CHEMISTRY THAT MATTERS™

PP-REINFORCED COMPOSITES FOR AESTHETICAL AND STRUCTURAL APPLICATIONS

HIGH PERFORMANCE, FLOW, IMPACT, FLAME RETARDANCY, AND SUSTAINABILITY

Tariq Syed

September 31, 2025

SABIC AT A GLANCE

1976
Company established

29,000
Employees around the world

140+
Countries served

11,000+
Patents portfolio

Top 2
Chemical Brand Value*

4.9
US$ bn
Estimated Brand Value*

74.1
US$ bn
Total assets

0.6
US$ bn
Net income from continuing operations

37.7
US$ bn
Annual revenue

135
New products each year

60
Manufacturing/compounding sites worldwide

20
Technology & Innovation Centers

*Brand Finance, 2025. Rankings - SABIC Brand Space

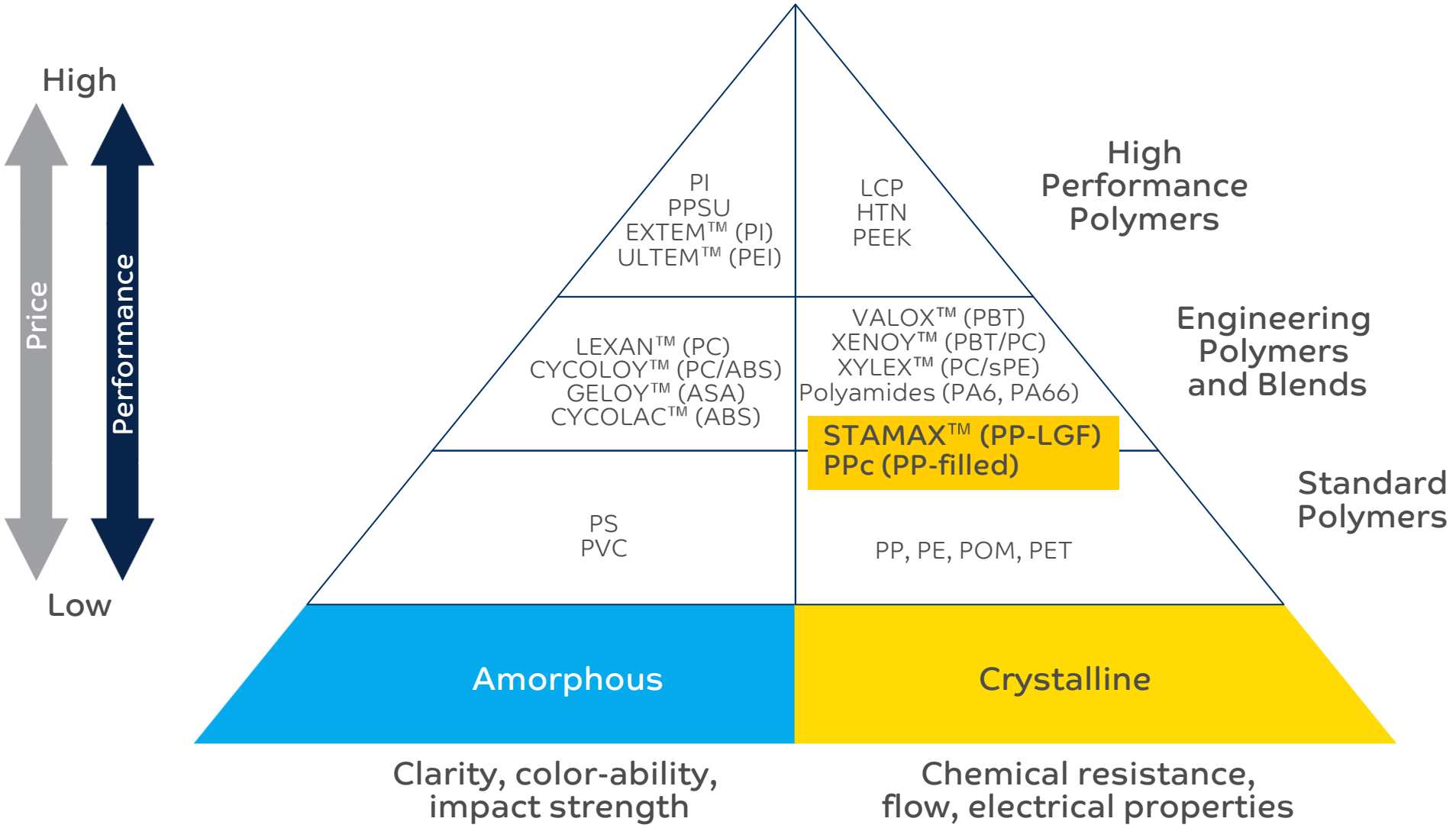
FILLERS / REINFORCEMENTS IN PLASTICS – ROLE OF GLASS FIBERS

- **FILLERS** are an **inert** materials
- Highly **cost competitive**
- **Improved properties** of neat polymers
- Fillers classified as
  - Fillers
  - Reinforcements

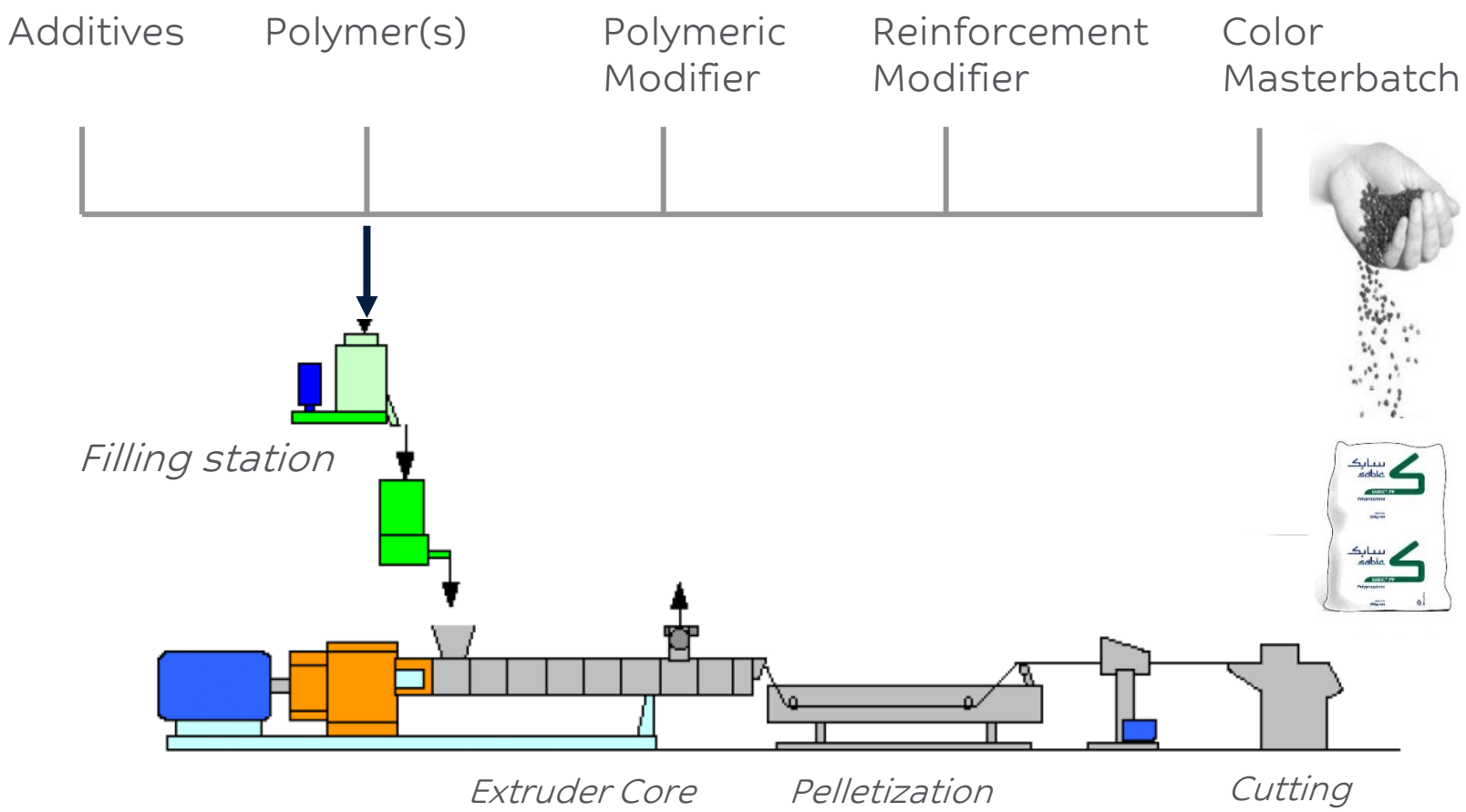
- **REINFORCEMENTS** noticeable improve tensile strength because of their **higher aspect ratio**
- Reinforcements are available in the form of **chopped or continuous, woven, or nonwoven fabrics**
- In the reinforcements class, glass fibers dominate as long glass fiber (**LGF**) and short glass fiber (**SGF**)
- One must design and mold the parts necessarily to keep **high aspect ratio, which is the primary reason of higher performance**

Fillers are used in plastics to tailor desired properties

SABIC PP COMPOUND (PPc) AND STAMAX™ RESIN IN THE POLYMER PYRAMID

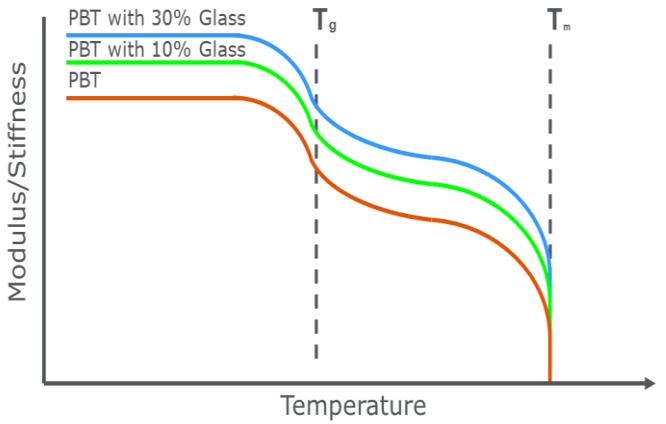


POLYMER COMPOUNDING AND REINFORCEMENT MODIFIERS



Fillers & Reinforcements:

- To improve mechanical and thermal properties
- Aspect ratio
- Glass fiber
  - Long
  - Short
  - Chemistry



%Glass & thermal events

A compound is tailored to achieve the desired properties by using the right matrix and additives

QUICK GUIDE ON GLASS FIBERS FOR POLYMERS

Glass Features:
- Glass type/composition *E, ECR, R, S…*
- Sizing/coating *on glass, Silane, Zirconium…*
- Cross section geometry *of strand*
- L/D ratio

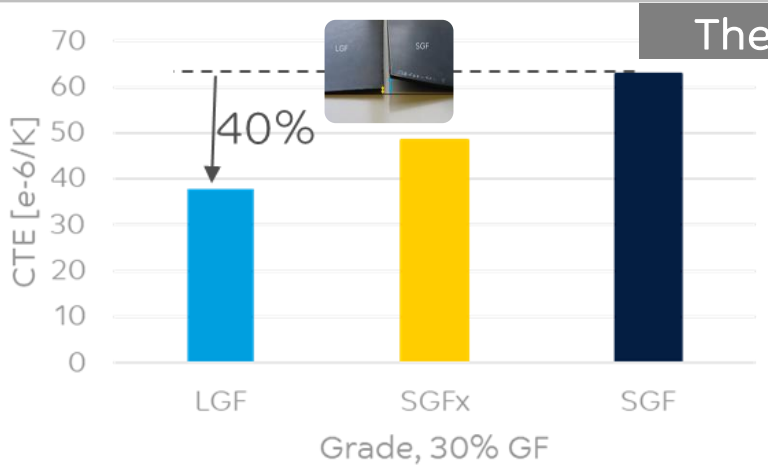
PROS:
+ Higher mechanical properties
+ Higher HDT *especially in crystalline resins*
+ Better impact *in Low Izod resins*
+ Improved FR *fire-resistant*
+ Reduced shrinkage *lower CTE*
+ Higer value vs cost
+ Good recycle/off spec resin outlet

Glass – Critical Qualities to Know:
- Loss on Ignition (LOI) *to quantify sizing*
- Moisture *drying and curing*
- Strand integrity *resistance to bundle, fuzziness*
- Filament per bundle
- Logging (appearance), fiber bundles attached to each to other
- Chop length *of short glass*
- TEX *for long glass*
- Metal content *may affect electrical properties*

CONS:
– Reduced elongation
– Alters melt flow *lower*
– Brittleness ⇑ / ductility ⇓ *in high ductile resins PC, ABS…*
– Loss of transparency
– Increased weight
– Anisotropic properties & warpage
– Surface appearance *rough/pitting…*
– Melt stability issues *if choose wrong glass, coating or pH…*

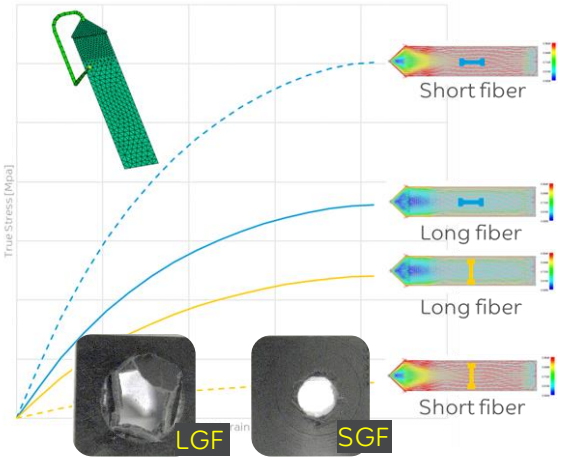
Evaluate your choice of glass, case by case

LONG VS SHORT GLASS IN COMPOSITE



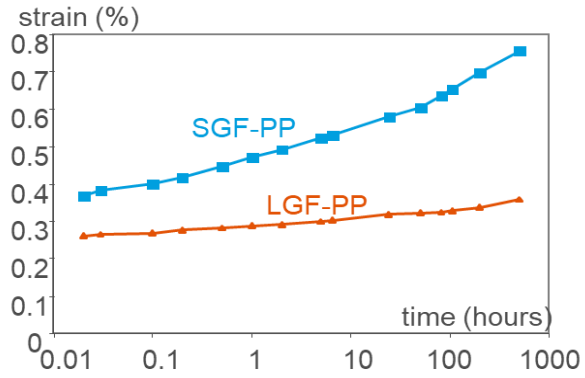
Thermal Expansion

LGF-PP enhanced ***CTE*** performance



Anisotropic Behavior

LGF-PP ***more isotropic*** behavior, enhanced X-flow properties



Creep Flow

LGF-PP enhanced ***creep*** performance

Strain @ 80°C for load of 10 MPa

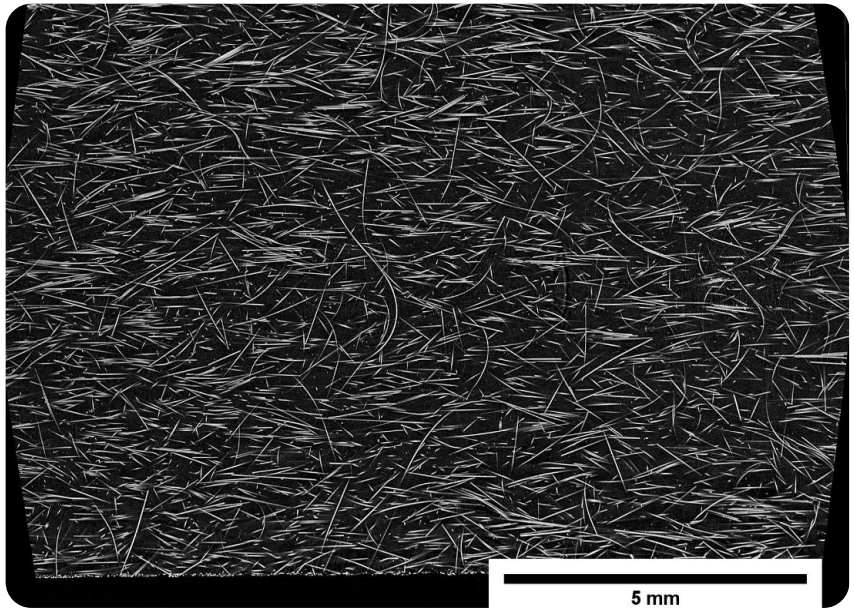
Warpage

LGF-PP enhanced ***warpage*** behavior

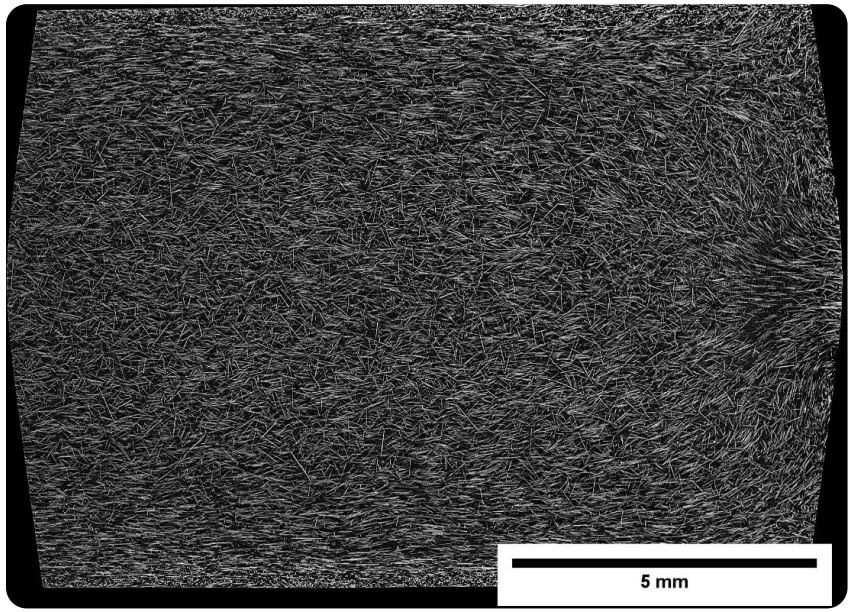
LGF-PP offers a significant boost in impact, warp, and creep

Values determined on 30% fiber filled PP

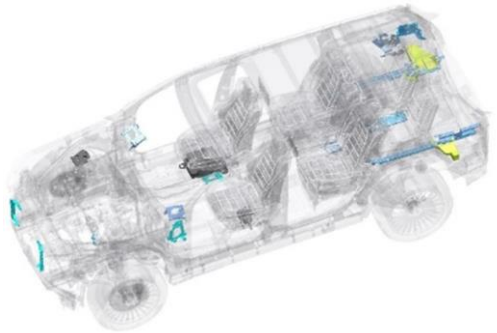
FIBER LENGTH DISTRIBUTION IN LGF & SGF MOLDED PARTS



CT Images from 30% **LGF** injection molded par

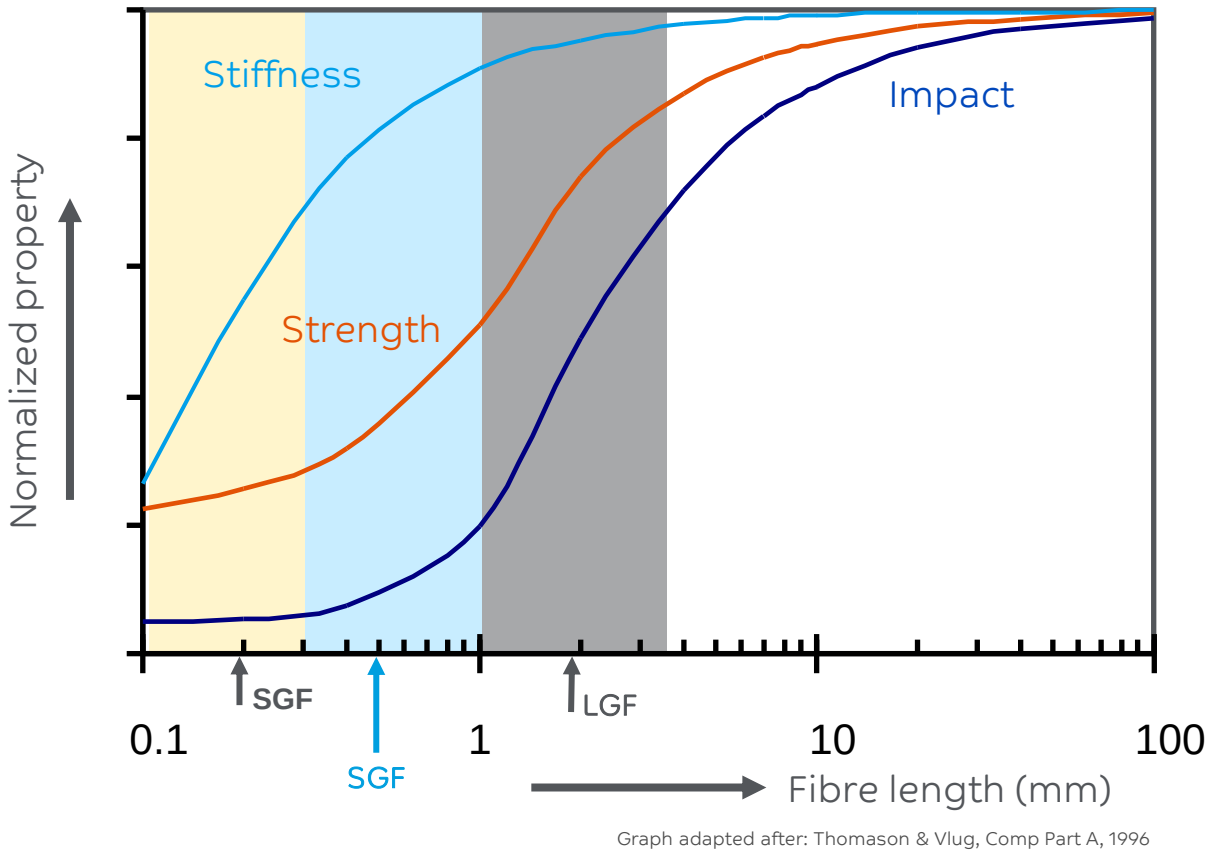


CT Images from 30% **SGF** injection molded part



The average length of LGF >>> SGF molded parts

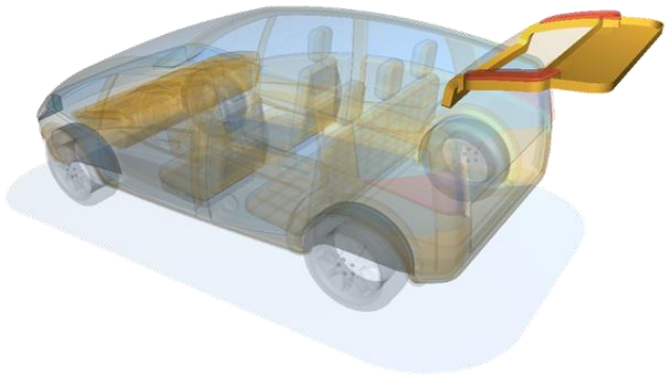
REINFORCEMENT IN MOLDED PARTS



Graph adapted after: Thomason & Vlug, Comp Part A, 1996

Contributions due to reinforcements

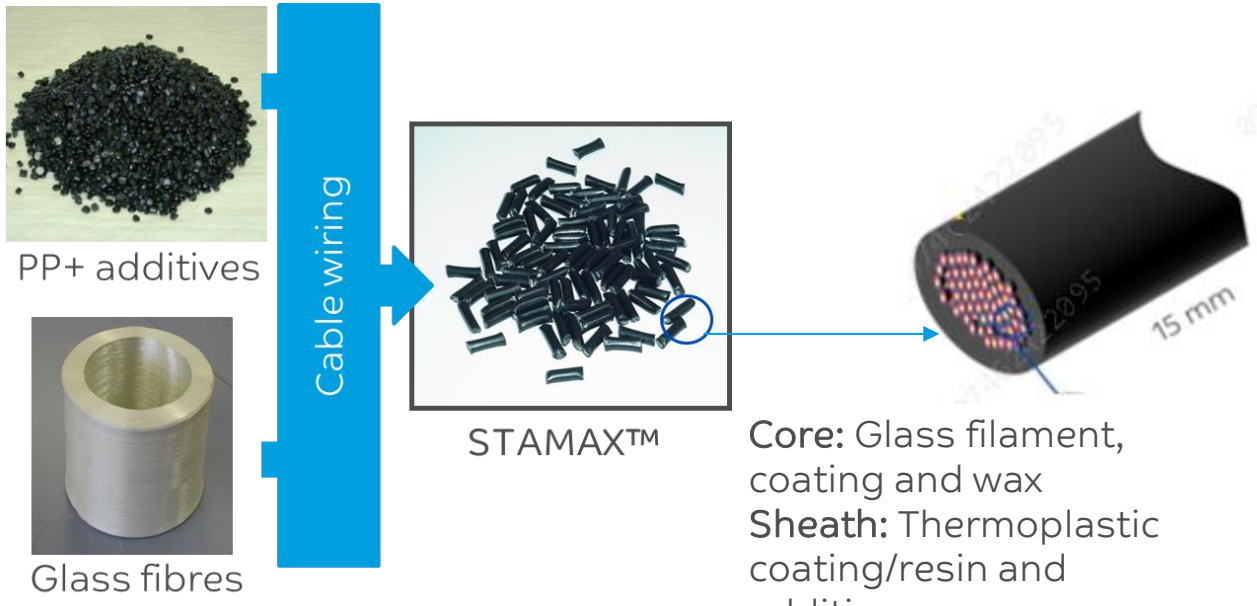
- Improved properties
- Works in existing setup and tools
- Lower cost vs specialized grades
- LGF for higher impact in PP, good creep, low warpage



Industry is always seeking higher performance from reinforcements

WHAT IS STAMAX™ RESIN?

Wire-coated PP glass fiber composite



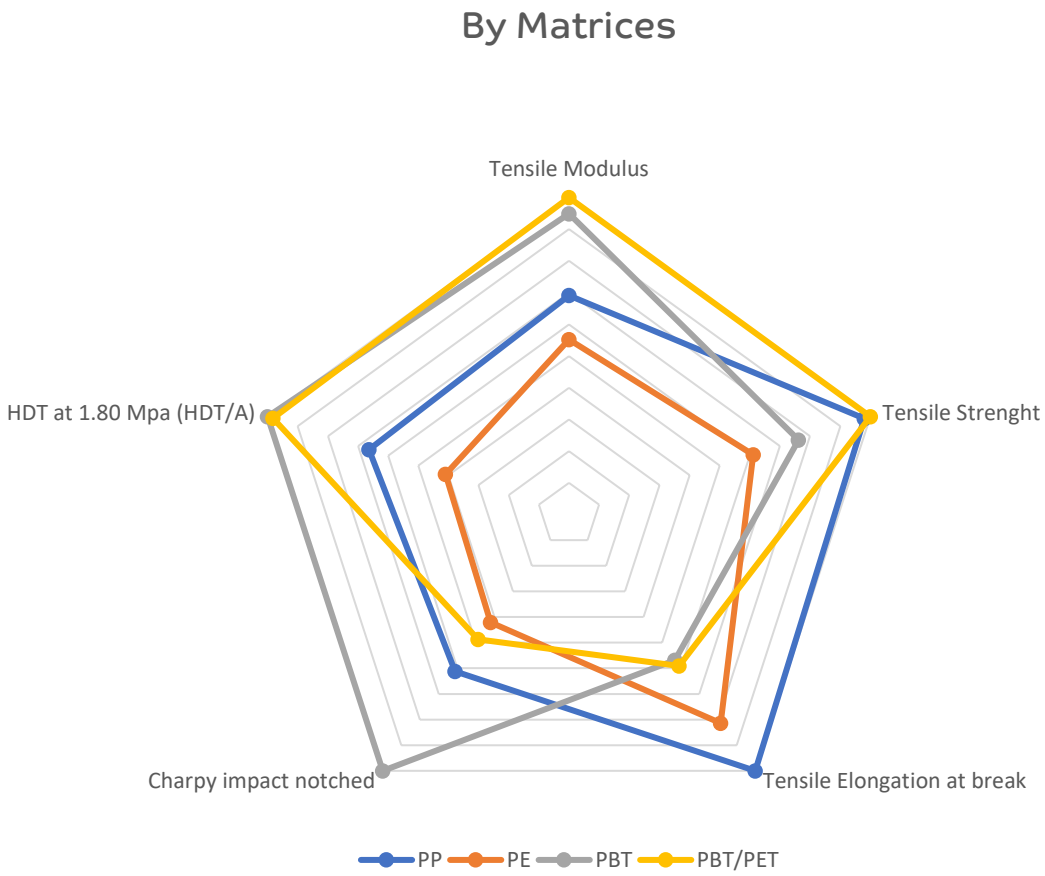
Core: Glass filament, coating and wax
Sheath: Thermoplastic coating/resin and additives

Long fibers provide

- Excellent stiffness and strength
- Excellent Impact resistance over a broad temperature range
- Dimensional stability (comp. low warpage)
- Weight reduction
- **Cost savings due to innovative wire-coating process vs other processes**

A drop-in solution, enabling weight and cost savings

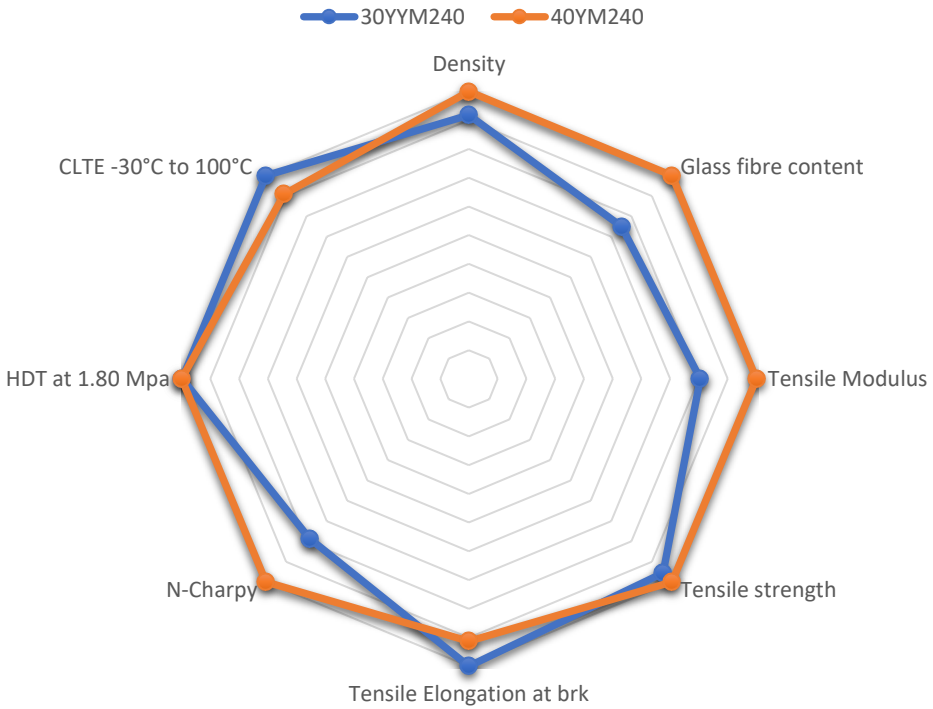
STAMAX™ RESIN AND POLYMER MATRICES



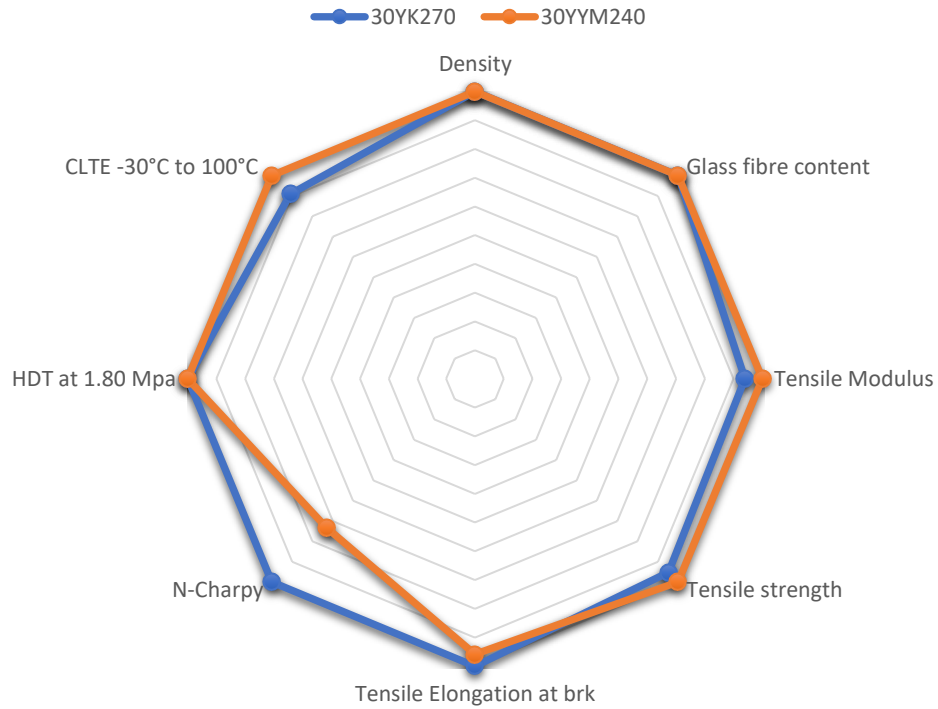
Long glass composites can be tailored to achieve desired properties

TYPICAL PP-BASED PROPERTIES – STAMAX™ RESIN

By % Glass Loading



By Matrix Type



TAILGATES

The industry can benefit from value chain players with significant expertise – to develop fully functional parts

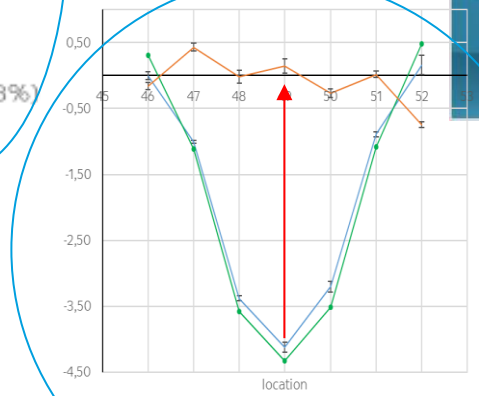
SABIC SUPPORT: FOR PLASTIC TAILGATES – VALUE PROPOSITION

Potential for weight savings

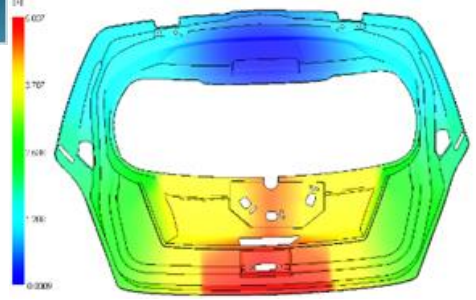
	Concept	Thickness	Structural design	Mass
Steel		1.0 mm	Tailored blanks (2.5 mm)	12.7 kg
SMC		2.5 mm	Limited ribbing	9.0 kg (-29%)
Composite hybrid		1.5-4 mm	Effective ribbing	7.9 kg (-38%)

In house simulation tools developed for faster time to market with more efficient warpage optimization

Design freedom… part integration… cost-efficient design… system tooling cost reduction



Warpage Counter Correction



SABIC technical support is available for challenging design and application needs

IMPROVED AESTHETICS – SABIC SOLUTION

Aesthetic STAMAX™ resin grade developed via SABIC wire-coating process to address new applications trend

Excellent aesthetics without compromising properties – STAMAX 40YM240 resin series

Tailgates in global production

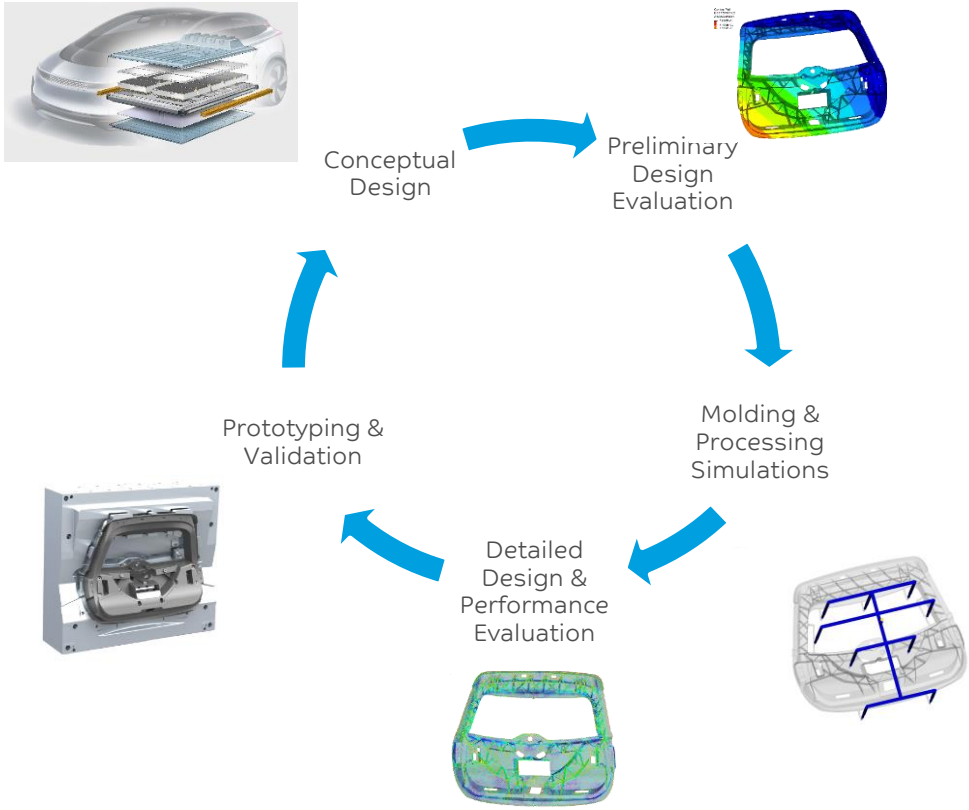
Improved interior aesthetics via the wire-coating process

IMPROVED AESTHETICS

New trend towards **lower cost and weight**, led to the **integration of structural parts** with interior surfaces

CTQ Requirements:

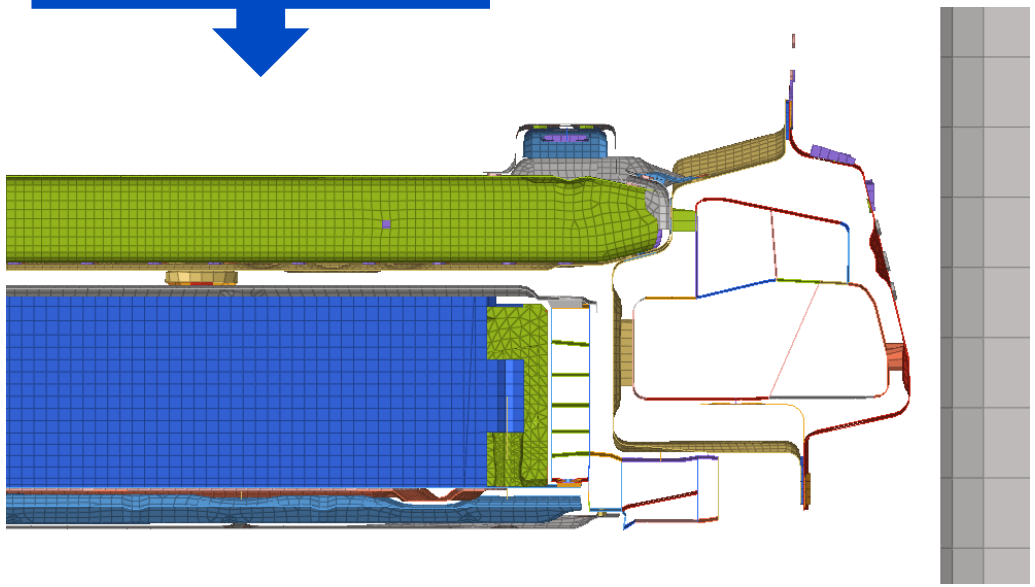
- Stiffness/strength
- Robust/slam/impact
- Gap and flushness
- Dimensional stability at temp
- Class A surface
- Weight / cost balance



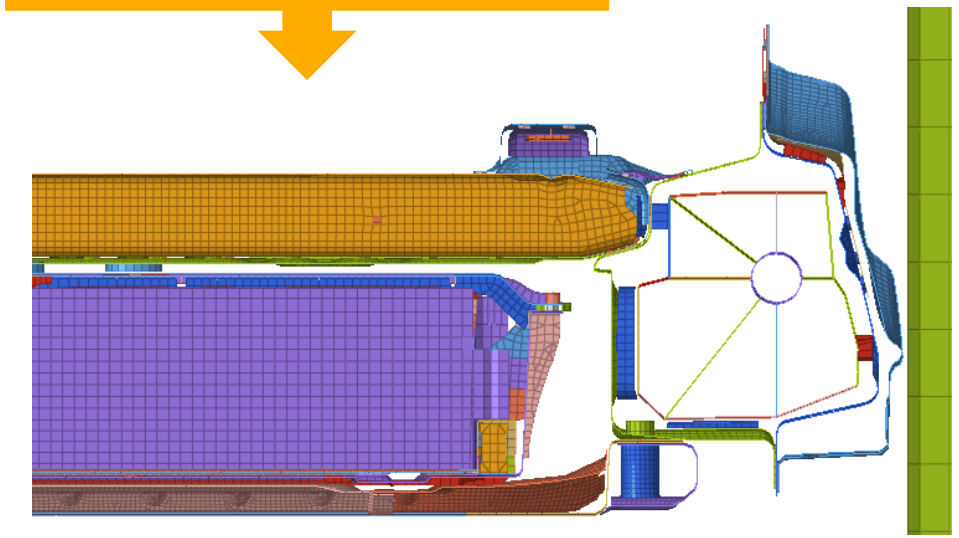
Lower system cost and lightweighting require improved aesthetic solutions

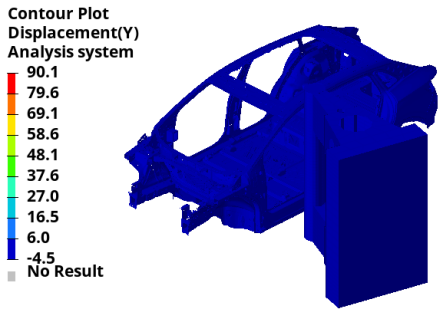
SABIC SUPPORT: SOLUTIONS FOR STRUCTURAL COMPONENTS

Initial design by customer



Final design w/ SABIC support



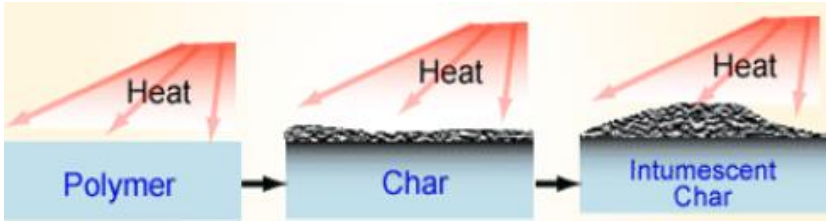


SABIC technical support available for challenging design and application needs

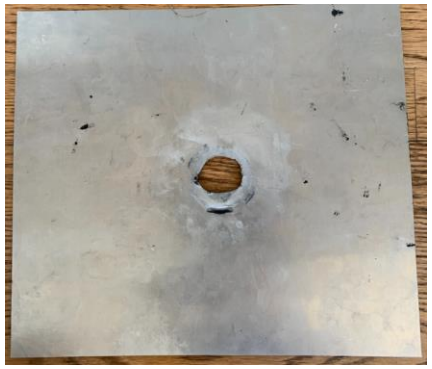
FIRE PERFORMANCE – REDUCED SCALE FIRE TEST

Use of flame retardant non-halogenated structural thermoplastics

Final 20 seconds of 5.5-minute test @ 1100°C

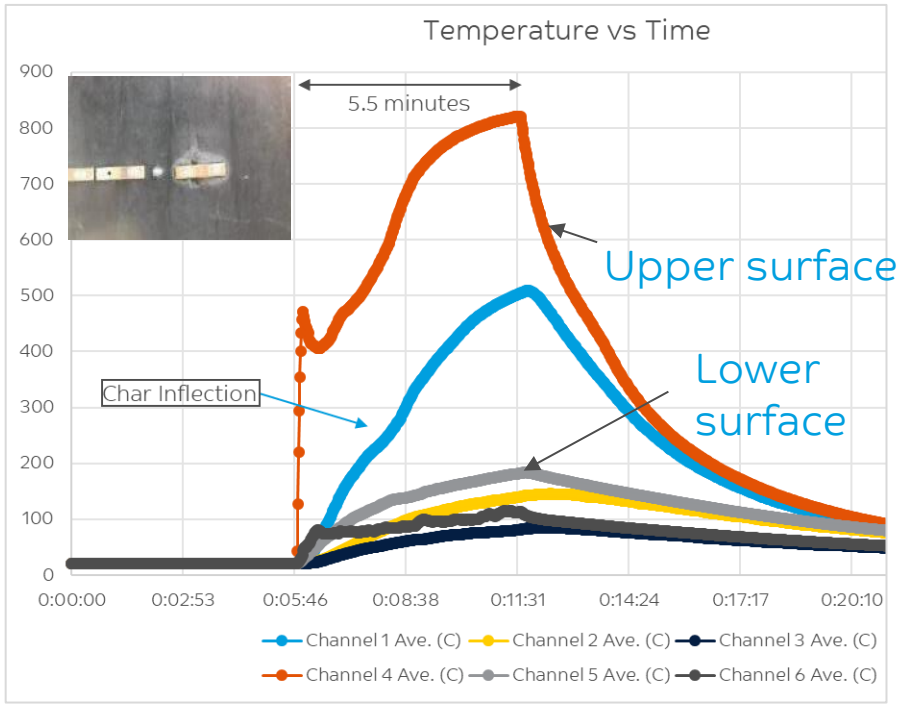


Aluminum sheet



Plastic sample

Non exposed side < 200°C



Innovative material solution – meets challenging requirements

SOLUTIONS WITH CUSTOMERS ACROSS THE GLOBE

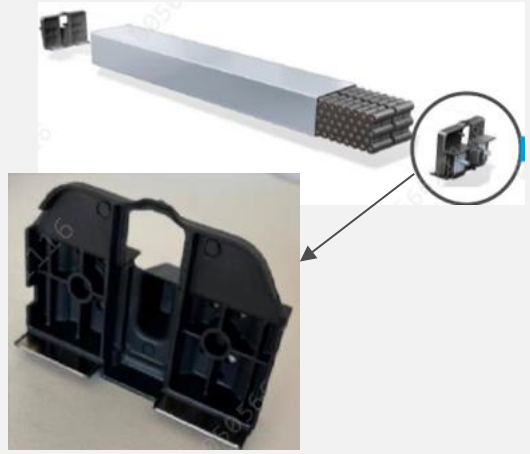
HONDA pHEV-CRV BATTERY COVER

- **Non-halogenated** FR PP solution
- **Enhanced fire safety**
- **40% lighter** vs metal

JAGUAR LANDROVER BATTERY END PLATE

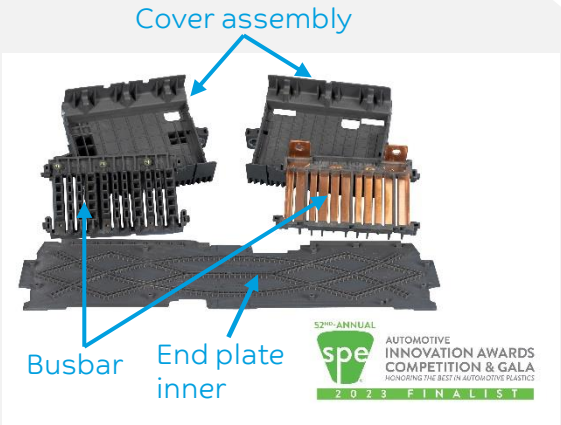
- **Enhanced fire performance vs Al**
- **10% weight saving vs Al**
- **10% cost saving vs Al**

SPE AUTOMOTIVE INNOVATION AWARDS COMPETITION & GALA 2023 FINALIST



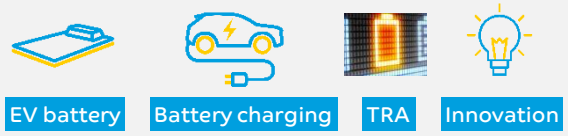
HYUNDAI IONIQ6 BEV BATTERY MODULE

- **Enhanced fire safety**
- **20% cost saving** vs incumbent FR PA (Nylon)
- **10% weight reduction** vs FR PA (Nylon) solution



NEXT → THERMAL RUNAWAY BARRIER SOLUTION

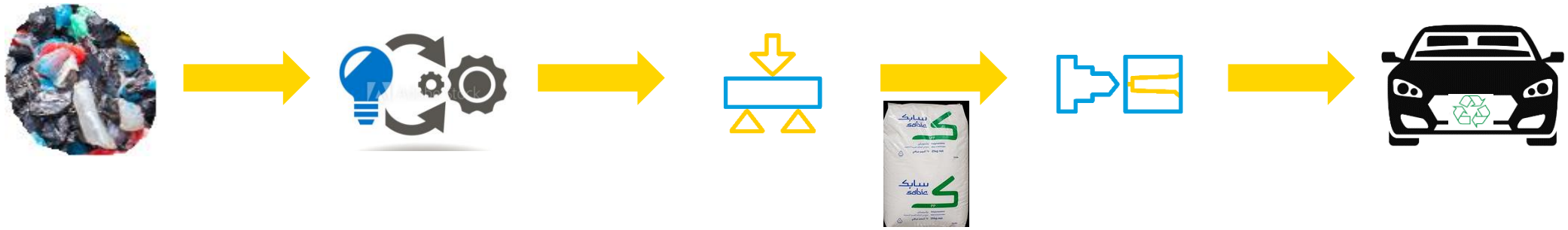
- **Enhanced fire safety** Prevents fire propagation
- **Up to 50% cost saving** vs incumbent Aerogel / mica
- **Electrical isolation** vs metals



TRA barriers

Prevents fire propagation from cell to cell, serving as an anti-fire and heat propagation wall

COMPOSITES GRADES FOR PP-LGF – TRUCIRCLE™



GRADE	DESCRIPTION
T2A40YR240	40% Filled, 25% MR content
T2A30YR270	30% Filled, 25% MR content

- PP grades with recycle content developed to bolster global sustainability endeavors
- This remarkable accomplishment was the result of extensive efforts in sourcing, screening, and optimization at every step

These grades epitomize a significant step forward in sustainable engineering

SUMMARY OF BENEFITS FROM PP-REINFORCED COMPOSITES

OPPORTUNITY FOR WEIGHT REDUCTION

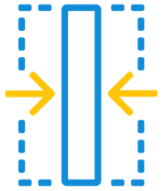
- Through low density (compared to other resins)

POTENTIAL SYSTEM COST SAVINGS

- Ease of processing & lightweighting
- Diverse product portfolio

MECHANICAL PERFORMANCE

- Potentially allows wider “design window” opportunities



LOWER WALL THICKNESS

- Potential to build slender design

HIGH STIFFNESS/HIGH FLOW

- Best in class in the market providing high design freedom

HUMIDITY RESISTANCE

- No pre-drying, no conditioning necessary with some matrices

All the above are significant advantages of plastic-reinforced composites


سابك
sabic
THAT MATTERS
THANK YOU

DISCLAIMER

THE MATERIALS, PRODUCTS AND SERVICES OF SABIC OR ITS SUBSIDIARIES OR AFFILIATES ("SELLER") ARE SOLD SUBJECT TO SELLER'S STANDARD CONDITIONS OF SALE, WHICH ARE AVAILABLE UPON REQUEST. INFORMATION AND RECOMMENDATIONS CONTAINED IN THIS DOCUMENT ARE GIVEN IN GOOD FAITH. HOWEVER, SELLER MAKES NO EXPRESS OR IMPLIED REPRESENTATION, WARRANTY OR GUARANTEE (I) THAT ANY RESULTS DESCRIBED IN THIS DOCUMENT WILL BE OBTAINED UNDER END-USE CONDITIONS, OR (II) AS TO THE EFFECTIVENESS OR SAFETY OF ANY DESIGN OR APPLICATION INCORPORATING SELLER'S MATERIALS, PRODUCTS, SERVICES OR RECOMMENDATIONS. UNLESS OTHERWISE PROVIDED IN SELLER'S STANDARD CONDITIONS OF SALE, SELLER SHALL NOT BE RESPONSIBLE FOR ANY LOSS RESULTING FROM ANY USE OF ITS MATERIALS, PRODUCTS, SERVICES OR RECOMMENDATIONS DESCRIBED IN THIS DOCUMENT. Each user is responsible for making its own determination as to the suitability of Seller's materials, products, services or recommendations for the user's particular use through appropriate end-use and other testing and analysis. Nothing in any document or oral statement shall be deemed to alter or waive any provision of Seller's Standard Conditions of Sale or this Disclaimer, unless it is specifically agreed to in a writing signed by Seller. Statements by Seller concerning a possible use of any material, product, service or design do not, are not intended to, and should not be construed to grant any license under any patent or other intellectual property right of Seller or as a recommendation for the use of any material, product, service or design in a manner that infringes any patent or other intellectual property right.