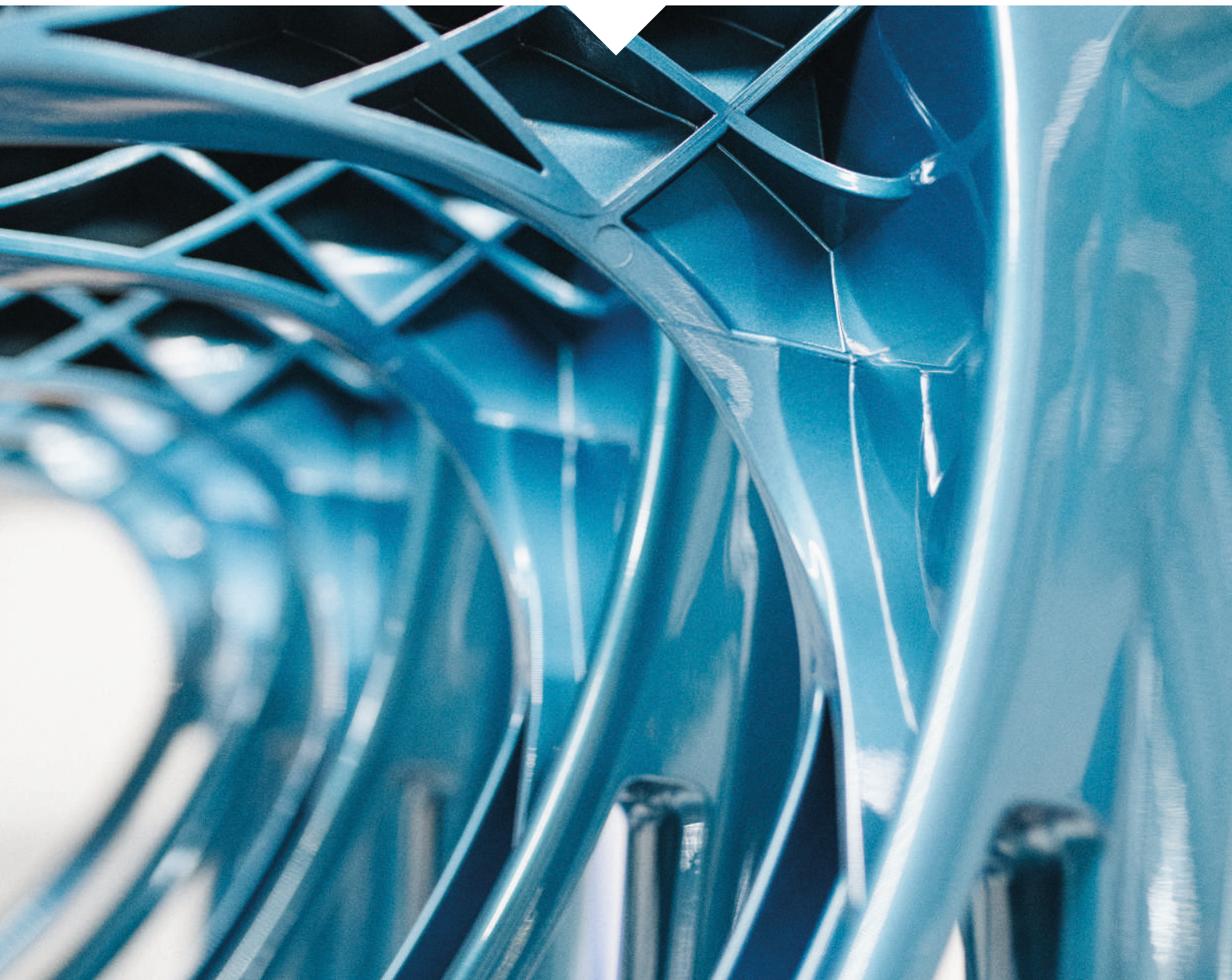




Progress beyond

Xencor™

Long Fiber Thermoplastics



Solvay Specialty Polymers

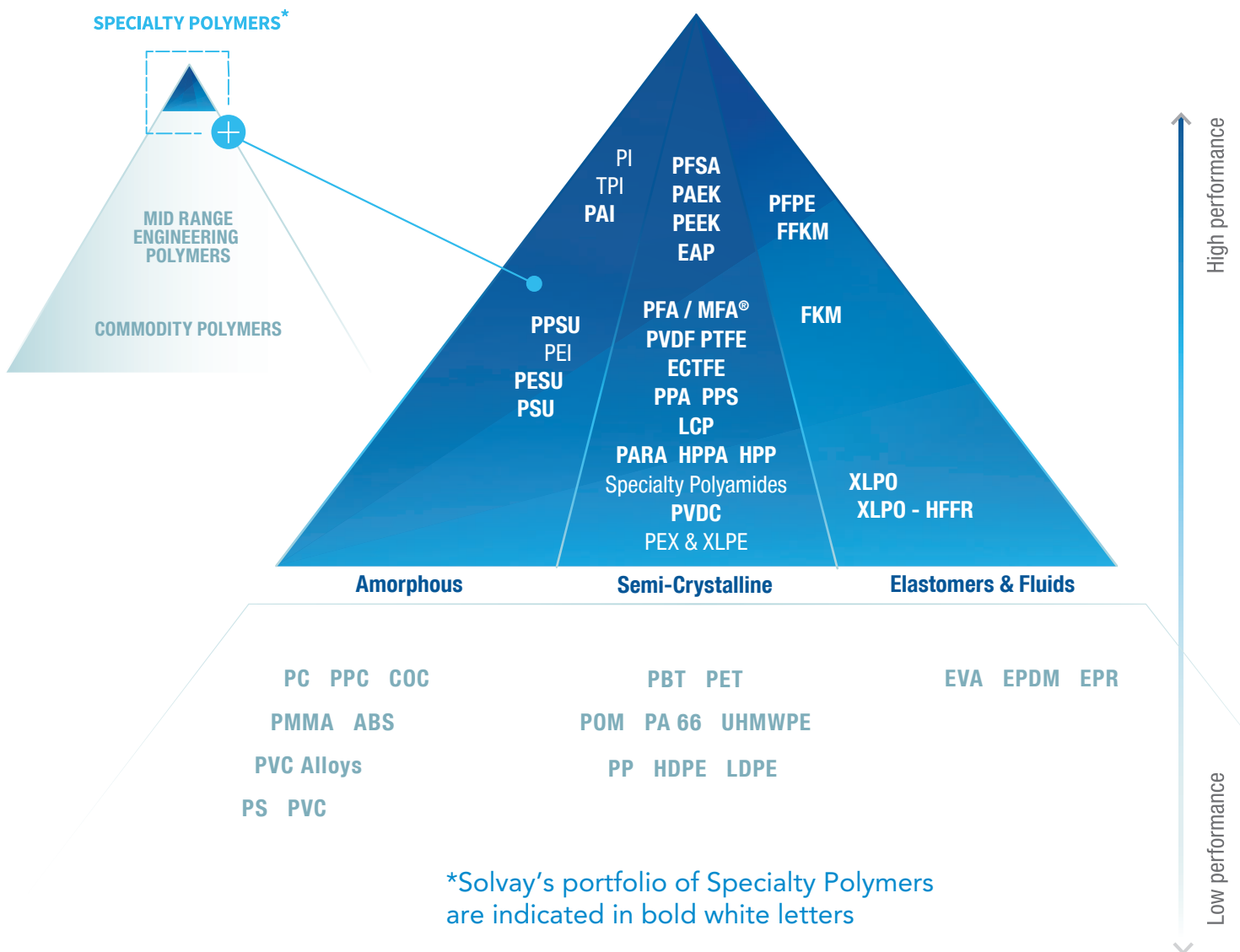
Providing solutions for tomorrow's challenges in today's markets

Specialty polymers are innovative, top-tier solutions and Solvay is at the leading-edge of the industry with the world's broadest portfolio.

In our dedicated centres of research and innovation, our world-class polymer scientists develop strong, lightweight polymers, fluids and elastomers that provide competitive solutions, greater design freedom and added value for our partners.

We offer the broadest selection of advanced materials that meet the needs of the world's key industries such as deep-sea exploration to 3D printing, from state-of-the-art batteries to implantable spinal devices. Our passion for innovation began more than 150 years ago and is still in our DNA.

At Specialty Polymers we want our customers to be part of our winning mindset. We approach new projects by combining our resources with yours to facilitate development and fast track winning solutions together.



Explore New Opportunities in Metal Replacement

Xencor™ Long Fiber Thermoplastics (LFT) are innovative injection-moldable reinforced products that target challenging metal replacement applications and semi-structural applications. They are designed specifically to achieve maximum synergy between high performance, design freedom, weight reduction and per-part cost economy through fast cycle times.

Fiber Skeleton to Deliver New Standard of Performance

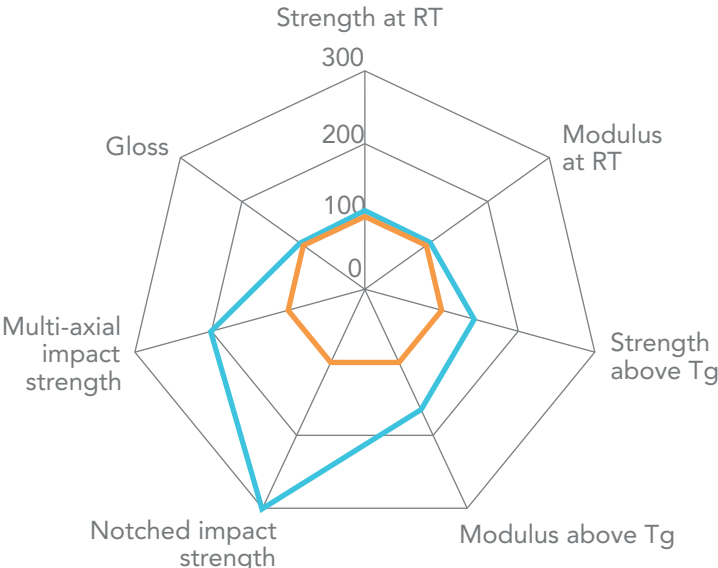
The key feature of Xencor™ LFT compounds is to create a unique 3D entangled long fiber network inside the molded part, during the molding process. This network actually forms a strong fiber skeleton, which ensures an optimal dimensional stability and significantly improves the thermal-mechanical properties compared to traditional highly filled short-fiber reinforced plastics.



Molded part



Fiber skeleton (as retrieved after burning off the resin)



— Xencor™ LFT compounds
 — Short-fiber compound
 RT Room Temperature
 Tg Polymer Glass Transition Temperature

Figure 1: Short-term properties comparison (% of performance improvement vs. short-fiber compound)

Xencor™ LFT compounds deliver an unrivalled set of properties to meet the most stringent requirements

- Unique combination of high stiffness and outstanding impact resistance
- Excellent retention of performance at high temperature
- Extremely low creep under high permanent loading
- Outstanding fatigue resistance
- High dimensional stability and very low warpage
- Excellent surface finish



Xencor™ LFT compounds help design engineers and processors to meet precise critical component requirements in tough market environments, such as:

- Automotive
- Advanced Transportation
- Consumer Goods
- Sport & Leisure
- Industrial & Environment

In order to ensure the adequate support and guidance of our customers, reliable simulation capabilities have been developed for Xencor™ product line and are of prime importance for the design of new plastic parts.

Xencor™ LFT Compounds High-Performance Portfolio

The Xencor™ family offers a wide range of high-performance reinforced products ranging from PA66 to high temperature resins, such as PPA or PPS, and covers a wide variety of applications.

Product/Grade	Color	Description
Xencor™ PA66		
LGF 1030 HI	BK / NT	High Flow, High Impact 30% Long Glass Fiber
LGF 2040	BK	High Flow, General Purpose 40% Long Glass Fiber
LCF 2030	NT	High Flow, Electro-conductive 30% Long Carbon Fiber
Xencor™ HPPA		
LGF 4050	BK	Easy Flow High Perf PA, Hot Water moldable 50% Long Glass Fiber
LGF 4060	BK	Easy Flow High Perf PA, Hot Water moldable 60% Long Glass Fiber
Xencor™ PARA		
LGF 1050	BK / NT	General purpose, High Gloss 50% Long Glass Fiber
Xencor™ PPA		
LGF 1930 HS	BK / NT	Easy Flow PPA, Heat Stabilized 30% Long Glass Fiber
LGF 1930 FW HS	BK	Easy Flow PPA, Heat Stabilized 30% Long Glass Fiber, Improved Friction
LGF 1950 HS	BK / NT	Easy Flow PPA, Heat Stabilized 50% Long Glass Fiber
Xencor™ PPS		
LGF 3045	BK / NT	Easy Flow PPS, General Purpose 45% Long Glass Fiber

Solvay also offers a family of wear-resistant LFT compounds sold under the Tribocomp® tradename that offer select combinations of mechanical and tribological properties, making them an efficient alternative to metal, even when lubrication is marginal or non-existent.

Product/Grade	Color	Description
Tribocomp® PA66		
LGF30 PTFE12	NT	High Flow, General Purpose 30% Long Glass Fiber, PTFE filled
LGF30 PTFE18	NT	High Flow, General Purpose 30% Long Glass Fiber, PTFE filled
LGF30 TS0	BK	High Flow, Black 30% Long Glass Fiber, PTFE filled
LGF30 PTFE15 MoS	NT	High Flow, Black 30% Long Glass Fiber, Special F&W package



As a world leader in specialty polymers, we are continually developing innovative solutions and working closely with our customers. This will lead to further expansion of our Xencor™ portfolio.

Cost-Effective Solution

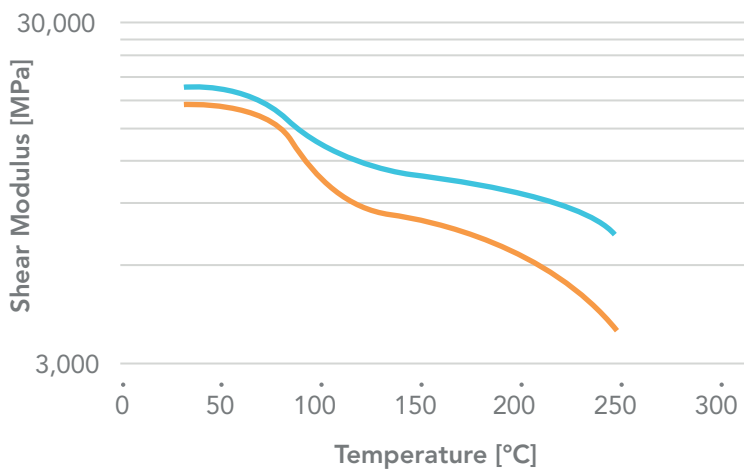
Nowadays, OEMs and their suppliers are replacing metal to reduce weight and lower manufacturing costs, mainly through parts consolidation, functions integration and elimination of secondary operations.

Xencor™ products are designed to meet these challenges. In addition, their specific manufacturing process promotes optimal feedability and easy processing on standard molding machines. To reach optimal performances, molding conditions and gate design just simply need to be adapted in order to prevent excessive fiber breakage.

Distinctive Properties for the Performances You Need

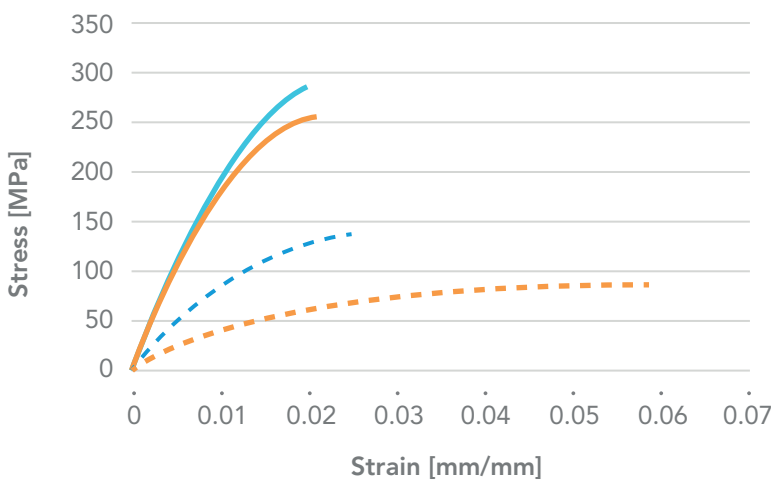
Stiffness Retention at High Temperature

The fiber skeleton significantly improves the retention of performances at high temperature, especially above glass transition temperature of the plastic material.



— Xencor™ HPPA LGF 4060
— HPPA 60% GF

Figure 2:
Mechanical performance
at high temperature



— Xencor™ HPPA LGF 4060
- - Xencor™ HPPA LGF 4060, 120°C
— HPPA 60% GF
- - HPPA 60% GF, 120°C

Figure 3:
Stress - Strain
Curves Comparison
at 120°C

Outstanding Impact & Crash Resistance

Xencor™ grades are extremely resilient materials. The active participation of the fiber skeleton in impact energy dissipation and in the inhibition of crack propagation provides a unique positioning for Solvay LFT grades in terms of their stiffness/toughness combination. This makes Xencor™ LFTs excellent candidates for metal replacement in structural applications or applications needing to withstand crash impact and high speed stress.

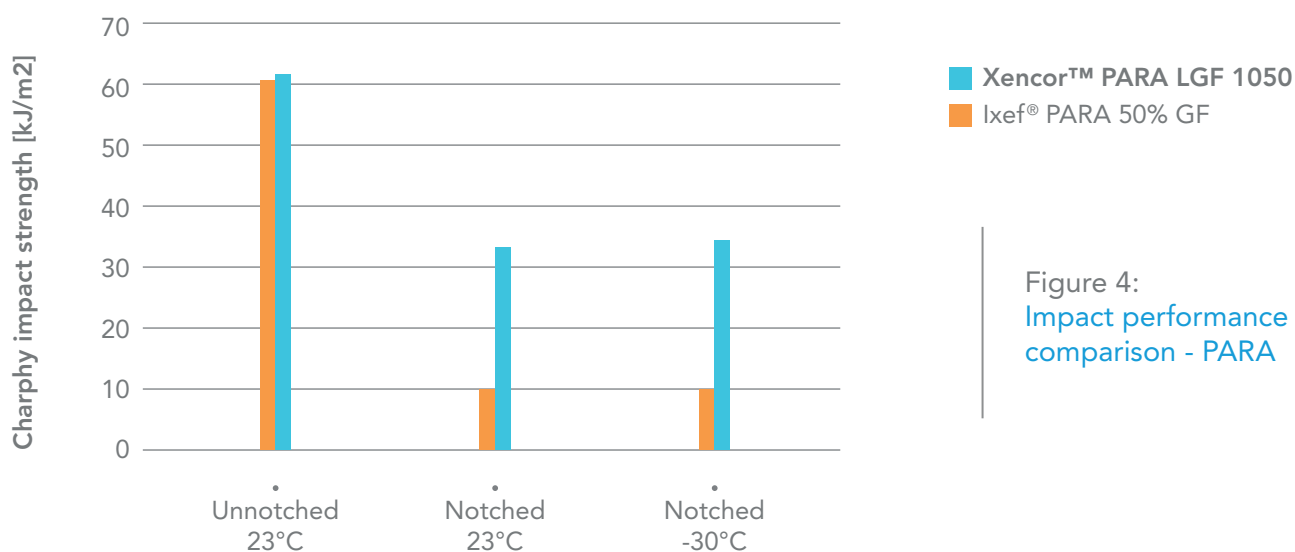


Figure 4:
Impact performance comparison - PARA



Figure 5:
Multi-axial impact performance – PPA

Creep & Fatigue Resistance

Xencor™ grades have some of the best fatigue and creep properties available from any thermoplastic on the market today. They are the ideal choice for parts operating continuously under load or for applications where components cannot be constructed with sufficient thickness or without the necessary number of strengthening ribs to prevent deformation occurring under load.

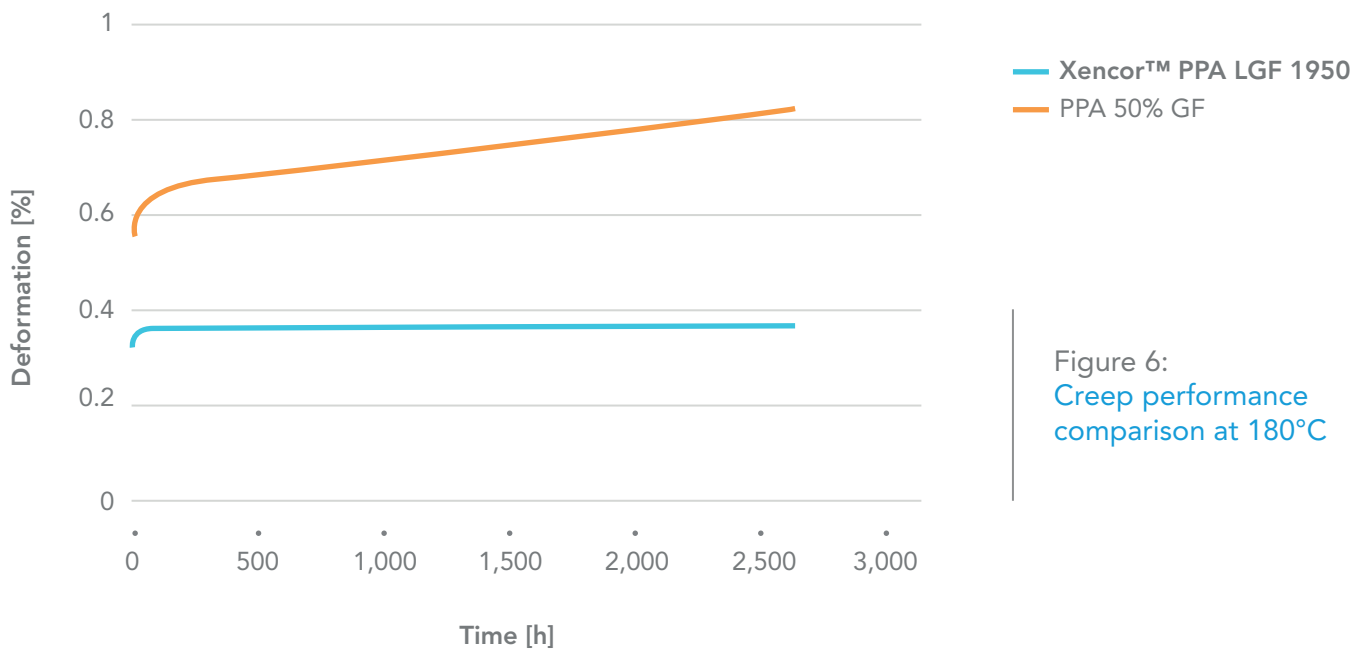
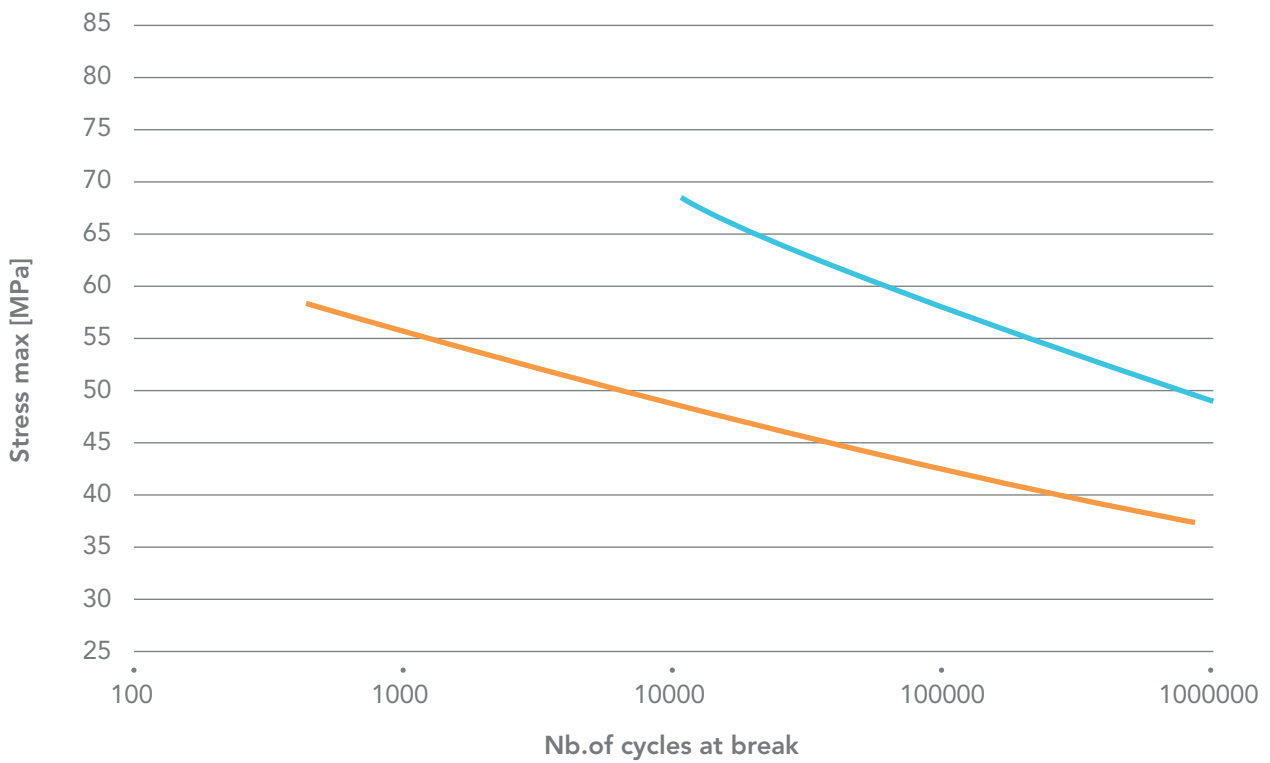


Figure 6:
Creep performance
comparison at 180°C

Typically, in creep, the fiber skeleton significantly limits the initial part deformation that occurs after load application as well as the increase in deformation over time. Long-term performance can exceed that of die-cast metals, such as Aluminum or Zinc, in particular at high temperatures. Finally, compared to other engineering plastics, Xencor™ LFT compounds exhibit a significantly lower tendency to warp and are suitable for molding components to tight tolerances.

Outstanding dynamic fatigue performances

Xencor™ grades have some of the best fatigue and creep properties available from any thermoplastic on the market today. They are the ideal choice for parts operating continuously under load or for applications where components cannot be constructed with sufficient thickness or without the necessary number of strengthening ribs to prevent deformation occurring under load.



— Xencor™ HPPA LGF 4060
— HPPA 60% GF

Figure 7:
Fatigue performance
Comparison at 150°C
(Tensile dynamic mode, 10Hz, R=0.1)
- Xencor™ HPPA

Very high dimensional stability

The coefficient of linear thermal expansion (CLTE) of Xencor™ compounds is low and more isotropic. It can be similar to that of many cast metals and alloys at room temperature. Low mold shrinkage and the ability to maintain tight tolerances allows for high reproducibility.

Coefficient of Linear Thermal Expansion (10⁻⁵ K⁻¹)

Xencor™ PPA LGF 1950 HS	1.3 (Flow Direction)
Xencor™ PPA LGF 1950 HS	3.3 (Transverse Direction)
Xencor™ PARA LGF 1050	1.4 (Flow Direction)
Xencor™ PARA LGF 1050	3.0 (Transverse Direction)
Steel	1.2
Aluminum	2.4
Brass	1.8
Zinc	3
Magnesium	2.5

Excellent Gloss & Surface Appearance

Xencor™ compounds provide the same surface finish and gloss as short-fiber products with the same reinforcement loading. Interestingly, the typical resin-rich surface characteristic of PARA compounds is preserved with Xencor™ PARA grades resulting in a highly polished appearance, even with high glass fiber content.

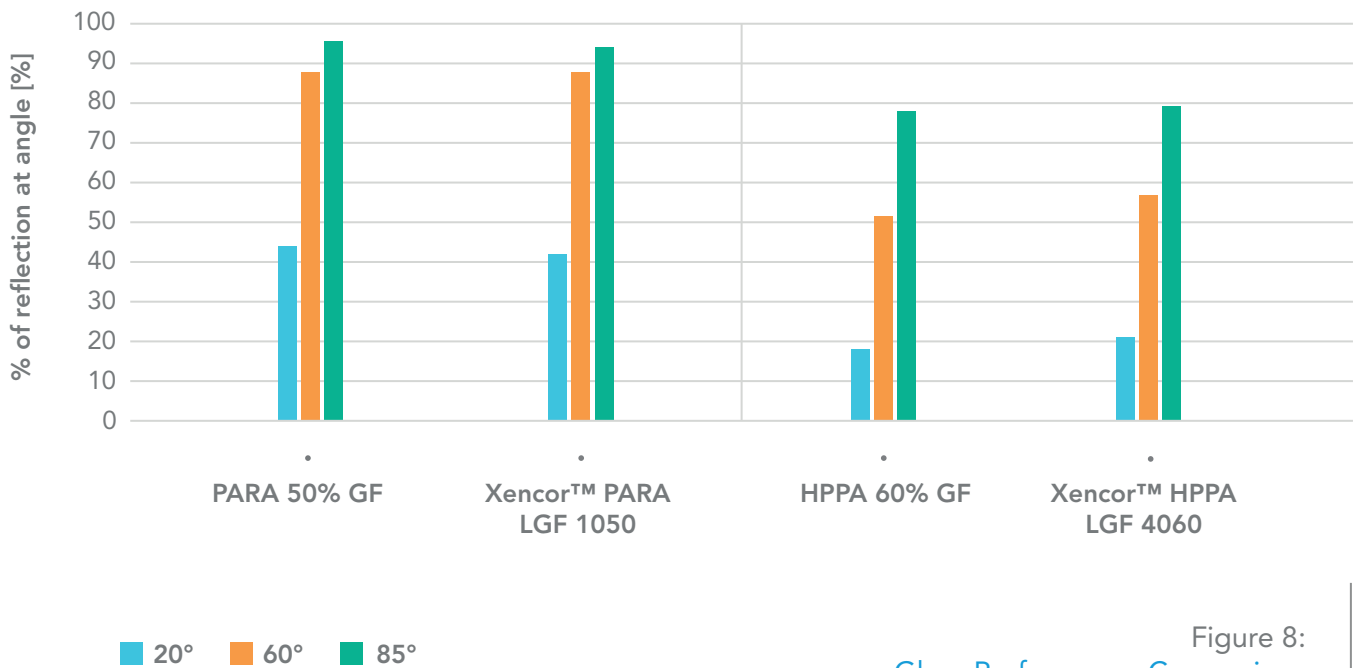
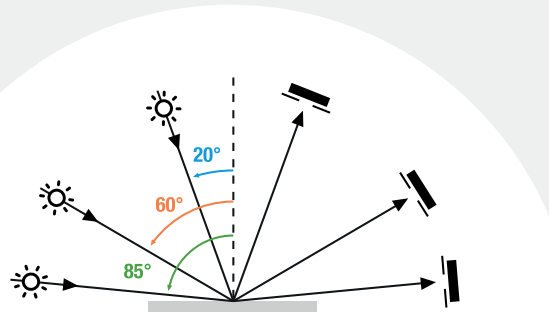


Figure 8:
Gloss Performance Comparison
according to DIN 67530
(% of reflection of incident light)
Xencor™ PARA & Xencor™ HPPA

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Progress beyond

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