



INNOVATIONS FOR LIVING™

COMPOSITE SOLUTIONS

LongFiber ThermoPlastics Amol Mangalmurti

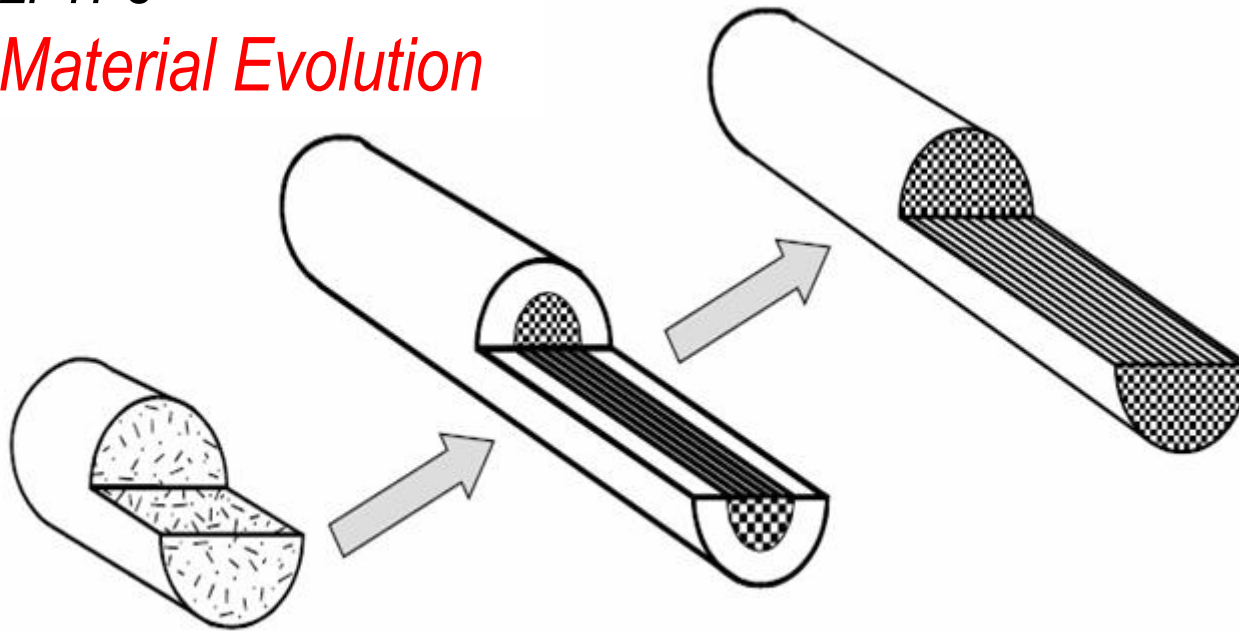
NCRAC Hyderabad June 16th 2012



- 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

LFTPs

Material Evolution



Short Fiber Granule
Fiber Length = 0.2 – 0.4 mm

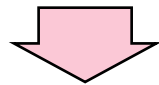
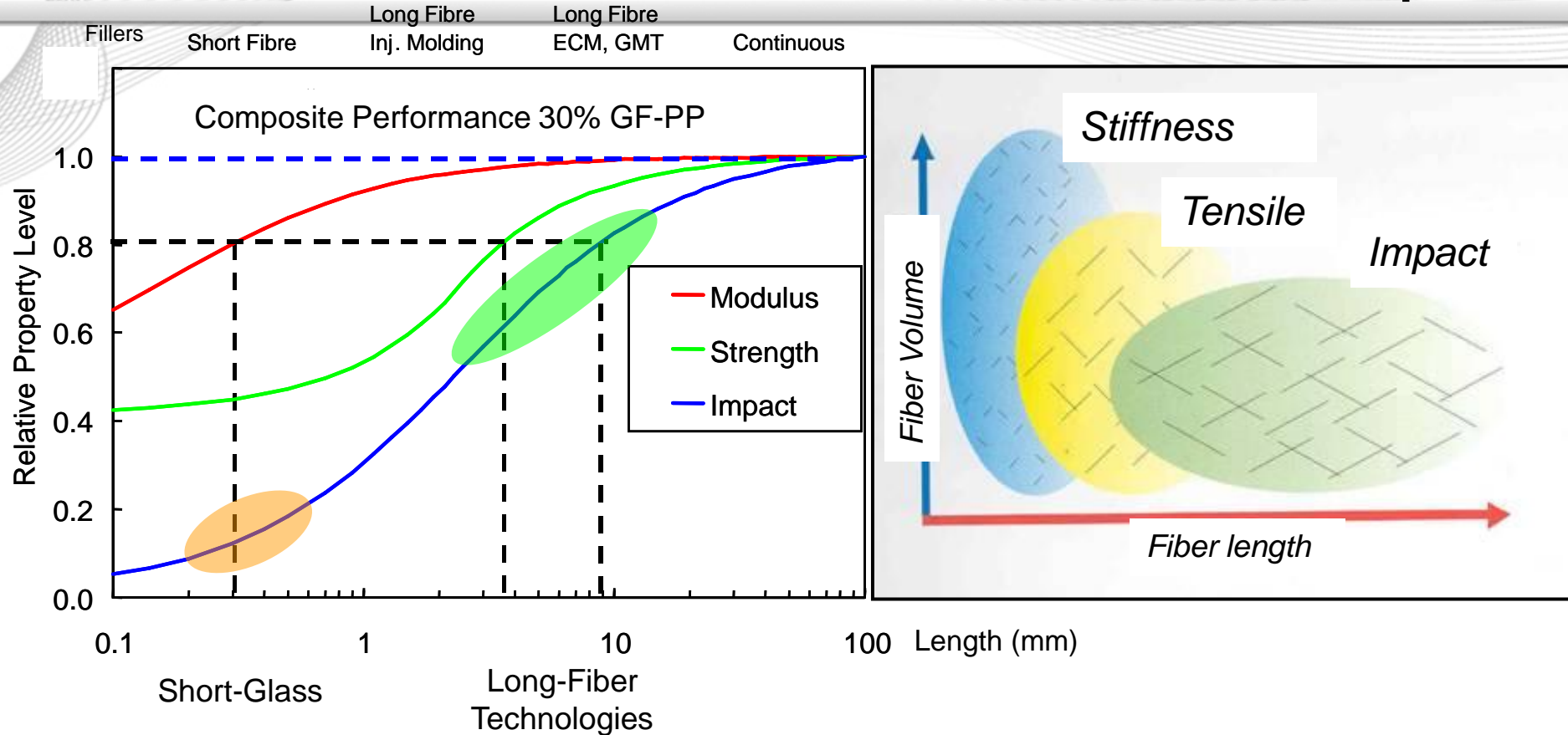
Wire-Coated or
Co-Mingled Fibers

Fully Impregnated
Long Fiber Granule
Fiber Length = 11 mm



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COMPOSITE SOLUTIONS Long Glass Fibers v/s Short Glass Fibers Comparison



LFT Technology Boosts Material Property Profile :
Impact, Creep, Short- & Long-term Heat Resistance



- 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





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Polypropylene / Glass Composites

Testing Items	Unit	Testing Standard	40%CS-PP	40%LFT-PP(<i>internal</i>)	STAMAX 40YM240	Celstran PP-GF40-02	OCMAX 4010HU-BH
Density	g/cm ³	ISO1183	1.22	1.22	1.22	1.21	1.21
Tensile strength	MPa	ISO527	100	105	121	117	119
Flexural strength	MPa	ISO178	161	142	184	180	196
Flexural modulus	MPa	ISO178	7830	7760	7850	8060	8160
Impact strength	kJ/m ²	ISO179/1e A	14.6	16.3	22	23	24.5

Note: StaMax™ is the trademark of Sabic Petrochemicals

Celstran™ is the trademark of Ticona Engineering Polymers

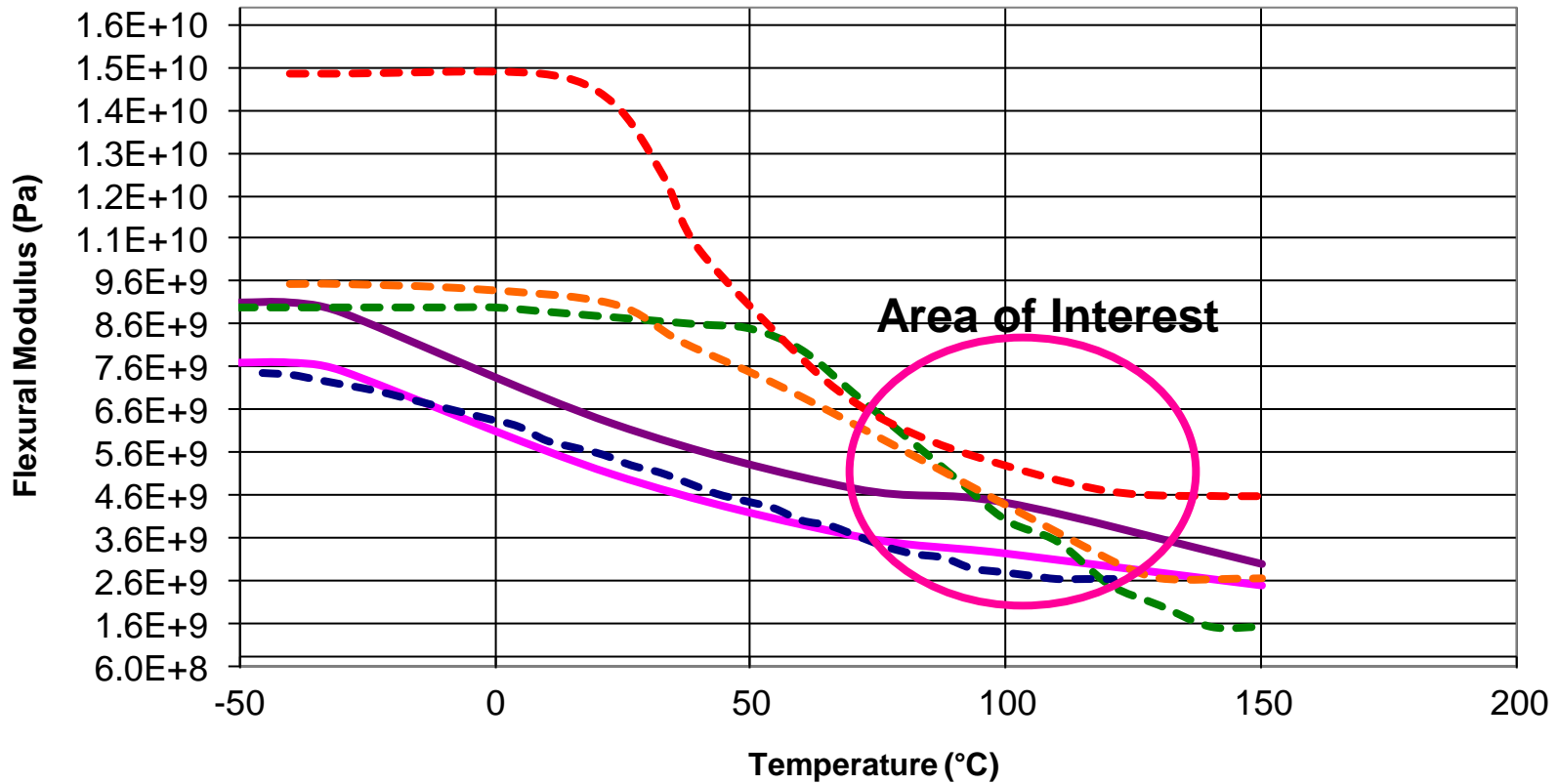


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DMA - Bending for PP LFT/ 30% & 40% LGF

DMA - Flex Modulus

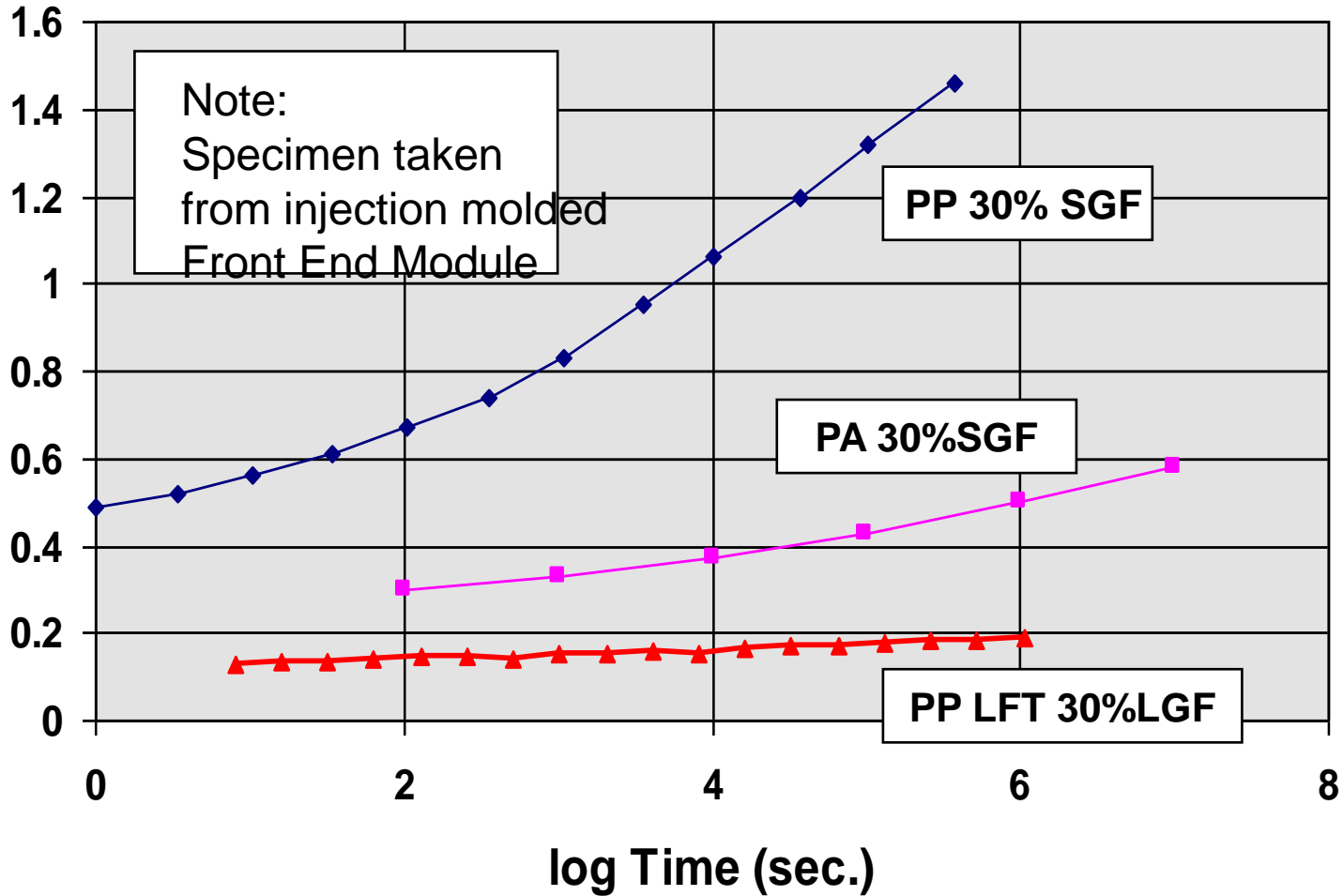


PP LF 30 % Polo FEM PP LFT 30% PBT 33% PA6 30% PET 45% PET



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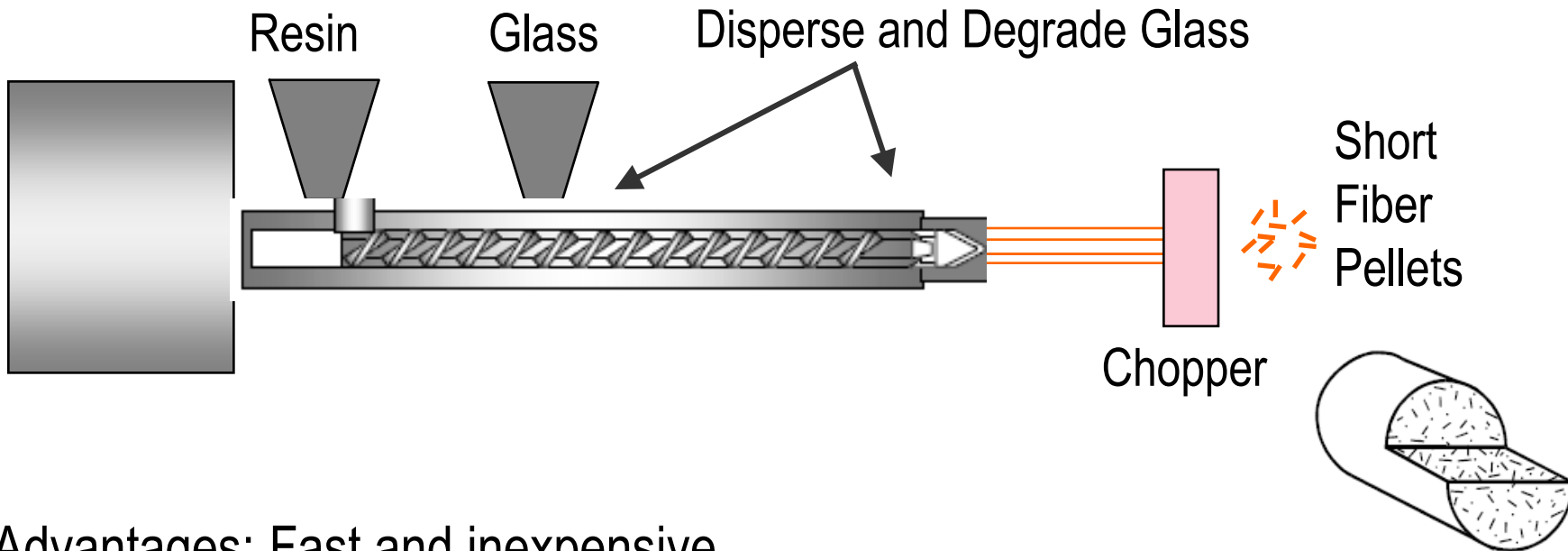
Elongation (%)





- 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
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Advantages: Fast and inexpensive

Disadvantages: Sub-optimal quality composites

3~4mm pellet length
0.25 – 0.5 mm GF length

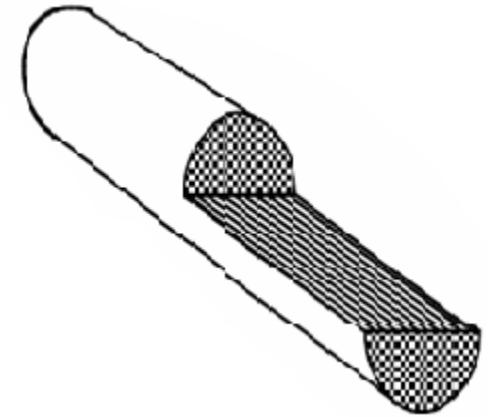
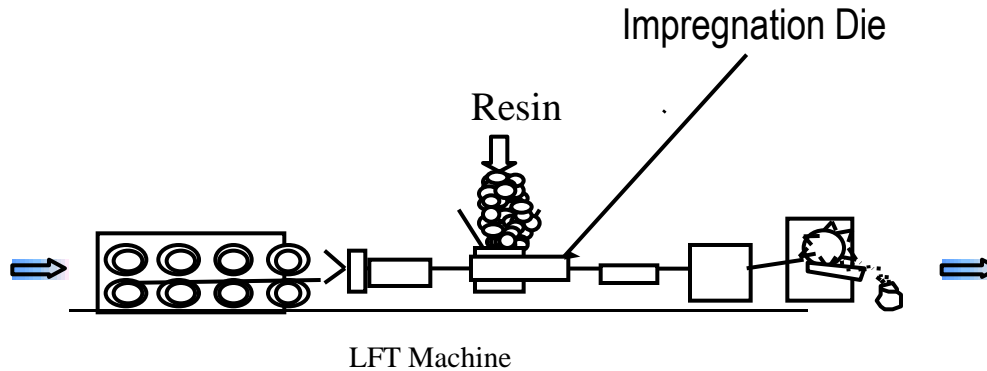


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Advantage: High quality composites
Limitation: Slower process



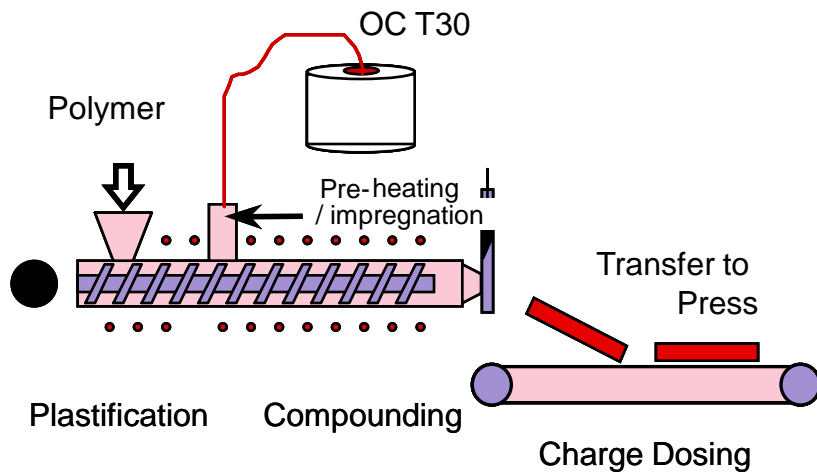
Direct Roving(T30)



LFT-PP

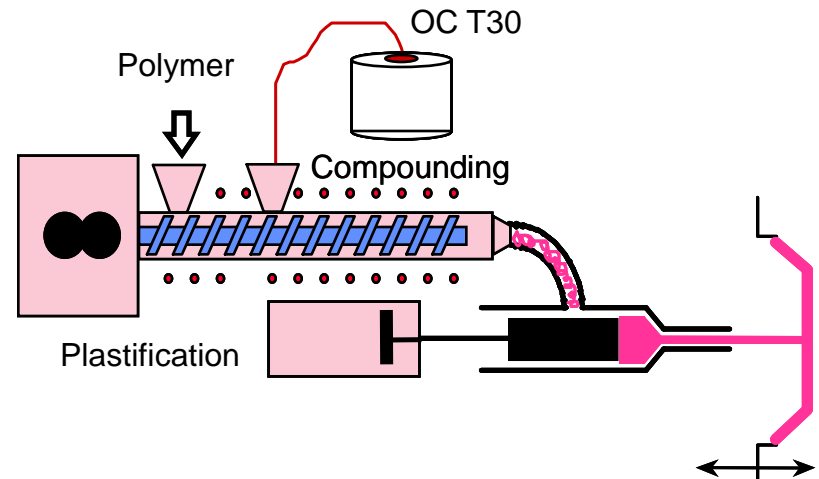
Long Fiber Pellets (8~12mm)

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

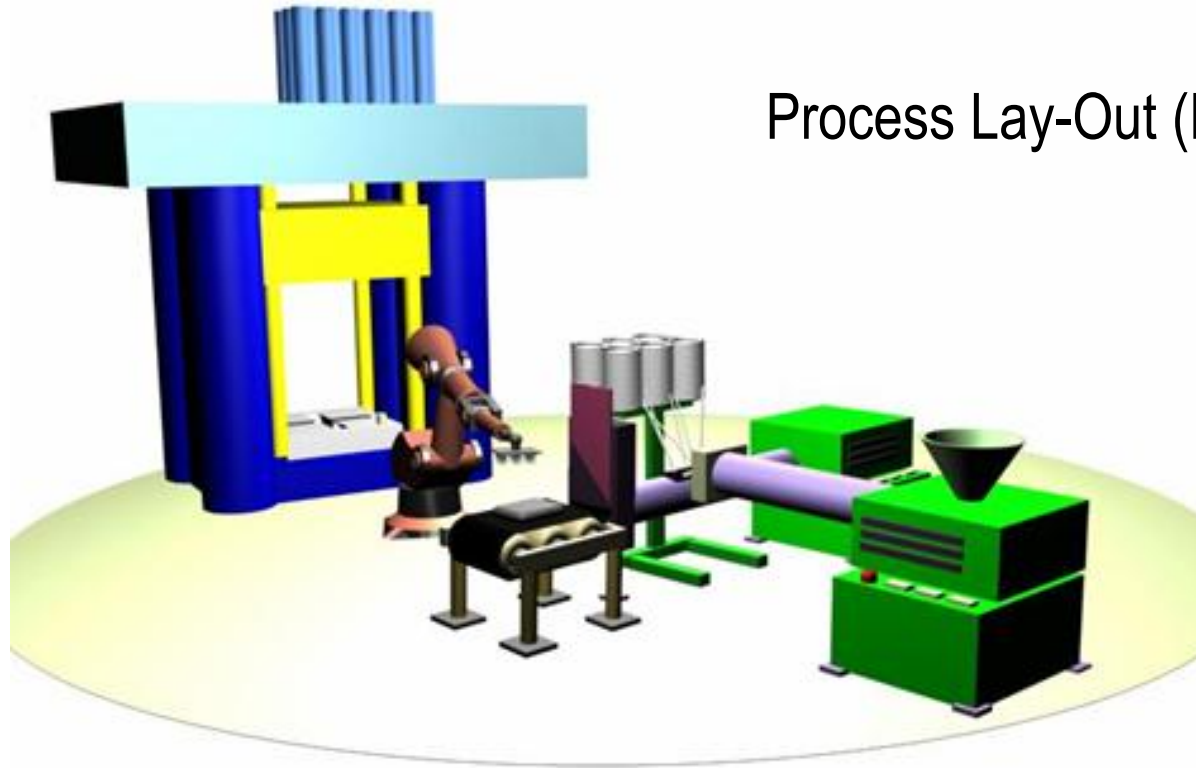


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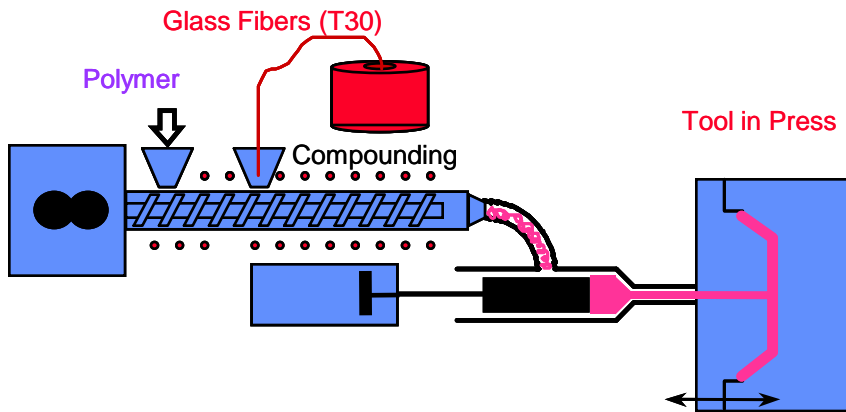
D-LFTP

Extrusion Compression Molding (ECM)

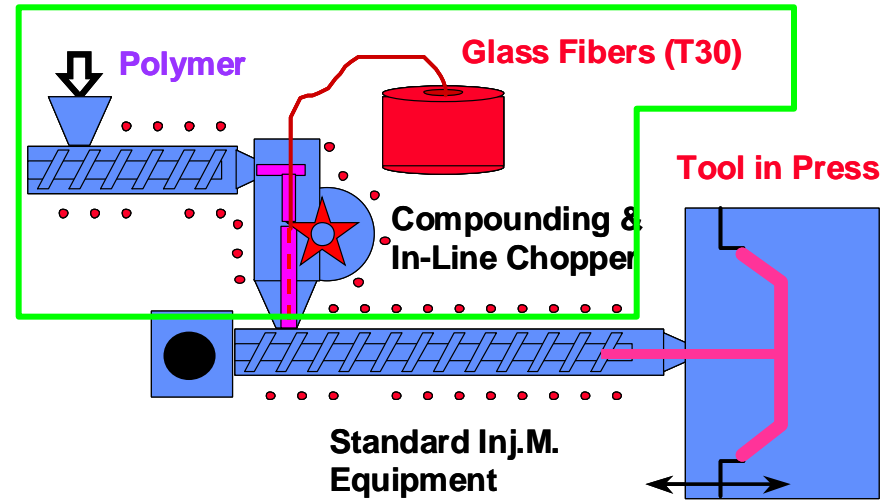


Process Lay-Out (Dieffenbacher)

KraussMaffei Principle



PlastiComp Principle



(Regrind)

PP LFT Concentrates 70%

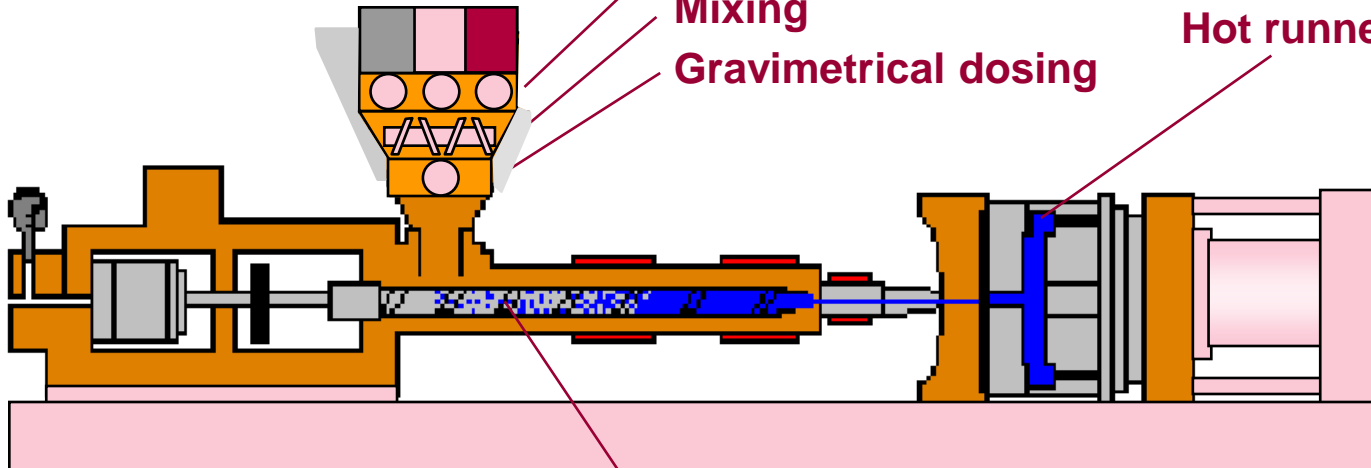
PP

Gravimetric dosing
Mixing
Gravimetric dosing

Hot runner design for LGF

Screw / standard or throughput optimised

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





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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



PA-LFT Under the Hood Metal Replacement

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....

- LF-PA & LF-PBT Under the hood
- Pump Housings
- Impellers
- Gear Housing
- Oil Management Systems
- Radiator End-caps
- Mirror Brackets
- Oil Sumps



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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 %



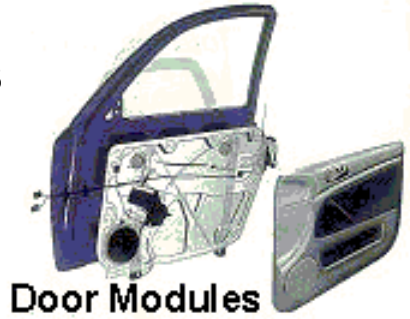
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LFTP Automotive Applications

Typical Metal Replacement Examples

Instrument Panel Carrier



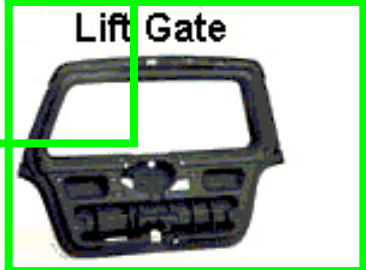
Door Modules



Sun Roof Guide



Gear Shift Bracket



Lift Gate



Seat Structure

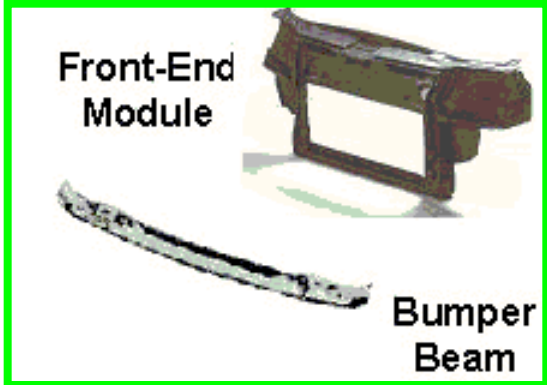


Battery Tray

Fuel Rail



Sill Finisher & Running Boards (US)



Front-End Module

Bumper Beam



Noise Shield



Under Body Panel



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



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Thank you.

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