Whitepaper

MOCOM

Tedur® IM

Impact-modified glass fiber-reinforced PPS for demanding applications

With Tedur®, MOCOM offers high-performance plastic compounds based on PPS for the highest technical requirements. The Hamburg-based compounding specialist is expanding its portfolio with Tedur® GF IM to include grades with increased impact and notched impact strength for particularly demanding applications.

The strong properties of **Tedur®** make the products interesting for many applications in which metals, thermosets or ceramics are usually used: for example, in coolant pumps and pump housings. High filler contents of up to 80 percent also allow manufacturers to further modify the mechanical properties while maintaining the good processability of the PPS due to its excellent flowability.

Challenge of conventional PPS compounds

One technical disadvantage of reinforced or filled PPS compounds is their brittleness. With **Tedur® L PPS 2030 IM SB1177-22** and **Tedur® L PPS 2040 IM SB1178-22**, MOCOM is now expanding its Tedur® portfolio with two new grades that combine the outstanding properties of conventional PPS with improved impact and notched impact strength. These new PPS compounds with glass fiber (GF) and impact modifier (IM) offer a **technically and economically interesting alternative to PPA compounds.**

Advanced development of PPS with increased toughness

The advantages of the new Tedur® GF IM compounds can be seen when comparing the basic properties with a conventional PPS GF40 and a PPA (6T/6) GF35 (table below).

Tedur® L PPS 2040 IM has a significantly higher notched impact strength of 15 kJ/m² than a conventional PPS GF40 and PPA GF35. Despite the impact modification, the heat distortion temperature (HDT) of Tedur® L PPS 2040 IM remains at the level of a standard PPS GF40. With an HDT A of 270 °C, Tedur® L PPS 2040 IM is significantly higher than that of PPA GF35 with a HDT of 245 °C.

Properties	Tedur® L PPS 2040 IM SB1178-22 (PPS GF40 IM)	PPS GF40	PPA (6T/6) GF35
Density (ISO 1183)	1.50 g/cm³	1.67 g/cm³	1.43 g/cm³
HDT A (1.8 MPa) (ISO 75-1/-2)	270 °C	275 °C	245 °C
Young's modulus (tensile) (ISO 527)	11,000 MPa	15,000 MPa	10,900 MPa (dry)
Tensile strength (ISO 527)	120 MPa	155 MPa	186 MPa (dry)
Elongation at break (ISO 527)	2.5 %	1.4 %	3.0 % (dry)
Charpy impact strength (ISO 179/1eU)	52 kJ/m²	30 kJ/m²	85 kJ/m² (dry)
Charpy notched impact strength (ISO 179/1eA)	15 kJ/m²	7 kJ/m²	12 kJ/m² (dry)
Shrinkage (ISO 294-4)	In flow 0.1 - 0.3 % Across flow 0.4 - 0.6 %	In flow 0.1 - 0.3 % Across flow 0.4 - 0.6 %	In flow 0.3 % Across flow 1.0 %

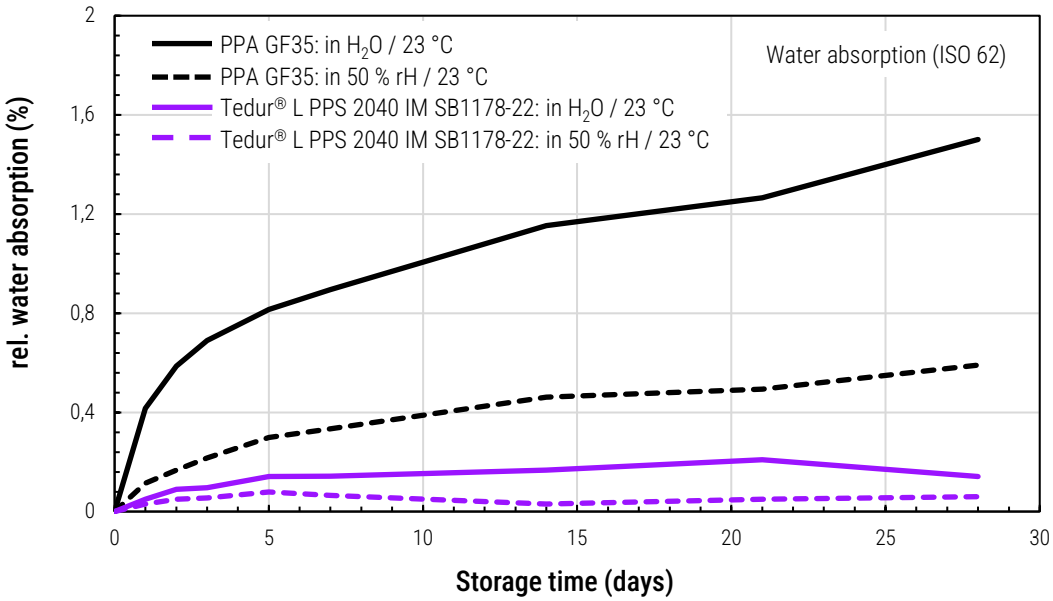
Technical advantages of PPS GF IM over PPA compounds at a glance

The new Tedur® PPS GF IM compounds have important technical advantages over typical PPA GF compounds:

- **Lower water and moisture absorption** leads to significantly better retention of properties under the influence of moisture
- **Better resistance to media and heat aging** leads to considerably better retention of properties under the influence of media and temperature
- **Lower creep tendency** under high loads and temperatures for improved dimensional stability of structural parts
- **Higher heat deflection temperature**

Low water absorption

Tedur® PPS GF IM Compounds absorb significantly lower amounts of water than PPA GF compounds (see figure) and exhibit lower processing shrinkage. Thanks to the **low water absorption**, the new Tedur® compounds have **very stable mechanical properties** and excellent dimensional stability when exposed to moisture. This makes them particularly attractive for **applications in humid environments** with high demands on mechanical properties and dimensional stability.



Very good chemical and heat ageing resistance

The improved chemical and heat aging resistance of Tedur® PPS GF IM compounds compared to PPA GF compounds was confirmed by aging tests (table below). The excellent hydrolytic and chemical resistance of Tedur® PPS GF IM compounds is shown during oil storage (LIQUI MOLY 5W-30; 1,000 h / 160 °C) and in water/glycol storage (1,000 h / 150 °C) in an autoclave. In the case of oil storage, the improved chemical resistance is primarily reflected in better toughness retention: While the Tedur® PPS GF IM shows no visible drop in notched impact strength after oil storage, the notched impact strength of the PPA GF compound is almost cut to half after oil storage.

Properties	Tedur® L PPS 2040 IM SB1178-22	PPA (6T/6) GF35
Storage in oil (1,000 h / 160 °C)		
Flexural modulus (ISO 178)	-5 %	±0 %
Flexural strength (ISO 178)	±0 %	+4 %
Charpy notched impact strength (ISO 179/1eA)	±0 %	-48 %
Storage in coolant: water/glycol (1,000 h / 150 °C)		
Flexural modulus (ISO 178)	+2 %	Brittleness & strong discoloration of the test specimens, measurement not possible
Flexural strength (ISO 178)	±0 %	
Charpy notched impact strength (ISO 179/1eA)	-50 %	
Heat ageing (1,000 h / 200 °C)		
Flexural modulus (ISO 178)	+10 %	+9 %
Flexural strength (ISO 178)	-12 %	-53 %
Charpy notched impact strength (ISO 179/1eA)	-10 %	-39 %

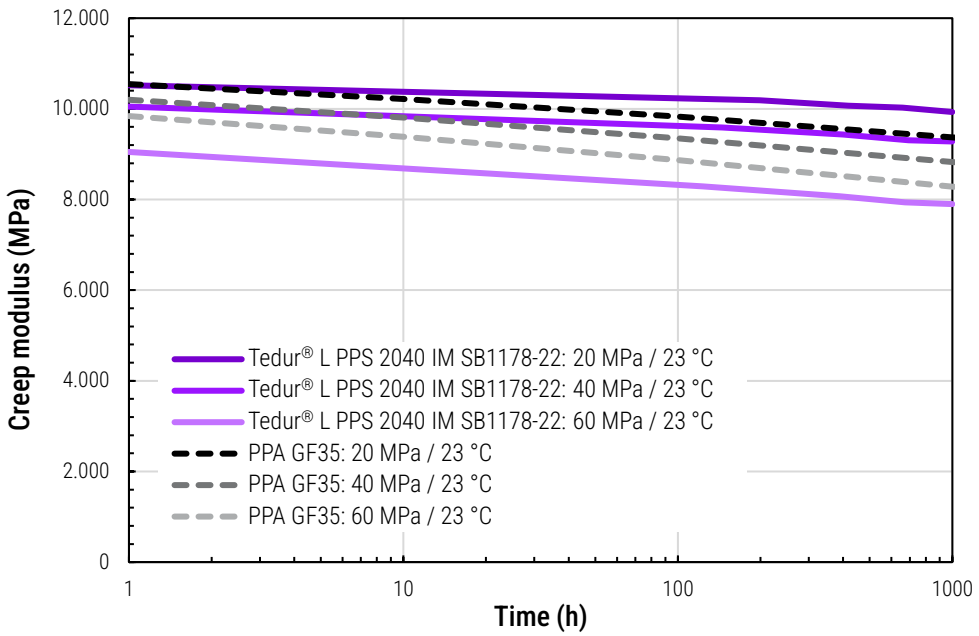
The new Tedur® GF IM compounds, for example Tedur® L PPS 2040 IM, also show significantly better resistance than typical PPA GF compounds during long-term storage in a coolant (water/glycol) : No significant changes can be seen in the flexural modulus and flexural strength (see previous table). Although the toughness values of Tedur® L PPS 2040 IM decrease considerably, the PPA GF compound shows complete embrittlement and strong discoloration (see figure), so that it was no longer possible to test the material after storage in coolant.

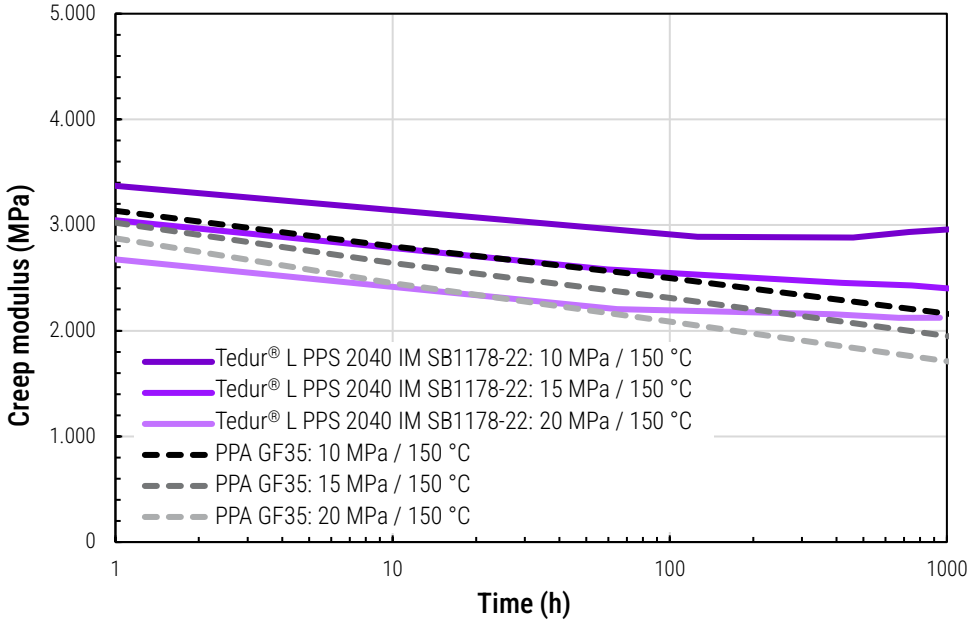
Embrittled and strongly discolored test specimens of PPA (6T/6) GF35 after storage in coolant (water / glycol) for 1,000 h / 150 °C.

In addition to the significantly better chemical resistance, the new Tedur® GF IM compounds have the further advantage of much higher heat ageing resistance compared to typical PPA GF compounds. While a clear drop in strength and toughness can be seen in the PPA GF compound, the mechanical properties of the Tedur® L PPS 2040 IM remain more stable after heat ageing test (200 °C).

Low creep tendency

The advantages of Tedur® GF IM compounds over conventional PPA GF compounds can also be seen in the creep behavior in terms of a lower creep tendency, especially at higher loads and higher temperatures (see figure). The drop in creep modulus over time is higher for the PPA GF compound than for the impact-modified Tedur® L PPS 2040 IM.

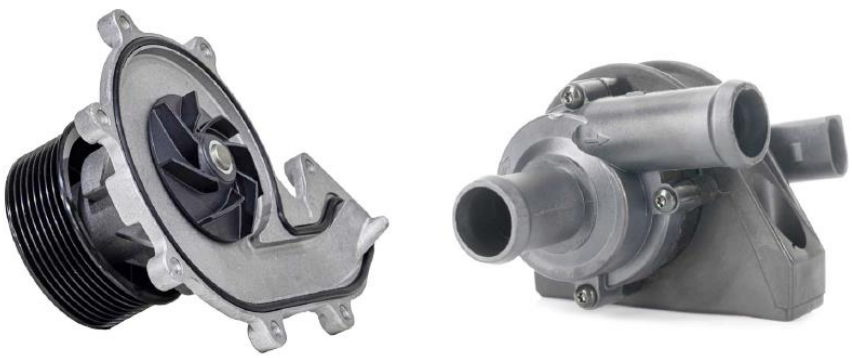




Target applications of the new Tedur® GF IM compounds

Tedur® L PPS 2030 IM SB1177-22 (GF30) und Tedur® L PPS 2040 IM SB1178-22 (GF40) **combine the typical properties of PPS** (very good dimensional stability, excellent resistance to media and heat ageing, low creep tendency) **with significantly improved impact and notched impact strength**. This makes the new impact-resistant PPS GF IM compounds perfect materials for **structural parts with high dimensional stability in technically demanding applications and aggressive environments** (moisture, media, heat).

Target applications for the recently developed Tedur® GF IM compounds are therefore in the field of fluid management, for example for pump gears and impellers (see illustration), gearboxes and heat exchangers as well as adaptors for fuel and cooling lines and in housing parts for pumps (see illustration). Their technical advantages and attractive price-performance ratio make the new Tedur® PPS GF IM compounds from MOCOM an interesting technical and economic alternative to PPA GF compounds.



Characteristic applications for an impact-modified, glass fiber-reinforced PPS: Impeller for coolant pump (left) and coolant pump housing (right).

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