victrex

Comparison of PEEK, PPS, and PES Polymers

Injection Moulded Grades

Polyetheretherketone (PEEK), polyphenylene sulfide (PPS), and polyethersulfone (PES) are all high-performance engineering thermoplastics.

Below, we compare their **short-term mechanical and physical properties** for injection moulded **unfilled (neat resin)** grades.

Key properties include strength, stiffness, impact resistance, and temperature capabilities, as well as chemical, radiation, wear, creep, and fatigue performance. ISO standard data (e.g. ISO 527 tensile tests, ISO 179/180 impact tests, ISO 75 heat deflection temperatures) are referenced where available.

	Semi-Crystalline Polymers		Amorphous Polymers
Material Characteristics	Polyetheretherketone PEEK (unfilled)	Polyphenylene sulfide PPS (unfilled)	Polyethersulfone PES (unfilled)
Tensile Strength (ISO 527)	90–100 MPa[1] (yield) – exhibits ductile yield around 5% strain[2].	65–80 MPa[1] (no distinct yield; breaks at ~1–2% strain, very low elongation[3]).	~85 MPa (yield at ~7% strain – moderately ductile[4].
Tensile Modulus (ISO 527)	~3.6 GPa[1] (high stiffness).	~3.8 GPa[1] (stiff, despite brittleness).	~2.65 GPa[4] (lower stiffness due to amorphous nature).
Elongation at Break	20–30% (high ductility)[3] Unfilled PEEK is tough and can deform significantly before fracture.	~1–2%[3] Unfilled PPS is extremely brittle -little plastic deformation.	~6–7%[4] Intermediate ductility – more than PPS, less than PEEK.

Impact Strength (Notched)	~8 kJ/m² (Izod/Charpy, notched)[1] High impact resistance; **Unnotched:** no break in Charpy tests[3].	~3 kJ/m² (notched)[1] – *very* brittle (notched specimens tend to break easily); **Unnotched:** often still breaks due to low toughness[3].	~7 kJ/m² (notched Charpy) – fairly impact resistant. **Unnotched:** no break (PES is very tough when not pre-notched)[4].
Glass Transition (Tg)	143 °C[5]. Semi-crystalline PEEK retains stiffness beyond Tg thanks to crystallinity.	90 °C[6]. Low Tg means PPS' amorphous regions soften at modest temperatures. (PPS can undergo some crosslinking upon first heat, partially mitigating softening).	225 °C[6]. High Tg (amorphous polymer); maintains rigidity until very high temperatures. No melting point (amorphous).
Melting Point (Tm)	343 °C[6]. Signifies processing temperature ~370 °C and high thermal stability of crystalline phase.	285 °C[6]. PPS processing ~300 °C; can undergo slight crosslink at high T which raises thermal stability further.	*N/A* (Amorphous – no Tm). Thermal decomposition onset ~>500 °C.[7]
Heat Deflection Temp (HDT @1.8 MPa)	~160 °C (unannealed, ISO 75)[5]. PEEK's HDT is highest among these (due to high crystallinity and Tg).	~110–130 °C (depending on grade; can improve if post-cured)[1]. Lower HDT due to low Tg, though high crystallinity gives shape stability up to ~200 °C in absence of load.	~205 °C (ISO 75)[4]. PES's HDT ~ near its Tg, indicating excellent short-term high-temperature usage (no crystalline phase, so softening begins at Tg).
Continuous Use Temp (approx.)	~250–260 °C (UL RTI ~260 °C). PEEK can continuously operate at extremely high temperatures (with minimal	~180–200 °C[1]. Beyond ~200 °C, PPS may oxidatively degrade or embrittle (though it doesn't melt until 280 °C)[1].	~180–190 °C (UL RTI ~190 °C)[4]. High Tg grants PES excellent continuous heat resistance in air until

	property loss even after 10,000 h) [5].		~200 °C, after which it softens.
Use when . . .	The component demands the *highest combination* of temperature capability (over 200 °C), mechanical load-bearing (especially long-term or cyclical), and toughness.	Chemical resistance and dimensional stability are paramount in the ~150–200 °C range, and where cost or ease of processing (PPS moulds at lower temperature than PEEK) is a factor.	For applications needing transparency or hydrolysis resistance at high temperatures

References

[1] The Difference Between PEEK and PPS, Hony Plastics "the difference between PEEK and PPS", 23/06/2025

[2] Victrex Material Properties Guide 01/04/2020

[3] Ultrason® E 2010 Datasheet - sushengpolymer.com

[4] PEEK vs. PES - MakeItFrom.com

[5] PEEK vs PPS: Which Do You Need? - Advanced EMC

[6] What Is the Difference Between PES and PPS? A Detailed Guide, www.Plastic-Pellet.com

[7] Radiation resistant Plastics, www.EnsingerPlastics.com