• What is LFT? → Introduction to LFT
• Why LFT? → Excellent mechanicals for structural applications
• LFT processing technologies
• LFT applications
• LFT – future Trends – Opportunities
• LFT Molding Guidelines
Glass fiber orientation

LFTPs

Material Evolution

Short Fiber Granule
Fiber Length = 0.2 – 0.4 mm

Wire-Coated or Co-Mingled Fibers

Fully Impregnated Long Fiber Granule
Fiber Length = 11 mm
**COMPOSITE SOLUTIONS**

Long Glass Fibers v/s Short Glass Fibers

Comparison

LFT Technology Boosts Material Property Profile: Impact, Creep, Short- & Long-term Heat Resistance
Why is LFRT growing quite rapidly?

- Advantages vs. short fiber
  - Significant lower warpage vs short glass fibers
  - Much lower CTEs and higher isotropy than short glass fibers
  - Improved impact performance (especially Low temp.)
  - Improved creep resistance (better than PA SGF)
  - Improved long and short term heat resistance

- Advantages vs. metal
  - Lower weight
  - Parts consolidation leading to lower cost
<table>
<thead>
<tr>
<th>Testing Items</th>
<th>Unit</th>
<th>Testing Standard</th>
<th>40% CS-PP</th>
<th>40% LFT-PP (Internal)</th>
<th>STAMAX 40YM240</th>
<th>Celstran PP-GF40-02</th>
<th>OCMAX 4010HU-BH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>ISO 1183</td>
<td>1.22</td>
<td>1.22</td>
<td>1.22</td>
<td>1.21</td>
<td>1.21</td>
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<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td>ISO 527</td>
<td>100</td>
<td>105</td>
<td>121</td>
<td>117</td>
<td>119</td>
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<tr>
<td>Flexural strength</td>
<td>MPa</td>
<td>ISO 178</td>
<td>161</td>
<td>142</td>
<td>184</td>
<td>180</td>
<td>196</td>
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<tr>
<td>Flexural modulus</td>
<td>MPa</td>
<td>ISO 178</td>
<td>7830</td>
<td>7760</td>
<td>7850</td>
<td>8060</td>
<td>8160</td>
</tr>
<tr>
<td>Impact strength</td>
<td>kJ/m²</td>
<td>ISO 179/1e</td>
<td>14.6</td>
<td>16.3</td>
<td>22</td>
<td>23</td>
<td>24.5</td>
</tr>
</tbody>
</table>

Note: StaMax™ is the trademark of Sabic Petrochemicals
Celstran™ is the trademark of Ticona Engineering Polymers
DMA - Flex Modulus

Temperature (°C)

Flexural Modulus (Pa)

PP LF 30 % Polo FEM
PP LFT
30% PBT
33% PA6
30% PET
45% PET

Area of Interest
**Creep at 80°C, 5 MPa**

**Elongation (%)**

- **PP 30% SGF**
- **PA 30% SGF**
- **PP LFT 30% LGF**

**Note:** Specimen taken from injection molded Front End Module

**Log Time (sec.)**

- 0
- 2
- 4
- 6
- 8
Short Fiber Compounding

Long Fiber Thermoplastics granulate (LFT-G)
- Wire coating (StaMax™, RheMax™)
- Long Fiber Pultrusion (Celstran™)

Direct Long Fiber Thermoplastics (D-LFT)
- Extrusion Compression Molding (ECM)
- Direct Injection Molding (DIM)

Note: StaMax™ and RheMax™ are the trademarks of Sabic Petrochemicals
Celstran™ is the trademark of Ticona Engineering Polymers
Advantages: Fast and inexpensive
Disadvantages: Sub-optimal quality composites

3~4mm pellet length
0.25 – 0.5 mm GF length
Advantage: High quality composites
Limitation: Slower process
Direct LFTP Processes

### Extrusion Compression

- Large Parts
- Thin Walls
- Easy Insertion of Hybrid Materials

### Injection Moulding

- Small, Medium, Large Size Parts
- High Part Complexity & Integration
- No Post-Processing

**Advantages:** High quality composites and lower cost

**Disadvantages:** Capital investment and process complexity
Process Lay-Out (Dieffenbacher)
KraussMaffei Principle

PlastiComp Principle

Polymer

Tool in Press

Glass Fibers (T30)

Compounding

Polymer

Tool in Press

Glass Fibers (T30)

Compounding & In-Line Chopper

Standard Inj.M. Equipment
Pellet Processing & Performance – PP LFT

- Simple / flexible process
- Global available process
- Standard equipment
- Best reproducibility
- Max. use of anisotropy

(Regrind)

PP LFT Concentrates 70%

Gravimetrically dosing
Mixing
Gravimetrically dosing

Hot runner design for LGF

Screw / standard or throughput optimised
LFT Automotive Applications

LFTP Advantages vs. Metal & SMC

- Cost Reduction
- Weight Reduction
- Design Freedom
- Function Integration (Easy Assembling)
- Sound Absorption
- Crash Resistance
- Corrosion Resistance
- Recyclability

LFTP Has a Fit in Replacing Assemblies (Part Integration), Parts with Complex Post Finishing and requiring Semi-Structural Performance

PP (D)LFT Typical Applications

- Modular Front Ends
- Underbody Shields
- IP Retainers & Center Stacks
- Seat Components
- Door Modules
- Load Floor
- Clutch Pedal, Cooling Fans, Brackets…

PA-LFT Under the Hood Metal Replacement

- LF-PA & LF-PBT Under the hood
- Pump Housings
- Impellers
- Gear Housing
- Oil Management Systems
- Radiator End-caps
- Mirror Brackets
- Oil Sumps
Commercial Applications Long Fiber Thermoplastic PP

Front End Module
PP LGF – 61 %

Door module
PP LGF 45 %

Torque converter bracket
PP LGF 40 %

Step of truck
PP LGF ~40 %
Typical Metal Replacement Examples

- Instrument Panel Carrier
- Door Modules
- Sun Roof Guide
- Gear Shift Bracket
- Lift Gate
- Seat Structure
- Battery Tray
- Fuel Rail
- Front-End Module
- Bumper Beam
- Noise Shield
- Under Body Panel
- Sill Finisher & Running Boards (US)
- Spare Wheel Well
Tooling Considerations

- Full round runners with a diameter of 0.25 in (5.56 mm) are preferred.
- Runners should have no sharp corners.
- Minimum gate thickness of 0.080 in (2 mm).
- Sprue as short as possible, with initial diameter of 0.25 in (5.56 mm), tapered to 11/32 in (8.73 mm).
- Open channel type hot runner systems are acceptable.
- Use same materials for molds as for other reinforced materials.

Processing Considerations

- Feed throat from hopper to machine must have sufficient opening to prevent bridging of long pellet composition.
- Reverse barrel profile to 'pre-soak' or 'soften fibers'.
- Minimum back pressure should be used, typically 0.17-0.34 MPa.
Thank you.

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