

ACETAL HOMOPOLYMER

KEPITAL[®] H100

Value+

We deliver value exceeding
our customers' expectation



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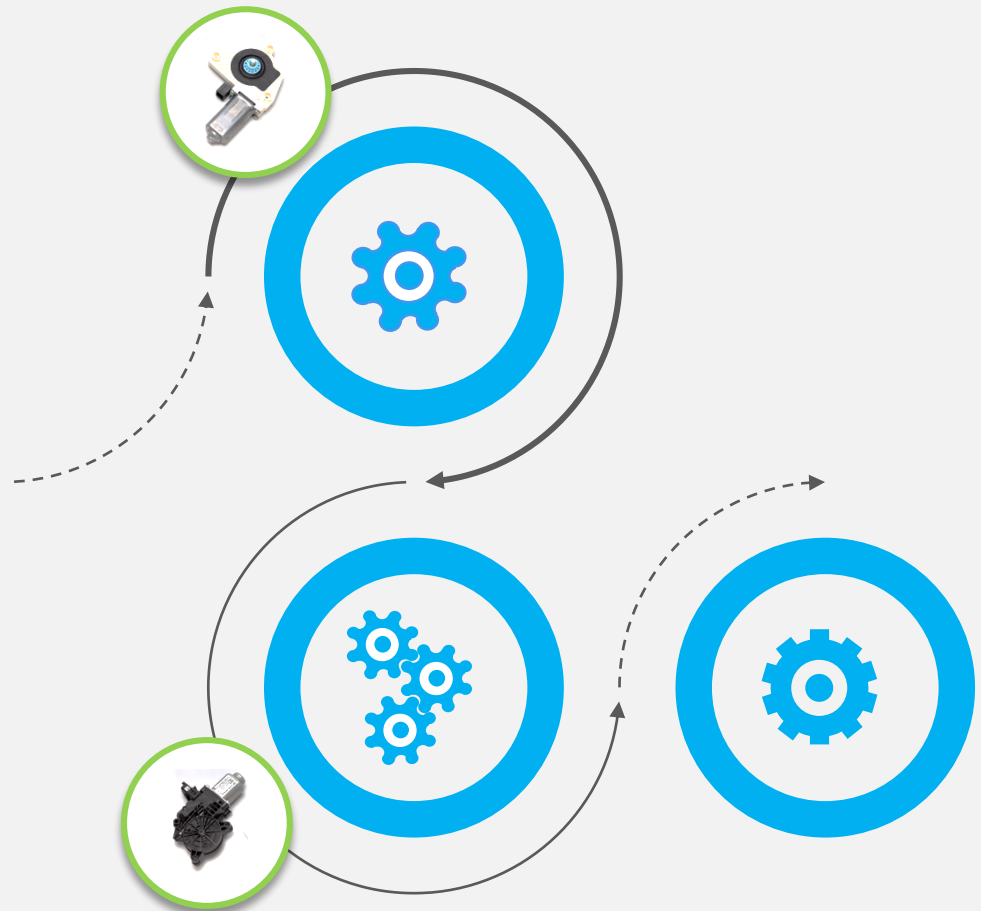
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General Information

KPAC as New POM Homopolymer Supplier

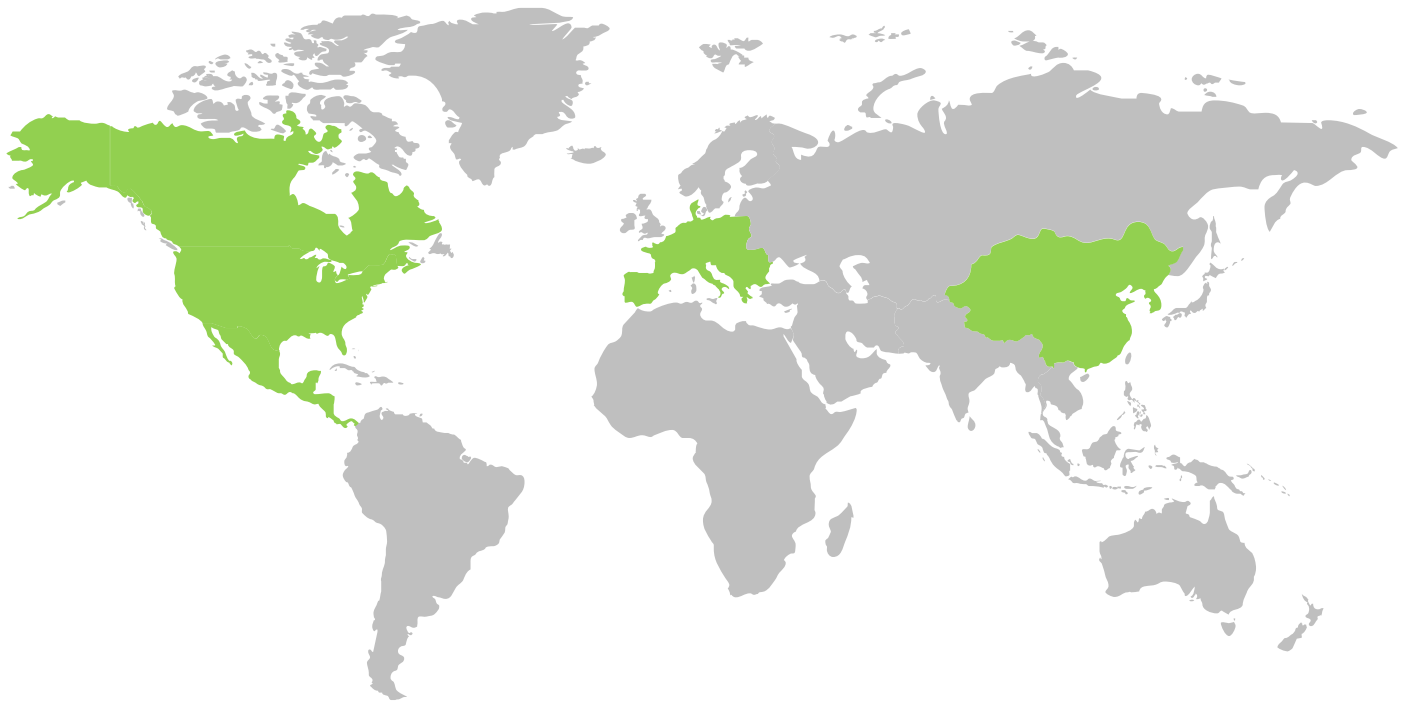
KOREA POLYACETAL (KPAC) has recently expanded its robust line of Technical polymers with the introduction of KEPITAL® H100, a new POM homopolymer. Already among the leading producers of POM copolymers, KPAC continues to innovate in the homopolymer category.

This innovation positions KPAC as a global provider of both POM copolymer And homopolymer solutions, creating a “one-stop-shop” for customers in need of POM for a variety of consumer and automotive applications. KPAC’s mission is to provide solutions for a better future. This innovation is a key component of this mission.

A high viscosity, unfilled POM homopolymer, KEPITAL® H100 is made using state-of-the-art, patented technology.

KEPITAL® H100 is setting new standards within the POM family. With the development of KEPITAL® H100, a highly viscous homopolymer type, we have introduced a homopolymer with enhanced features based on state of the art process technology. Its excellent processability and good mechanical properties opens entirely new options for our customers to manufacture sophisticated technical components out of KEPITAL®.

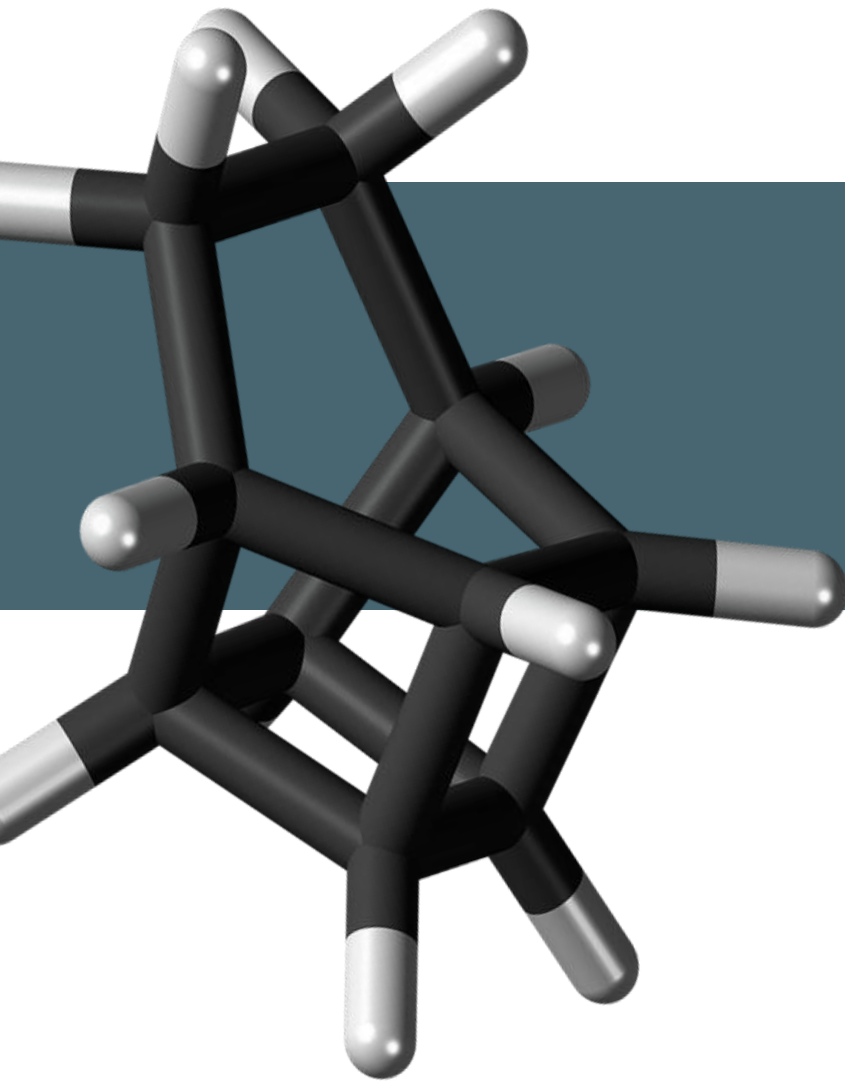




Description

- High Viscosity and Unfilled POM homopolymer
- High Strength, Hardness and Rigidity without Filler Reinforcements or Modifications
- High Toughness, High Impact Strength, and Elongation without Impact Modifiers
- Wide Processing Window for Injection Molding
- Excellent Resistance to Moisture, Gasoline, Solvents and Various Other Neutral Chemicals
- Excellent Dimensional Stability for Precision Parts
- Excellent Self-Lubricating





Chemical Structure

KEPITAL® H100 POM Homopolymer

POM(Polyoxymethylene) are categorized as either homopolymer or copolymer depending on their chemical structure. More accurately, POM homopolymer has the simplest chemical structure of all the polyethers.

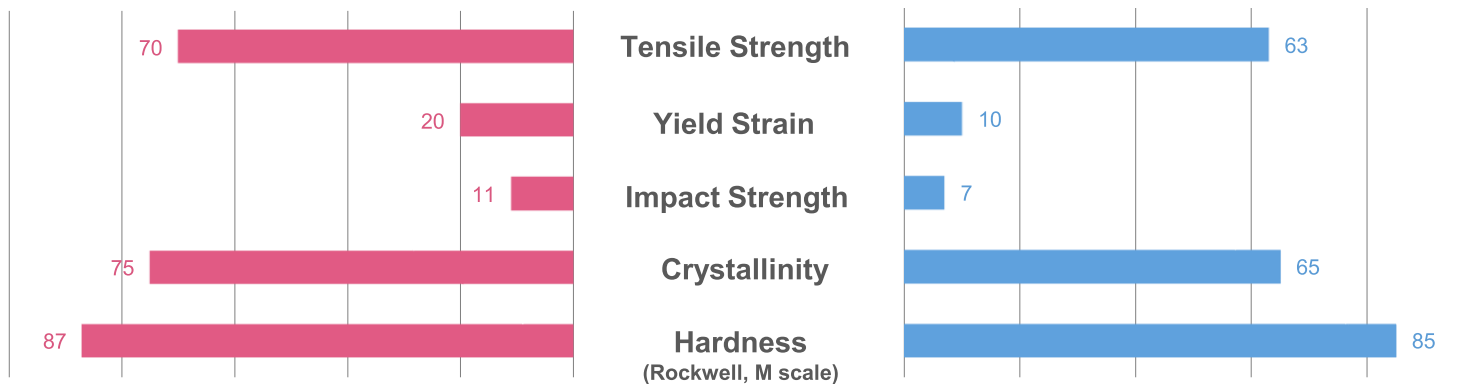
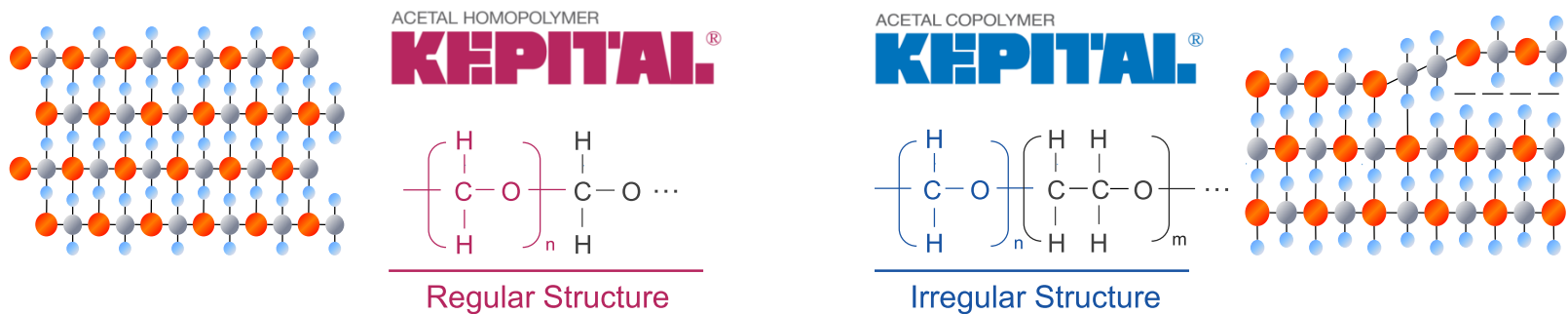
While POM copolymer has additional olefin structures between the polyethers.

With these differences, POM homopolymer exhibits 10 % higher crystallinity, which boost the mechanical properties and make it stronger and tougher.

Differences

Structure of POM Homopolymer and Copolymer

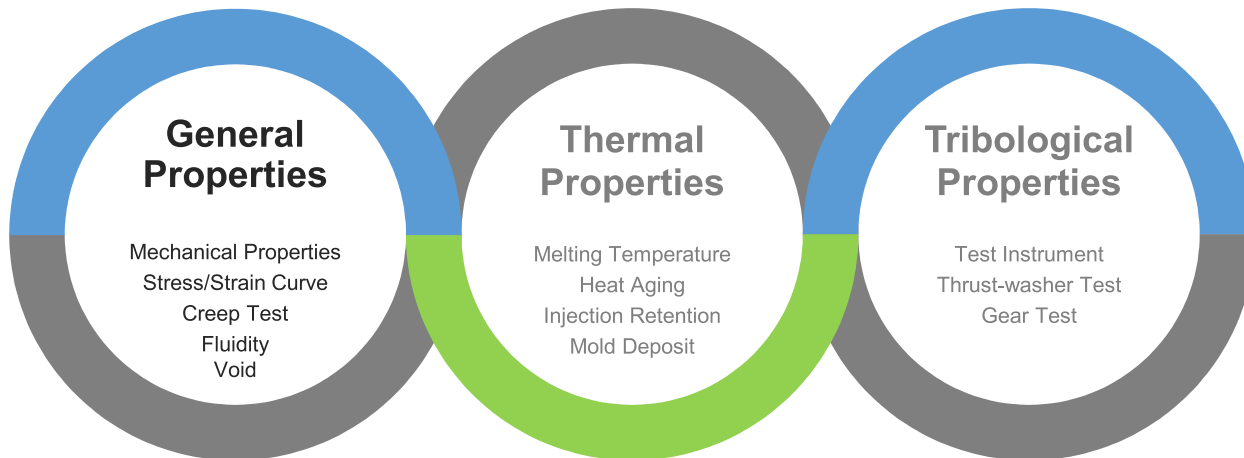
POM homopolymer has the simplest chemical structure of all the polyethers, which boost the mechanical properties of POM homopolymer compared to copolymer.



General Properties

KEPITAL® H100 POM Homopolymer

KEPITAL® H100 is superior in mechanical strength, stiffness, and toughness compared to POM copolymer. Especially, it is ideal for gears, bearings and automotive parts from its additional strength and toughness.



Comparison Table

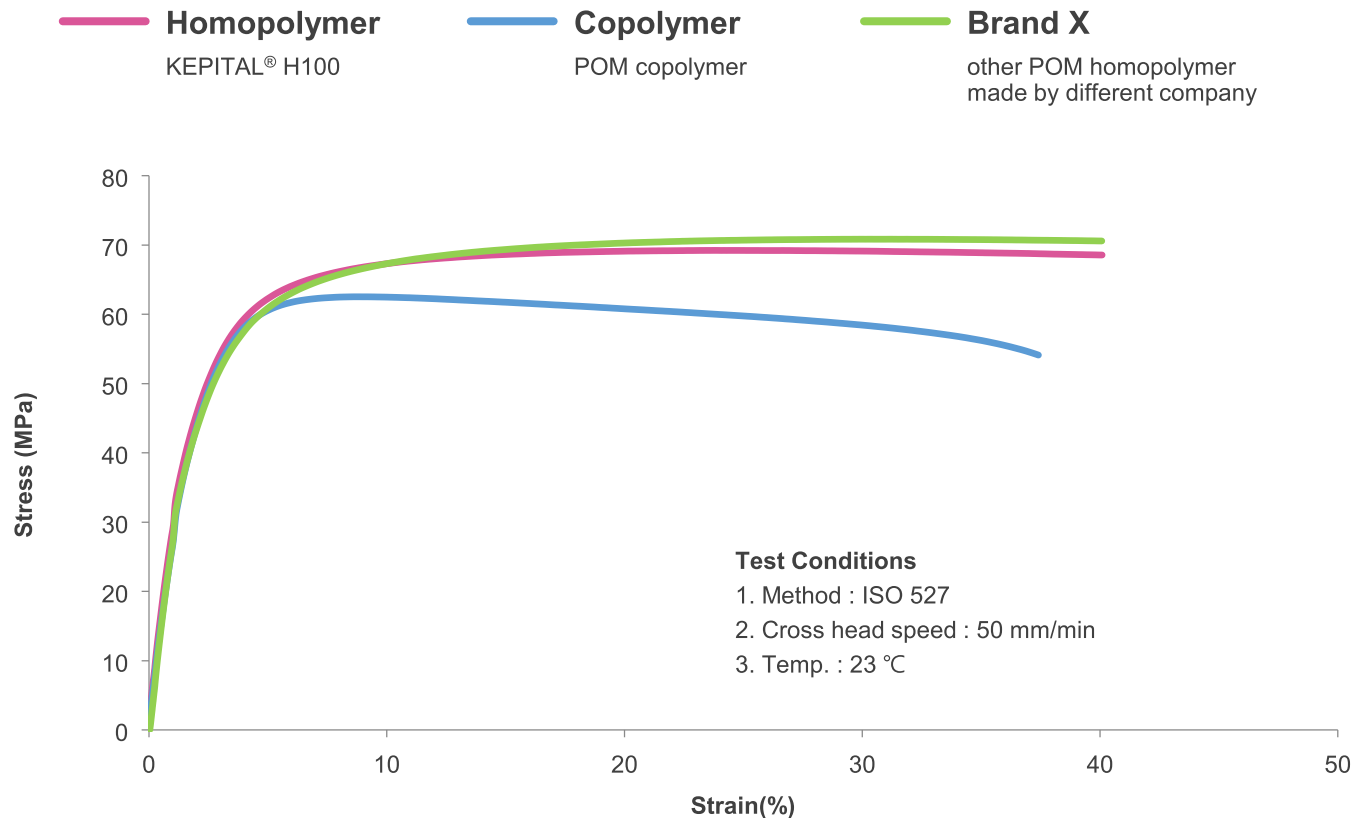
Properties	Unit	Test Method	Brand X ¹⁾	KEPITAL H100 ²⁾	POM copolymer
Physical properties					
Density	g/cm ³	ISO 1133	1.42	1.42	1.41
Melt Flow Rate(MFR 190°C, 2.16kg)	g/10 min	ISO 1133	2.6	2.2	3.0
Water Absorption(at 23°C, to 50% R.H.)	%	ISO 62	0.3	0.2	0.2
Mechanical Properties, Measured under Standard Conditions(23 °C, 50 % R.H.)					
Yield Stress	MPa	ISO 527	70	70	63
Elongation at Yield	%	ISO 527	25	20	10
Elongation at Break	%	ISO 527	40	45	40
Tensile Modulus	MPa	ISO 527	2,880	2,950	2,450
Flexural Modulus	MPa	ISO 178	2,720	2,650	2,400
Rockwell Hardness (M scale)	-	ISO 2039-1	88	87	85
Notched Charpy Impact Strength(at 23°C)	kJ/m ²	ISO 179	14	11	7
Notched Charpy Impact Strength(at -30°C)	kJ/m ²	ISO 179	11	8	6
Thermal Properties					
Heat Deflection Temperature (1.8 MPa)	°C	ISO 75	94	95	95
Melting Point DSC, 10°C/10min	°C	ISO 3146	177	176	165
Coefficient of Linear Thermal Expansion (temperature range 23 °C to 55 °C)	X10 ⁻⁵ /°C	ISO 11359	11	11	12

1) Brand X is other POM homopolymer made by different company.

2) KPAC's POM homopolymer

Stress/Strain Curve

Excellent Tensile Properties Compared to POM Copolymer



- The mechanical properties should be the principle guideline to select material from an engineer's point.
- KEPITAL® H100 has excellent tensile properties compared to POM copolymer.
- KEPITAL® H100 has similar yield stress and strain compared to other POM homopolymer.

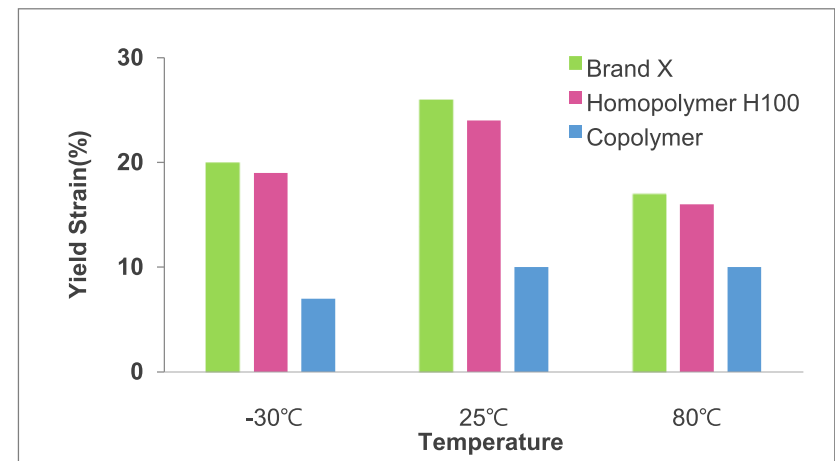
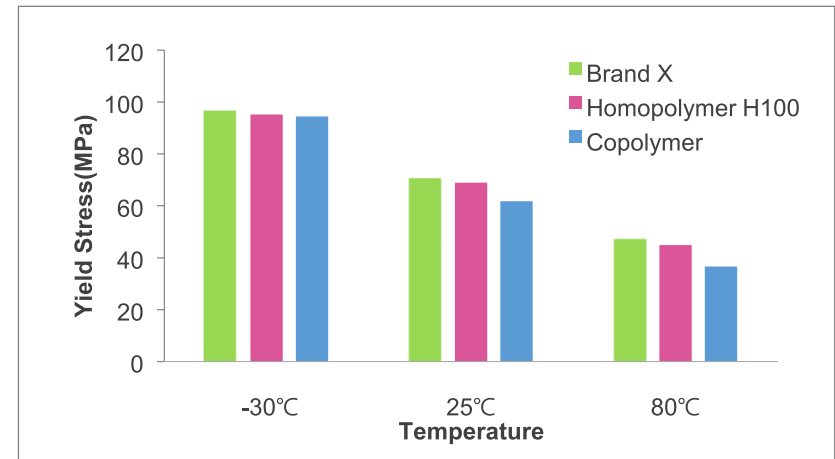
Tensile Properties

Excellent Tensile Properties Compared to POM Copolymer

Characteristics

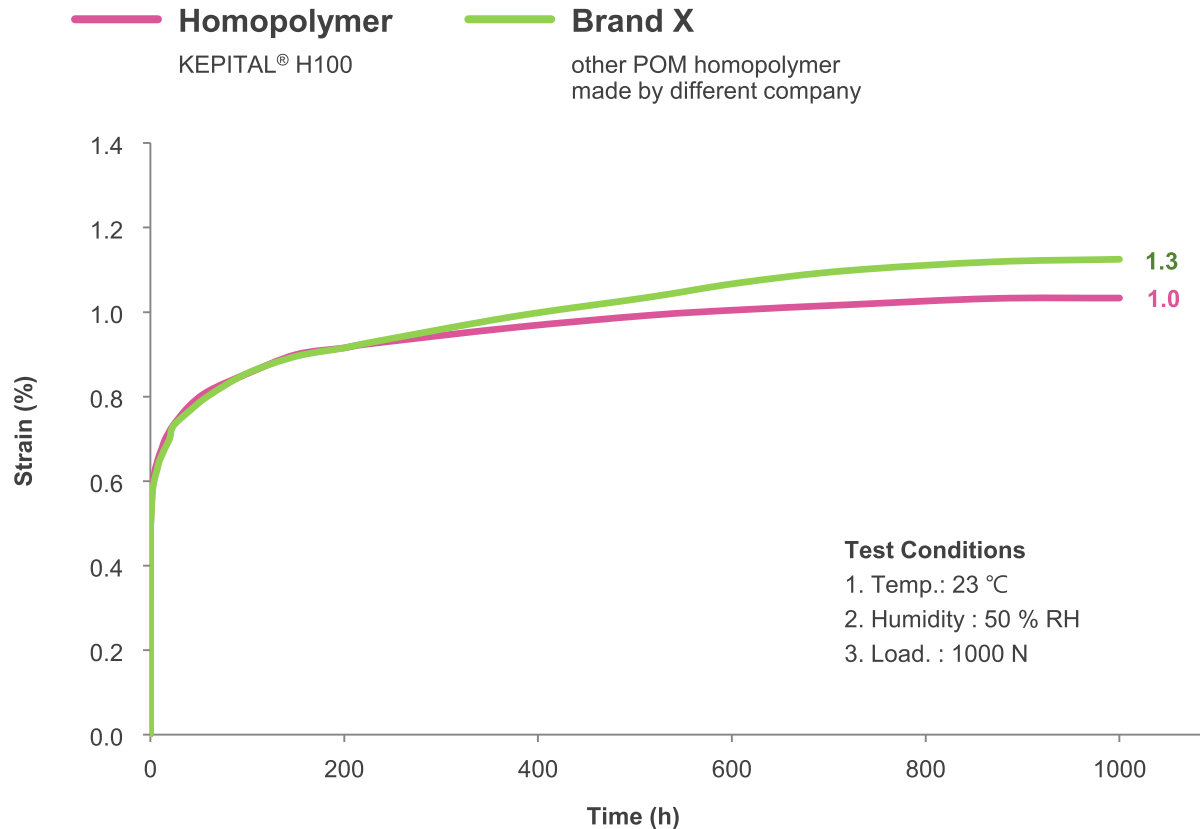
- KEPITAL® H100 exhibits similar yield stress and strain compared to other POM homopolymer at various temperatures.
- KEPITAL® H100 exhibits better stress and strain at yield compared to POM copolymer at various temperatures.

	Unit	Brand X	H100	POM copolymer
Yield stress at -30°C		96	95	94
at 23°C	MPa	70	69	62
at 80°C		47	45	37
Yield strain -30°C		20	19	7
at 23°C	%	26	24	10
at 80°C		17	16	10



Creep Resistance

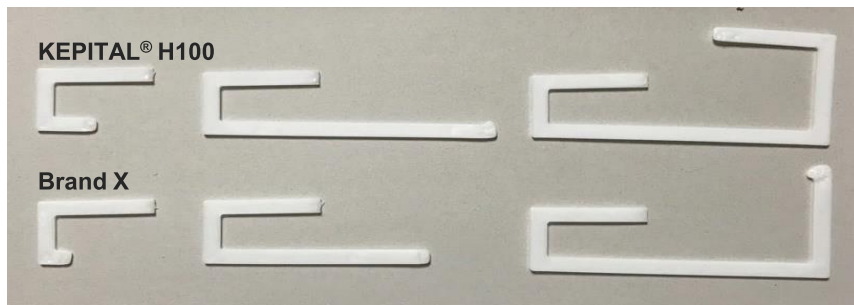
Tensile Creep Resistance Compared to Brand X



- When static stress are loaded to plastics, not only does the initial strain occur but also an incremental strain follows as time goes by due to its viscoelastic property.
- As such, less deformation under the load means that certain material has better deformation resistance property.

Flowability

Superior Flowability Compared to Brand X



Our newly developed POM homopolymer, KEPITAL® H100 exhibit better flowabilities under same injection pressure.

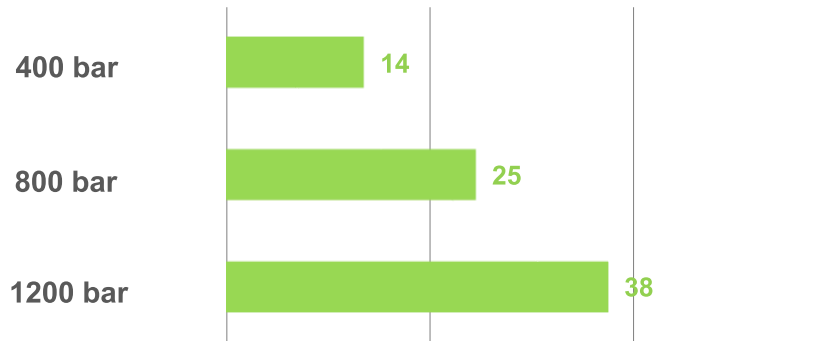
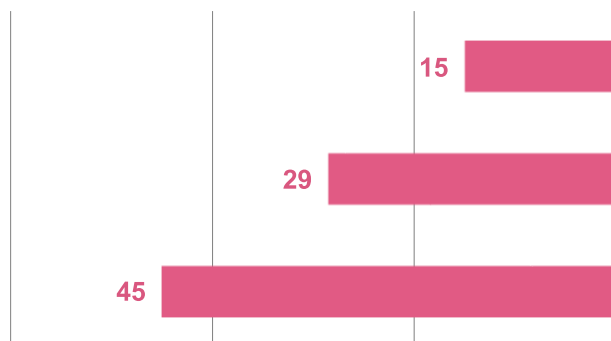


KEPITAL® H100

Our widely used POM homopolymer, Brand X exhibit slightly worse flowability, which could results in short shot or inefficient power consumption.



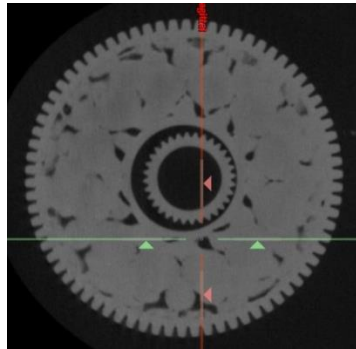
Brand X



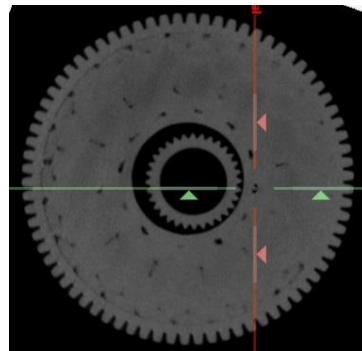
■ Injection speed : 20 mm/s Injection time: 3 sec Injection pressure : 400, 800 & 1,200 bar

Void Occurrence

Reduction in Void Occurrence under Injection Molding



(Brand X)



(KEPITAL® H100)



Injection Conditions

- Injection Machine Tonnage : 300 ton
- Runner Type : Hot runner
- Product Cavity : 6 cavity
- Injection Pressure : Brand X is 175 bar
KEPITAL H100 : 130 bar
*Save up to 25 % of pressure



Application

- Worm Wheel Gear
for Auto power Window Motor



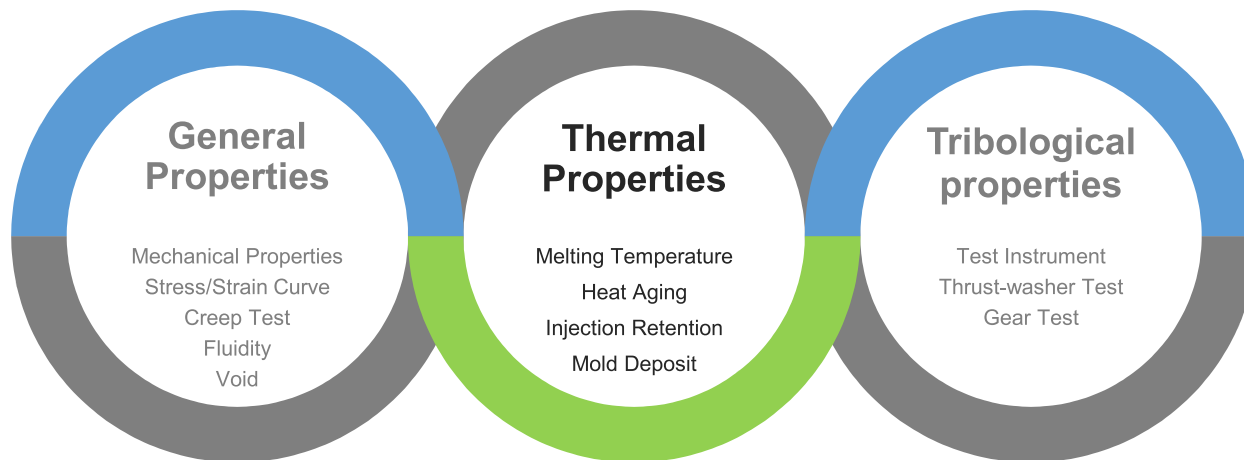
Void Comparison

- Size of void : KEPITAL® H100 < Brand X
- Number of void : KEPITAL® H100 < Brand X
- KEPITAL® H100 contain less number and size of void (which is also called 'low density center') under less filling pressure.

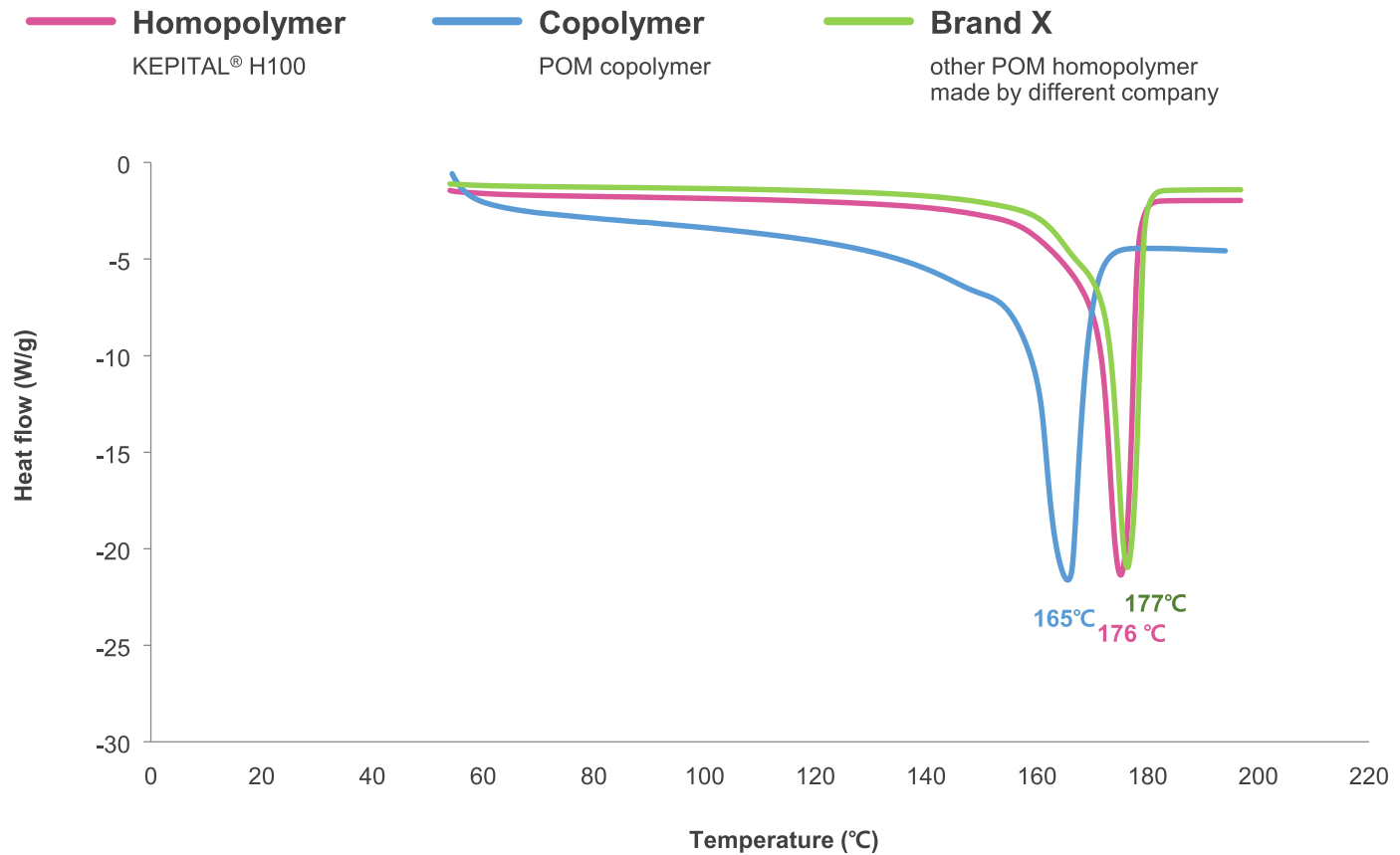


Thermal Properties

KEPITAL® H100 POM Homopolymer



Melting Point



- Generally, the melting point of a POM homopolymer is between 175 and 177 °C.
- While the melting point of a POM copolymer is 165 °C.
- KEPITAL® H100 is a highly crystalline engineering plastic with excellent mechanical properties.

Thermal Resistance

Improved Thermal Behavior under High Temperature Aging

Test Conditions

- Test Instrument : UL Spec. Oven
- Test Specimen : ISO Tensile Specimen
- Test Temp. : 140 °C
- Test Time : 1 week



Heat Aging Evaluation

- Brand X : particles chalked on the surface
- KEPITAL® H100 : chalking didn't occur.
- Less discoloration issue with KEPITAL® H100
- KEPITAL® H100 exhibits superior thermal stabilities compared to Brand X.



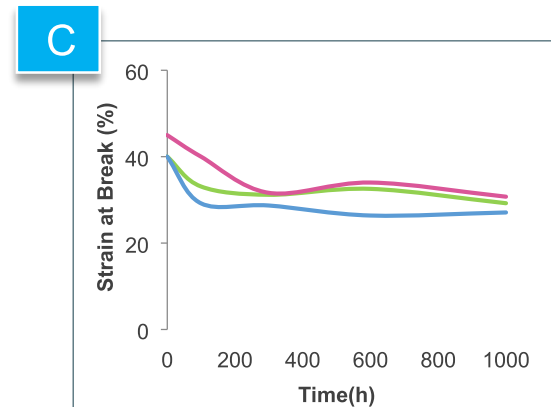
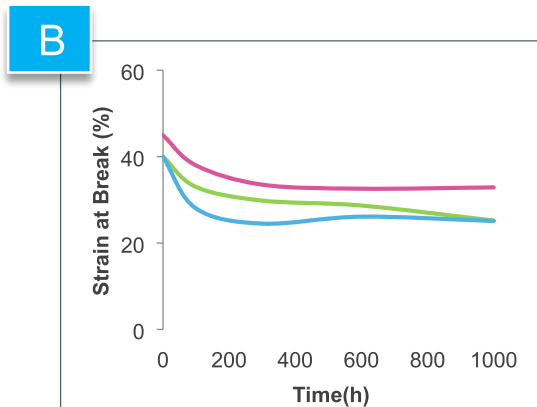
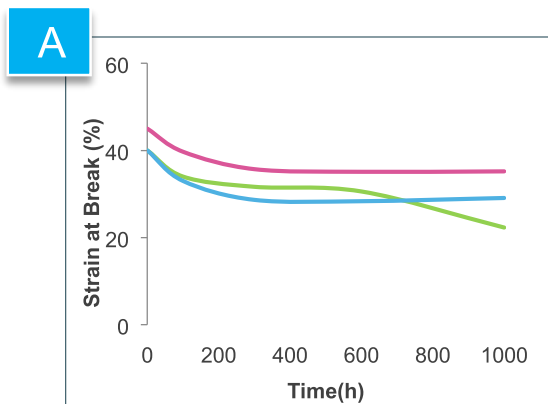
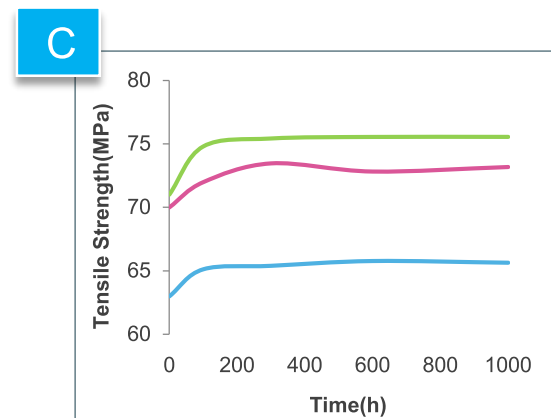
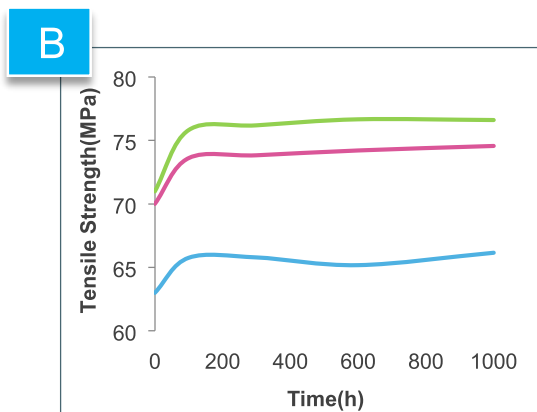
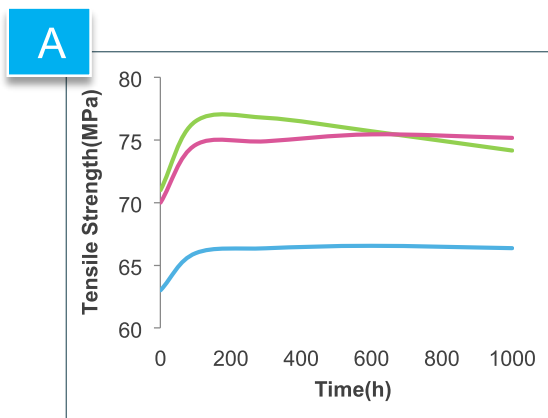
Thermal Behavior

Better Thermal Stability at Elevated Temperature

— Homopolymer
KEPITAL® H100

— Copolymer
POM copolymer

— Brand X
other POM homopolymer
made by different company



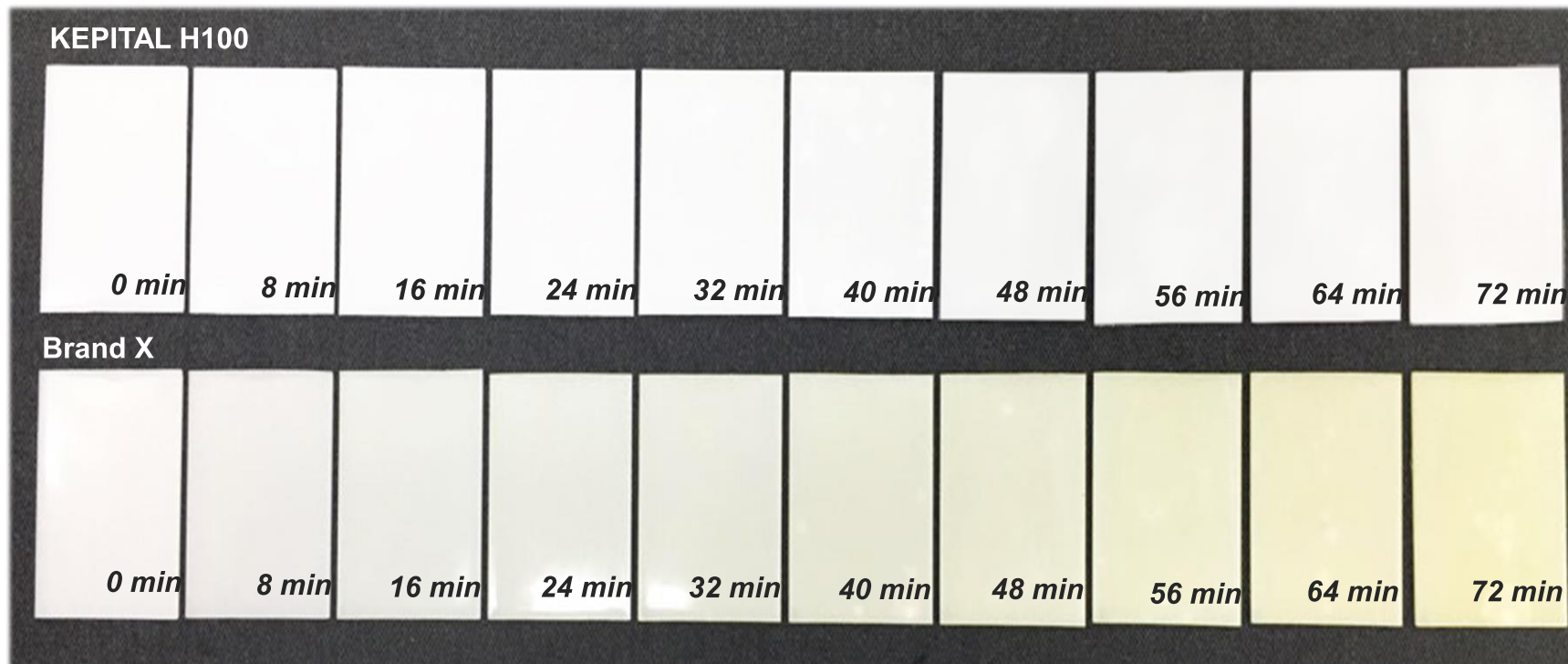
A : 120 °C, Heat Aging

B : 100 °C, Heat Aging

C : 80 °C, Heat Aging

Discoloration in Barrel

Less Discoloration with KEPITAL® H100



Test Conditions

- Injection Temp. : 220/220/220/220 °C
- Retention Time : Each 8 min.
- Clamping Force : 100 ton (FANUC)



Color Change

- KEPITAL® H100 exhibits less discoloration issue after coming out from injection barrel.
- KEPITAL® H100 provides wide process window with its excellent thermal stability.

Mold Deposit

Less Mold Deposit with KEPITAL® H100



(H100 100 shot)



(H100 300 shot)



(H100 500 shot)



(H100 1,000 shot)



(Brand X 100 shot)



(Brand X 300 shot)



(Brand X 500 shot)



(Brand X 1,000 shot)



Injection conditions

- Injection Temp. : 200/190/180/175 °C
- Mold Temp. : 80 °C
- Cycle Time : 27.5 Sec
- Clamping Force : 100 ton (FANUC)



Mold Deposit Evaluation

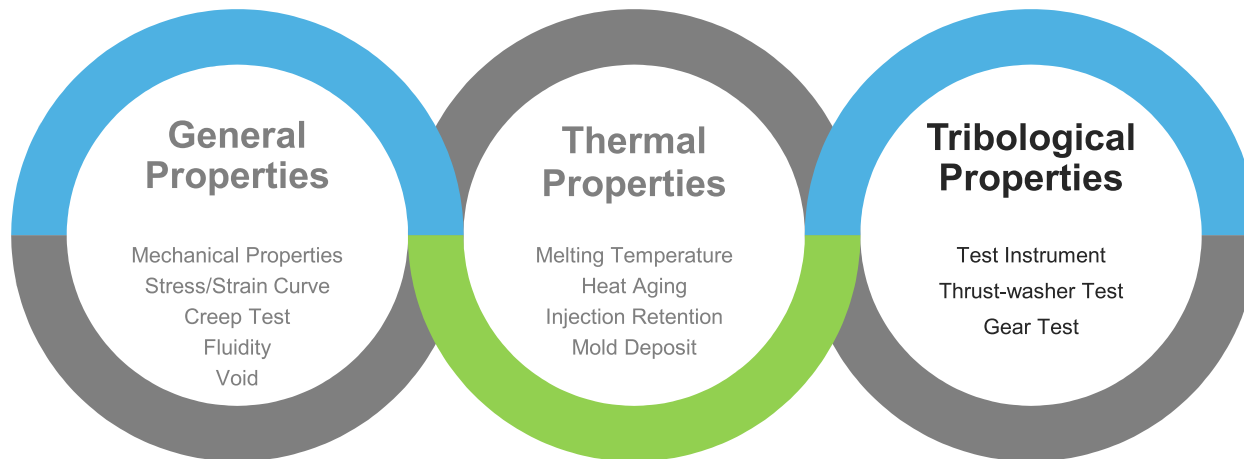
- Less mold deposit issue with KEPITAL® H100
- Enjoy cost-saving effect with longer cleaning frequency.



Tribological Properties

KEPITAL® H100 POM Homopolymer

KEPITAL® H100 has excellent anti-friction and wear properties. It can be used for various applications including gears, automotive door systems, bushings, housings, rollers and conveyor belts, etc.

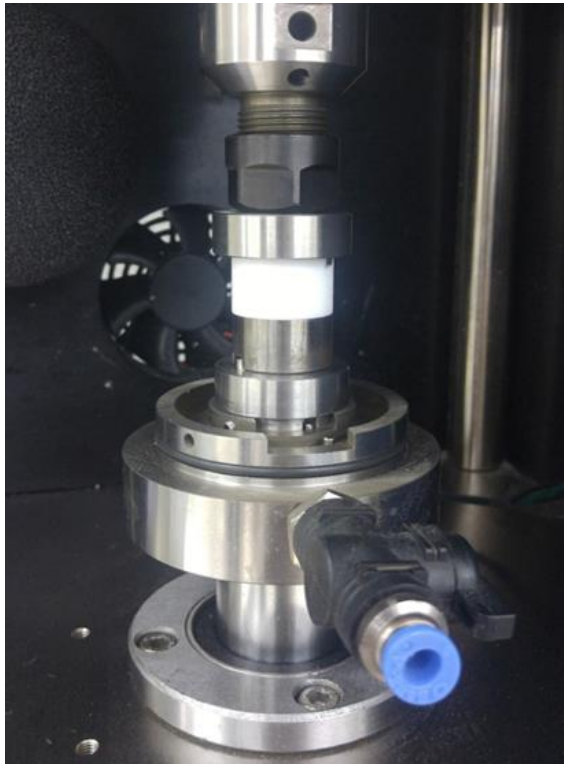


Test Instrument

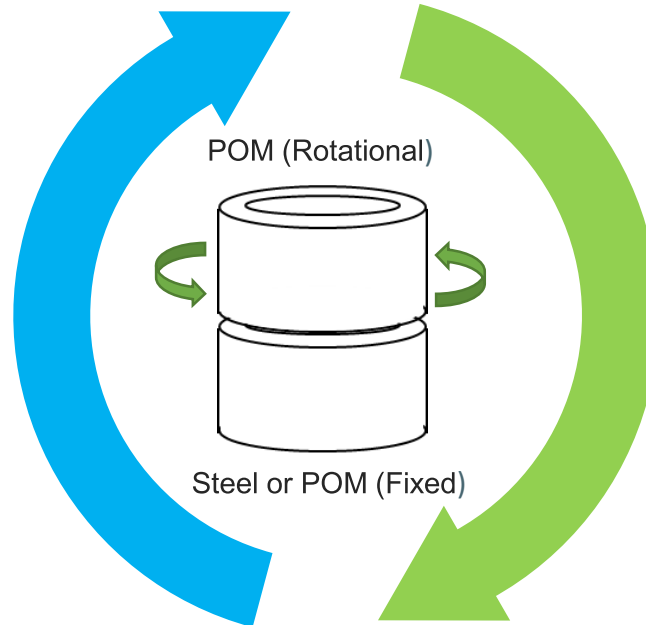
KPAC Can Provided Two Different Values of Operation Properties

Test items

- Dynamic friction coefficient
 - Specific wear amount



<Thrust washer tester (Ring-on-Ring type)>



$$V_s = \frac{V}{P \cdot L}$$

V_s : specific wear amount ($\text{mm}^3/\text{N}\cdot\text{km}$)

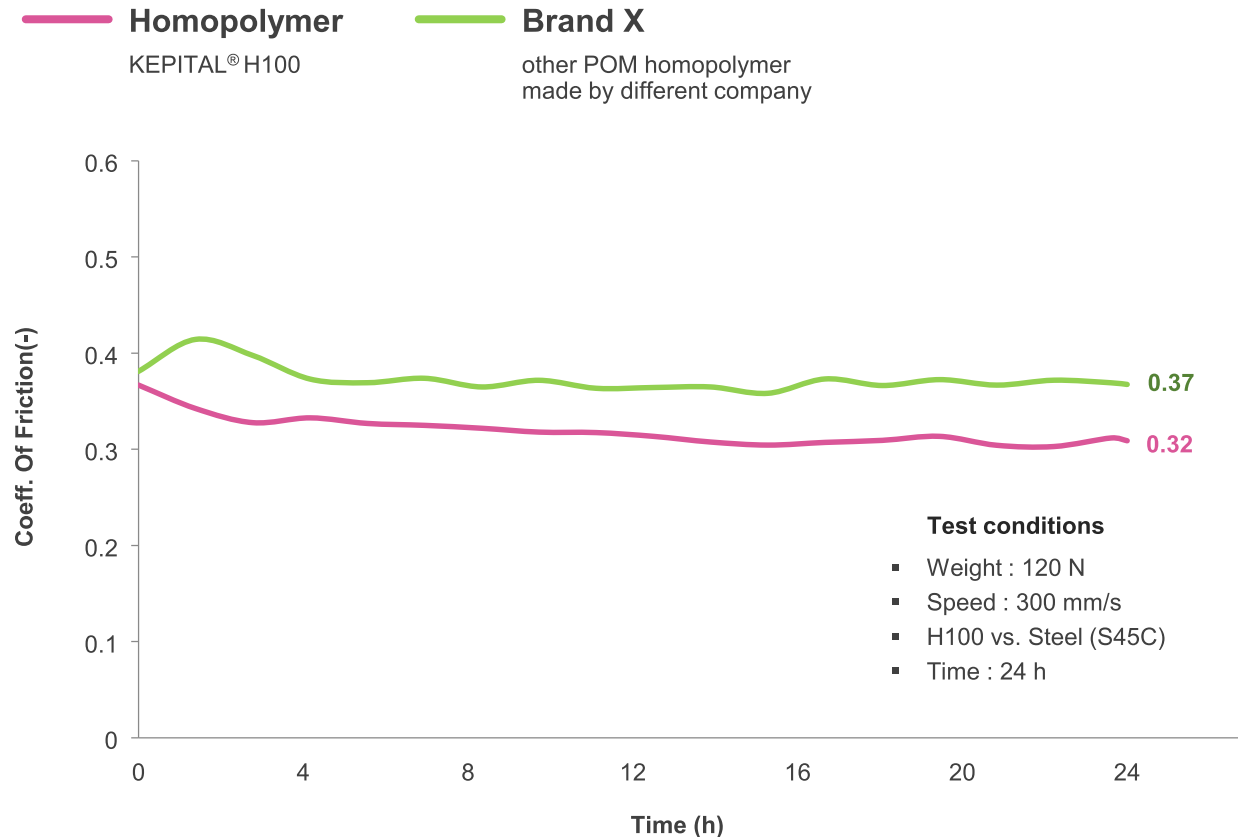
V : amount of wear (mm^3)

P : testing load (N)

L : average sliding distance (km)

Dynamic Coeff. of Friction (vs. metal)

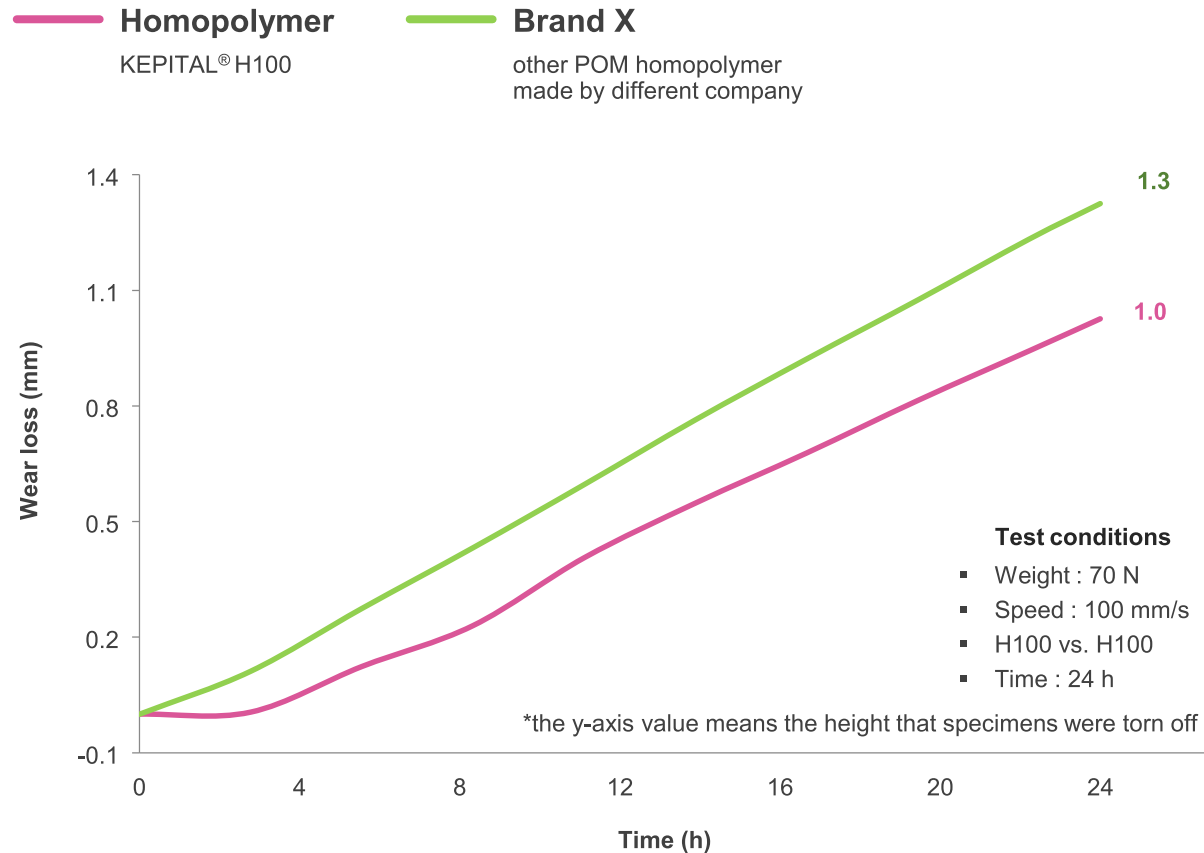
Superior Coefficient of Friction when Sliding with Metal



- KEPITAL® H100 has superior value of dynamic coeff. of friction compared to Brand X.

Wear Loss (vs. Itself)

Superior Wear Loss when Sliding with Itself



- KEPITAL® H100 has superior wear loss compared to Brand X.
- Dynamic coefficient of friction of KEPITAL® H100 and Brand X were measured as 0.4.

Gear Tooth Strength

KEPITAL® H100 Exhibit Similar Gear Tooth Strength Compared to Brand X



- KEPITAL® H100 has excellent gear tooth strength compared to POM copolymer.
- KEPITAL® H100 has similar gear tooth strength compared to Brand X.

Gear tooth strength

	Unit	Brand X ¹⁾	H100 ²⁾	POM copolymer
Results	kg _f • cm	137	137	125

1) Brand X is other POM homopolymer made by different company.

2) KPAC's POM homopolymer

Gear specifications

Item	Value
Gear Type	Spur Gear
Number of Gear Teeth	48 each
Pressure Angle of Gear	15°
Gear Module	0.9

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Thank you