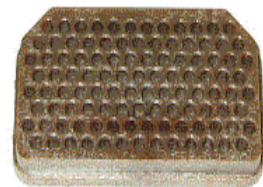
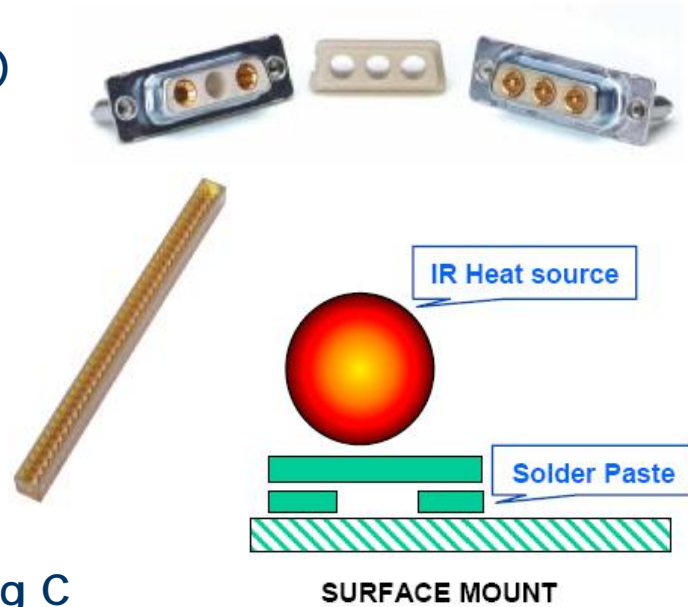
## Lead free soldering requirements.

- Reflow soldering temp 235 to 260 (short term)
- High heat FR compounds
- Halogen, Phosphorous free Flame retardancy

## Cross linkable Materials

- Cross linking at surface – Boost the short tem thermal stability
- High heat Amorphous Polyimide
- Glass transition temperature as high as 311deg C
- Inherent FR &Melt processable

- Extem\* Thermoplastics PI & LNP\*
- Xgen\* Starflam\* is used for lead free soldering applications

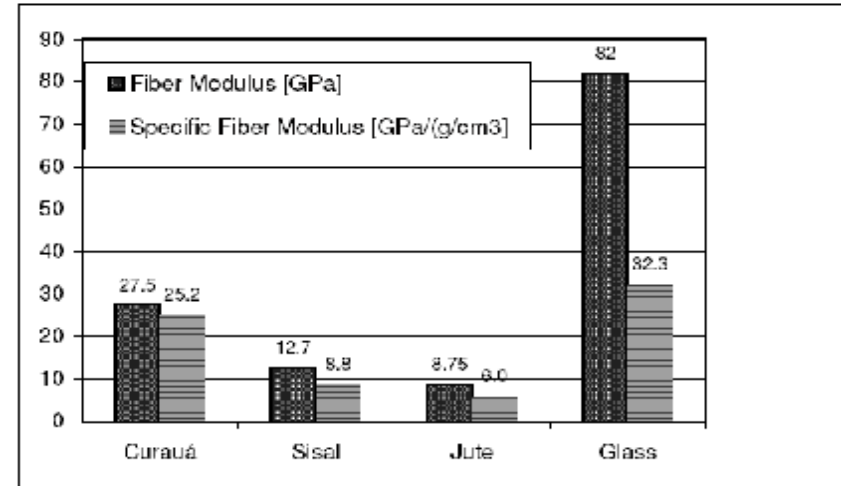


Solder Paste Material	Tm, °C
Sn-Cu	227
Sn-Ag	221
Sn-Ag-Cu (Sb, Bi, Ge)	210-222
Sn-Bi-Ag	203-217
Sn-Zn-Bi	189-199
Sn-Pb	175-190

# Natural Fibre reinforced composites



- Comparable properties with Mineral reinforced materials
- Added advantage for ELV-Automotive
- Low specific gravity.



Property	PA6	PX07444	PA6+20%GF	PA6 +20% MF
Density g/cm3	1.14	1.18	1.27	1.27
Tensile strength(Mpa)	63	83	101	73
Tensile Modulus(GPa)	1.4	5.5	6.5	6.5
Elongation at break (%)	>60	3	3	6
Izod impact strength (KJ/m2)	10	9	9	9
Flexural strength (Mpa)	95	115	160	115
HDT @ 1.82 Mpa (deg C)	57	186	194	110

PA6 : Un filled PA6, PA6+20%GF : 20% glass reinforced PA6  
 PA6+20%MF –20%Mineral filled & PX07444 : 20% Curaua filled

# Reducing Material Toxicity

## Eliminate Painting process

- **Potential Environmental Benefits**
  - No Paint solution
  - Reduction of VOC
  - Recycle Option
- **Engineering/Performance Benefits**
  - ~15% Lower Density/Weight
  - Lighter Weight, lower structure support
  - Better impact
  - Quick installation and ease of handling on assembly lines
- **Geloy\* XTW and Lexan\* SLX films offer solutions to better weathering as painted parts**

