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Case history

External samples investigation - RING SEAL TRASMISSION Comparison of PA6, PAI and PEEK

World Gasket Ellegi conducted an investigation of external samples, comparing its PEEK material with some materials used by competitors, consisting of Polyamide 6 (PA6) and Polyamide-imide (PAI). The objective of the investigation was to evaluate the performance of these materials in terms of mechanical strength, dimensional stability, and suitability for use under severe operating conditions.

The objectives were:

- to evaluate the mechanical and tribological performance of PA6 and PAI specimens compared with PEEK from World Gasket Ellegi;
- to analyse the dimensional stability of the materials under conditions of high temperatures and the presence of moisture
- determine the suitability of materials for applications requiring wear resistance and stability at high pressures.

Tested samples:

PA6 (Polyamide 6)

PA6 is a partially crystalline material with excellent impact strength properties and good processability. However, it is characterised by high hygroscopicity, which can impair dimensional stability in the presence of moisture. It has a melting point of 220°C and is often used for general mechanical applications due to its relatively low cost and versatility.

PAI (Polyamide-imide)

PAI is known for its high thermal and mechanical performance, with a melting point of up to 275°C and good wear resistance. It has high tensile and compressive strength, high toughness and stiffness, making it a stable material even at high temperatures. However, it has high moisture absorption and saturated vapour sensitivity, which can lead to undesirable dimensional changes.

PEEK by World Gasket Ellegi

PEEK is a thermoplastic polymer with exceptional performance, offering a unique combination of mechanical strength, dimensional stability, and resistance to chemicals and wear. It has a high melting point of 341°C and a continuous service temperature of up to 260°C. PEEK does not undergo hydrolysis or degrade in steam or water, thus maintaining its stability even under extreme operating conditions. It has a tensile strength of 29000 psi and also excels in insulation and fatigue properties.

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Results and comparison:

MECHANICAL RESISTANCE

PEEK: it showed superior mechanical strength compared to both PA6 and PAI, in terms of both tensile (up to 29000 psi) and compressive strength. This makes it particularly suitable for applications requiring resistance to high loads.

PAI: it offered good mechanical performance, with high tensile and compressive strength, but not at the level of PEEK.

PA6: it proved less suitable for high-pressure applications, although it had good impact strength, especially on conditioned parts.

DIMENSIONAL STABILITY

PEEK: it provides excellent dimensional stability, even at high humidity and temperatures above 250°C. It does not undergo hydrolysis and does not degrade in the presence of steam or water.

PAI: it has good dimensional stability at high temperatures, but high moisture absorption and steam sensitivity limit its performance in humid environments.

PA6: due to its hygroscopic nature, PA6 undergoes significant dimensional changes in the presence of moisture, making it less reliable for applications requiring high dimensional stability.

CHEMICAL AND THERMAL RESISTANCE

PEEK: it offers excellent chemical resistance, being insoluble in common solvents and maintaining its properties even at high temperatures (up to 260°C). It has a melting point of 341°C, making it extremely heat resistant.

PAI: it's resistant to chemicals and has a melting point of up to 275°C, but its sensitivity to moisture limits its applicability in harsh environments.

PA6: it has good chemical resistance to organic and inorganic compounds, but is less resistant to acids and absorbs moisture, which may compromise its properties.

TRIBOLOGICAL PROPERTIES

PEEK: it has excellent tribological properties, with superior wear resistance and a low coefficient of friction. This makes it ideal for applications where friction reduction is critical.

PAI: it offers good tribological properties, but PEEK generally proves to be superior, especially with regard to wear resistance.

PA6: its wear resistance properties are inferior to those of PAI and PEEK, making it less suitable for applications requiring high durability.

Conclusions:

World Gasket Ellegi's PEEK has proven to be clearly superior to PA6 and PAI materials, offering improved performance in terms of mechanical strength, dimensional stability, chemical resistance, and tribological properties. Thanks to these characteristics, PEEK is the optimal choice for seals intended for construction machinery, guaranteeing reliability and durability even under the most extreme operating conditions.

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