

THE ULTIMATE SOLUTION FOR HIGH-PERFORMANCE PLASTIC THERMOFORMING



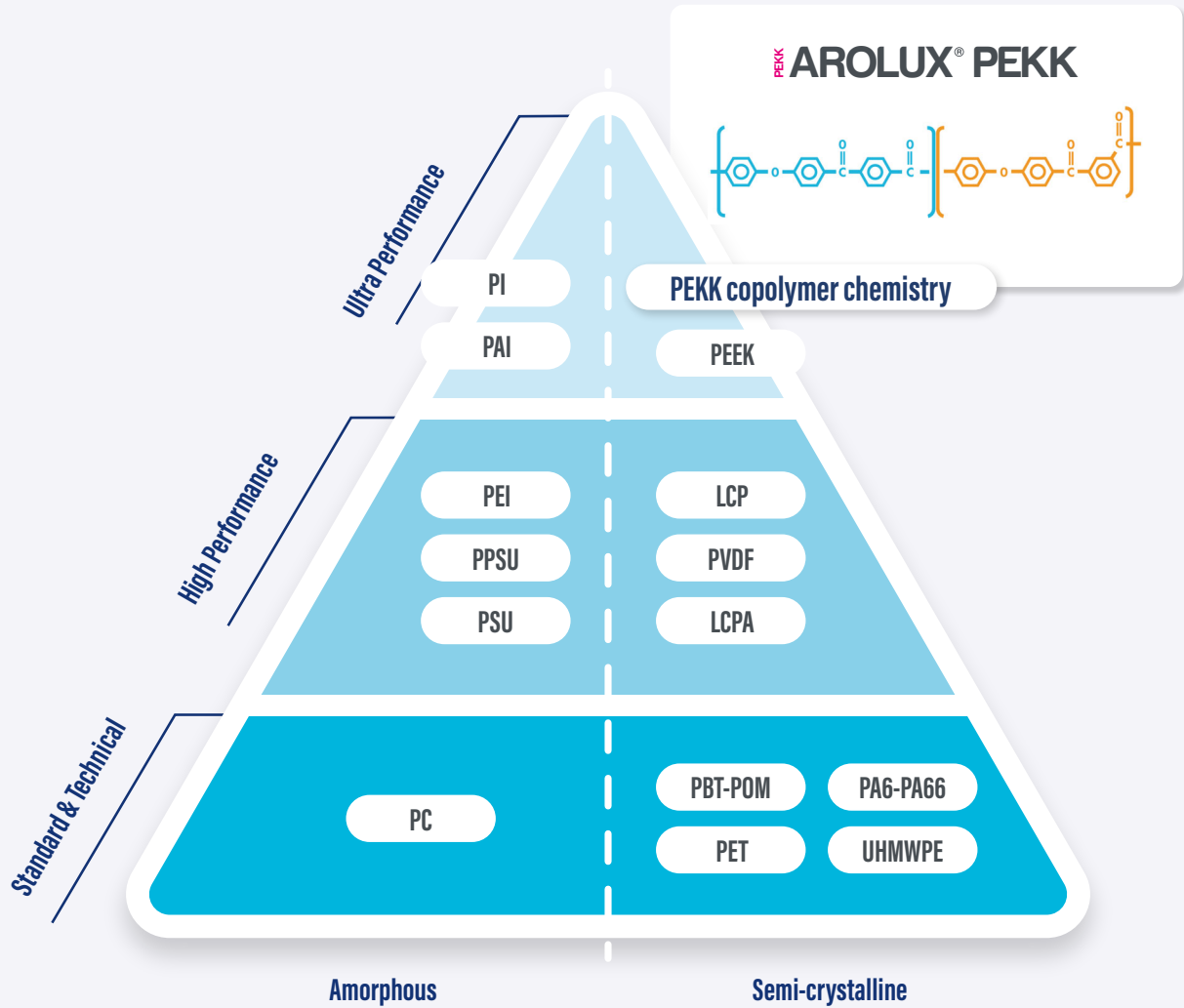
Part design adapted from a real PEKK thermoformed demo part produced by Plastiform SAS (France)

VALUE PROPOSITION BY

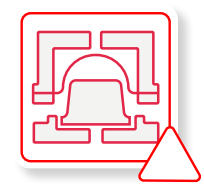
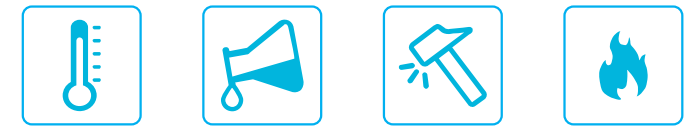
ARKEMA
INNOVATIVE CHEMISTRY

 **Westlake
plastics**
LIFE IN POLYMERS

CHALLENGE AROUND THERMOFORMING OF ULTRA-HIGH PERFORMANCE SEMI-CRYSTALLINE POLYMERS



Ultra-high performance
semi-crystalline polymers show great properties:

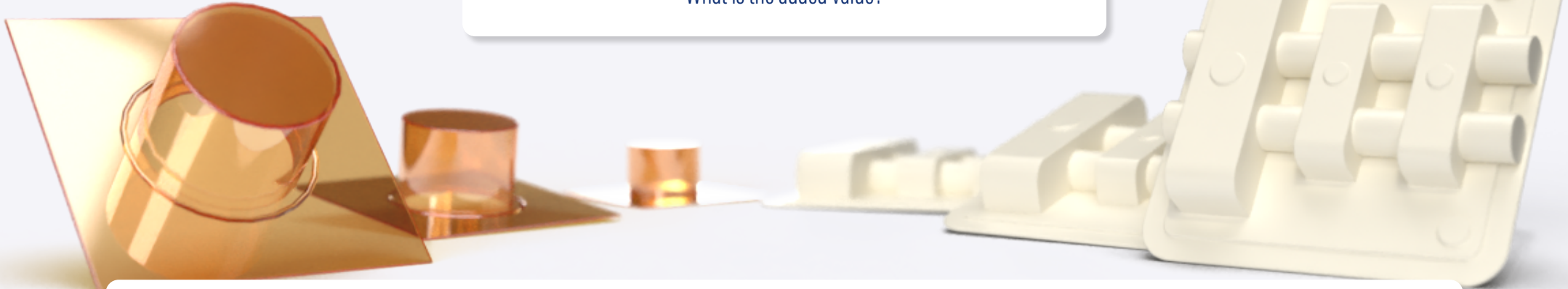


But they are not easily thermoformable!



UNLOCKING NEW MARKET OPPORTUNITIES

What is the added value?



COMPETITION

Semi-crystalline machined PAEK

Injection molded PAEK

HT amorphous
thermoformed polymers

Metal replacement

KEY ADVANTAGES OF THERMOFORMED PEKK

- Very high cost reductions: less material & faster processes!
- Possibility to produce very large parts
- Cost efficient way to produce many very small parts in one shot
- Low-cost tooling & easy prototyping
- Possibility to produce very large parts
- Very thin panels
- Significantly improved chemical resistance (ESCR)
- Higher mechanical properties up to 165°C
- Lightweight
- Process costs reduction

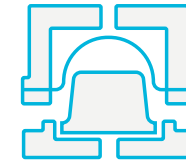
Many different markets opportunities!

AND OUR SOLUTION

Combining an innovative material with a specific process technology.

PEKK AROLUX® PEKK

ready-to-use thermoformable sheet from Kepstar® PEKK polymer



Thermoforming process know-how



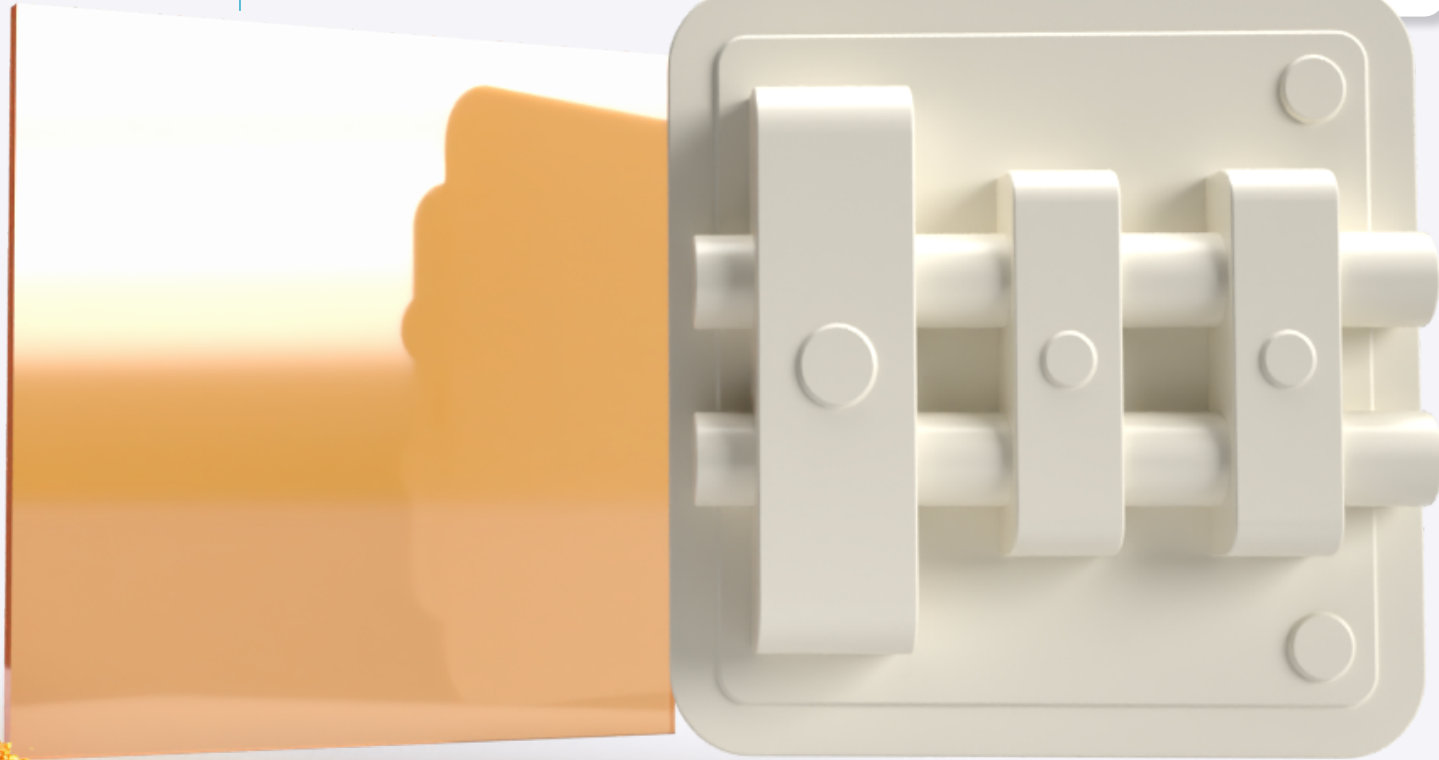
	Value	Unit
Tg	160-165	°C
Tf	>300	°C
Tensile modulus	3.6	Gpa(23°C)
Tensile strength	110	Mpa(23°C)

MARKET INSIGHTS SUPPLY CHAIN

PEKK **AROLUX® PEKK**

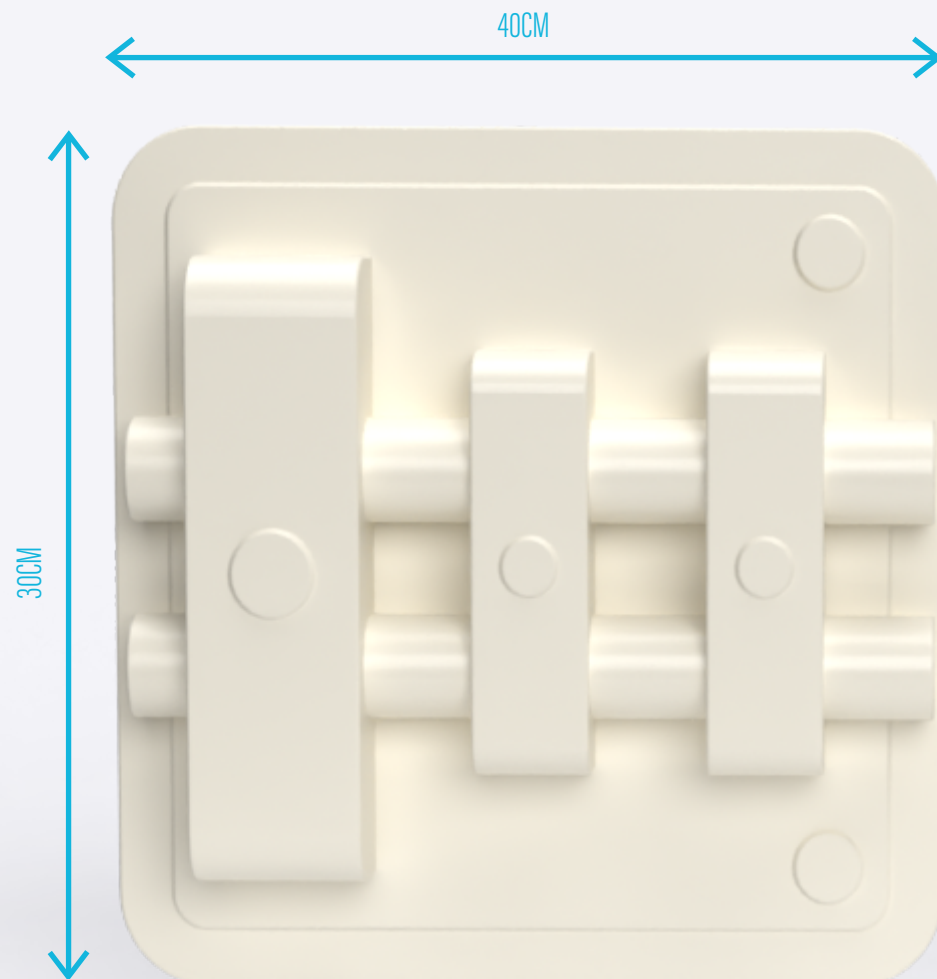
Technical thermoformed part

KEPSTAN®
BY ARKEMA



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LIFE IN POLYMERS



Case Study

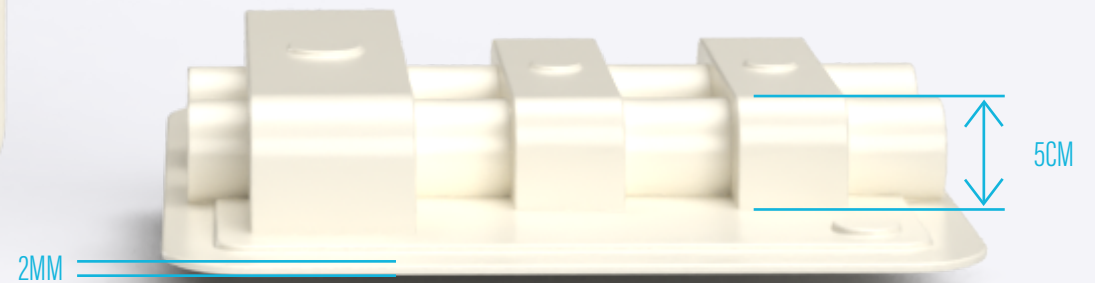
A FEW THINGS TO KEEP IN MIND

Machining would require >7kg of PAEK material & machining time.
Thermoforming requires 20 times less material. Cycle time 5min.

Injection molding is not suitable for big & thin parts.
Thermoforming is.

High T°C amorphous polymers show chemical limitations
...That PEKK does not.

Metal forming is costly & parts are heavy.
PEKK material is light & thermoformable.





TECHNICAL DATA ON KEPSTAN® PEKK FOR THERMOFORMING

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KEPSTAN® PEKK BENEFITS

Kepstan® PEKK is a ultra-high performance thermoplastic.



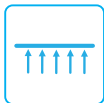
Tunable crystallinity



THERMOFORMABLE PAEK



High temperature resistance



Excellent barrier



High strength
High stiffness



Excellent electrical properties (isolative)



Low wear & friction



Excellent chemical resistance

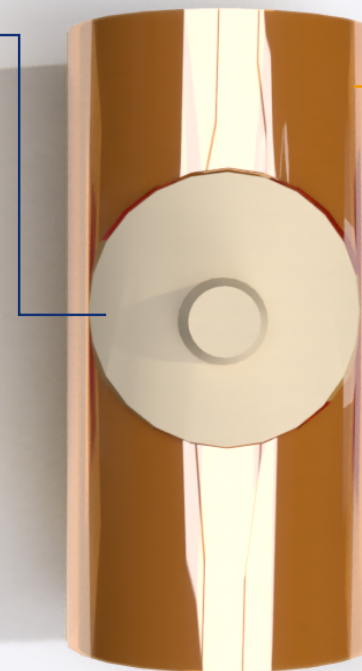


Flame resistance,
low smoke & toxicity



KEPSTAN® PEKK TENSILE PROPERTIES

Standard ISO 527-1BA	Injection molding 7000 series		Arolux® PEKK sheet Crystalline zone	
		Crystalline	Amorphous	Perpendicular to extrusion flow
Tensile Modulus E	GPa	3,6	3,1	3,6
Stress @ yield sy	MPa	113	90	110
Strain @ yield ey	%	5,3	5,5	5,2
Strain @ break eB	%	15	>30	9



Arolux® PEKK sheet Amorphous zone	
Extrusion flow direction	
	3,0
	95
	5,5
	>30

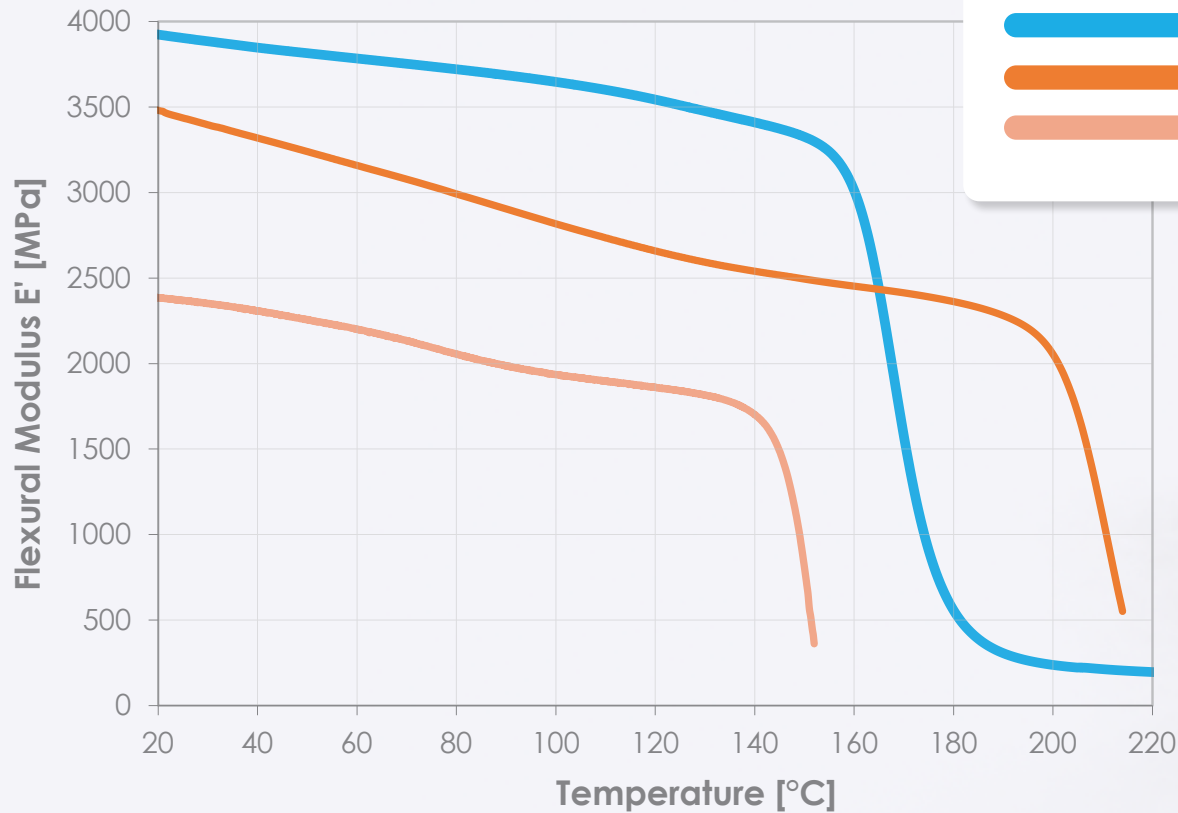
Crystalline PEKK exhibits highest mechanical properties.

Kepstan® PEKK is ductile in all cases.

Thermoforming enables the same high performance level as injection molding process!

FLEXURAL PROPERTIES

Kepstan® PEKK is designed for high mechanical resistance up to 165°C and can withstand a >240°C continuous use temperature.



	Flexural modulus @150°C	
PEKK	3 300 MPa	
PEI	2 480 MPa	+24%
PC	850 MPa	+280%

CHEMICAL RESISTANCE

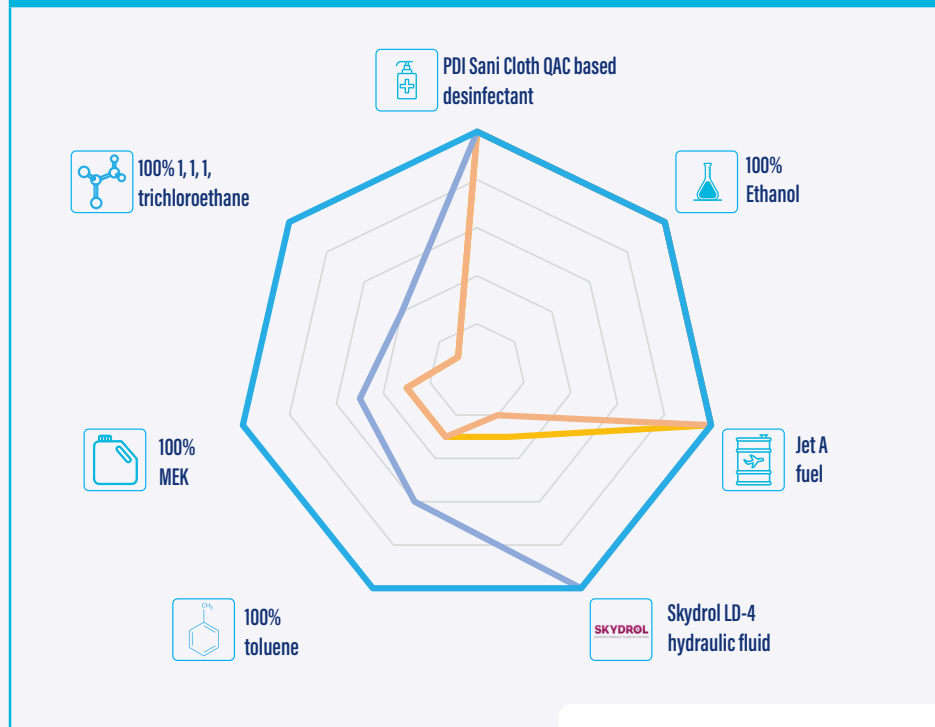
Kepstan® PEKK is designed for high chemical resistance.

1 week of immersion @23°C

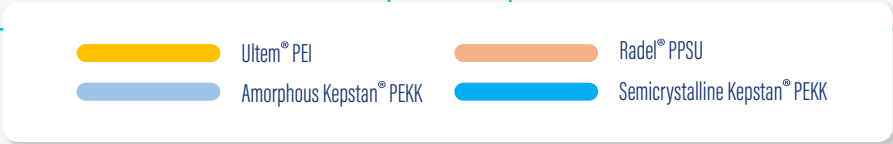
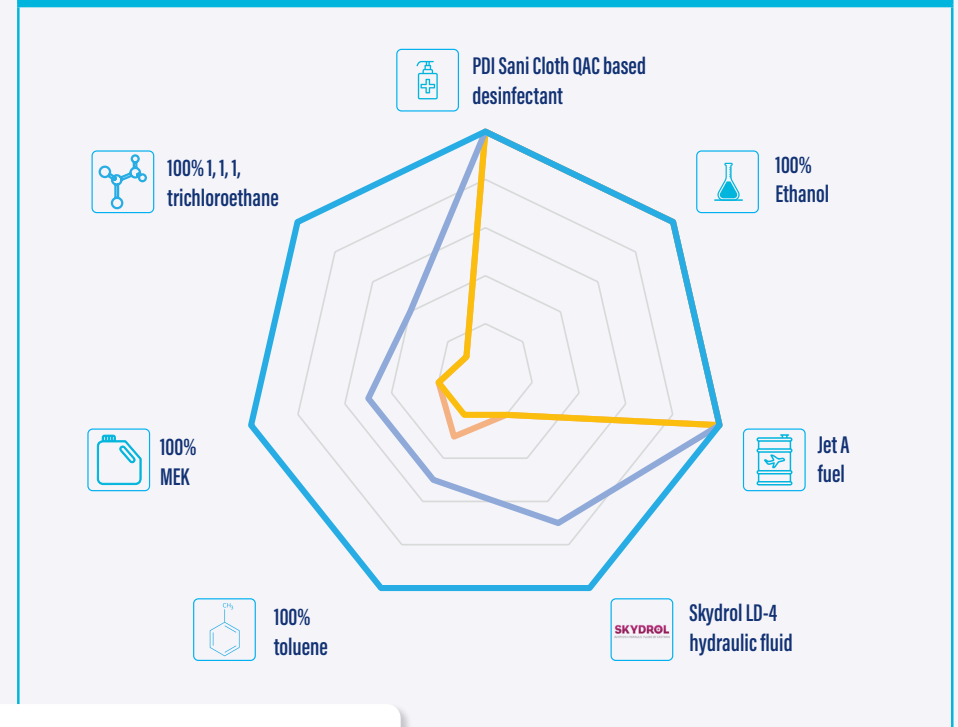
Crystalline Kepstan® PEKK enables the best chemical resistance.

Amorphous Kepstan® PEKK also shows much better resistance versus PEI or PPSU.

Environmental Stress Cracking Resistance - 0.50% strain



Environmental Stress Cracking Resistance - 1.10% strain



FLAME, SMOKE, TOXICITY (FST) PROPERTIES

Typical ratings

	Condition	Specification	Unit	Value
Flammability Rating (aero)	0.8 mm	UL 94	-	V-0
Fire protection on railway vehicles	2 mm	NF EN 45545 R22/R23	-	HL3 (highest rating)
Heat Release Rate (OSU)	3.0 mm	FAR 25.853	kW/m ²	43.52
Limiting Oxygen Index	1.6 mm	ISO 4589-2	%O ₂	35-38

Smoke toxicity

Gas	Flaming	Non-Flaming
Carbon Monoxide	280 ppm	None Detected
Carbon Dioxide	2449 ppm	None Detected
Nitrogen Dioxide	None Detected	None Detected
Sulfur Dioxide	None Detected	None Detected
Hydrogen Chloride	None Detected	None Detected
Hydrogen Fluoride	None Detected	None Detected
Hydrogen Bromide	None Detected	None Detected

THANK YOU



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