



# POKETONE

## Abrasion behavior & performance

2021. Feb.

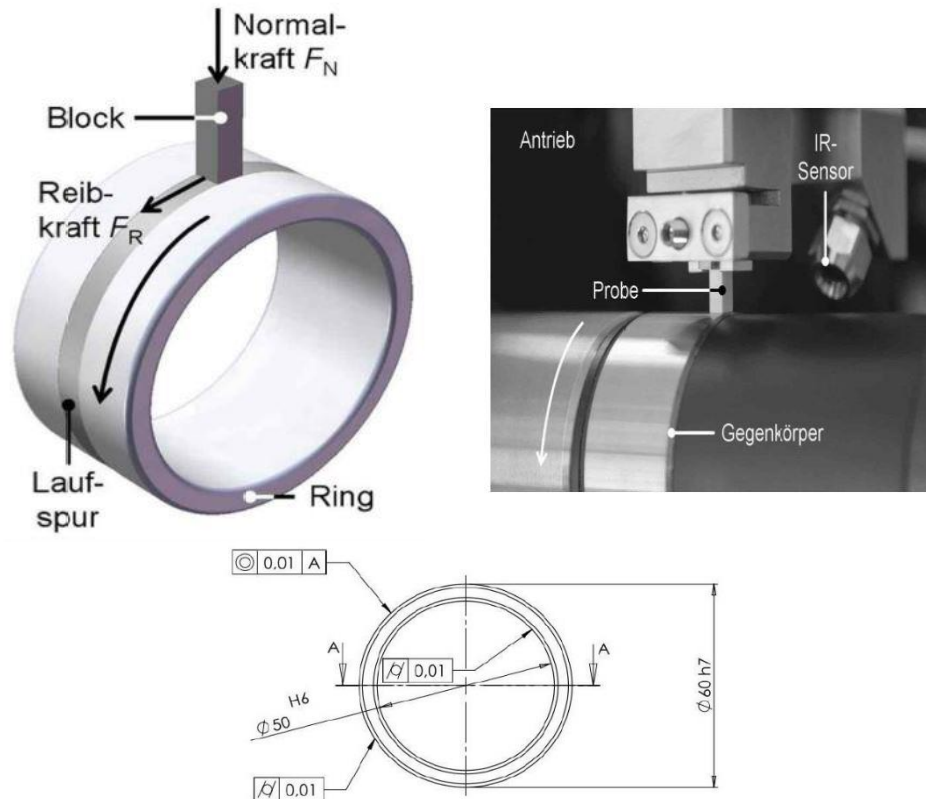
POK Business Division, Hyosung Chemical

**POKETONE**<sup>TM</sup>  
HYOSUNG POLYKETONE

# 1. Introduction to Test Method : ASTM G 137

What is test standard of ASTM G 137 ?

- Measure total abrasion loss on the ring during being rotated with the pressure of the block
- Available test range  
Temperature from room temp. up to max. 225°C, rotational speed of rings (0.01m/s to 2m/s), pressure on the block (5MPa to 30MPa)  
→ to check and measure the linear wear rate (unit : depth of um/hour)
- Specimen dimension  
Ring (50mm dia. x 28mm width), Block (6.35mm W x 6.00mm L x 12.7mm H)



[Wear resistant test in room Temp.]

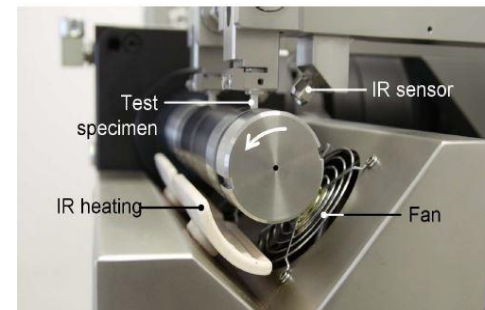


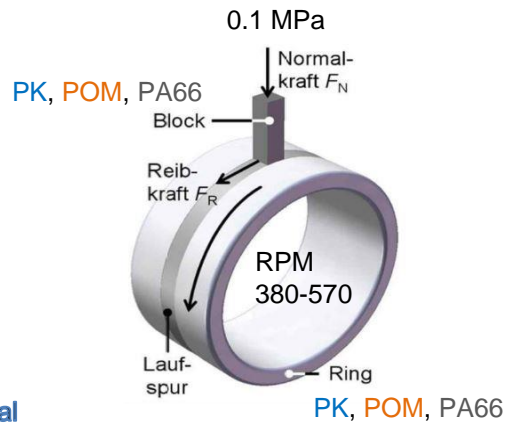
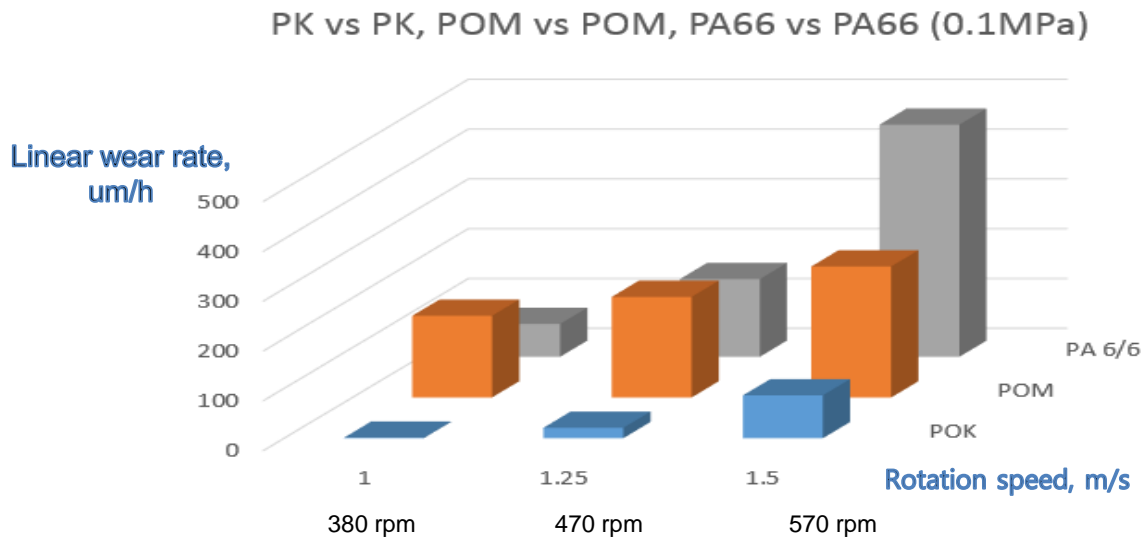
Figure 9: Temperature control unit of the Atlas TT, consisting of a powerful infrared radiator, an infrared thermometer and a cooling fan.

[Allowable limit Temp : 225°C with thermal heater]

# 2. Resin on Resin Test Result by ASTM G 137

- ① Same materials of block & ring
  - Same Condition except maintaining 0.1 MPa

► Under 1.5m/s, 0.1MPa Condition, PK abrasion loss is the lowest among the test materials.



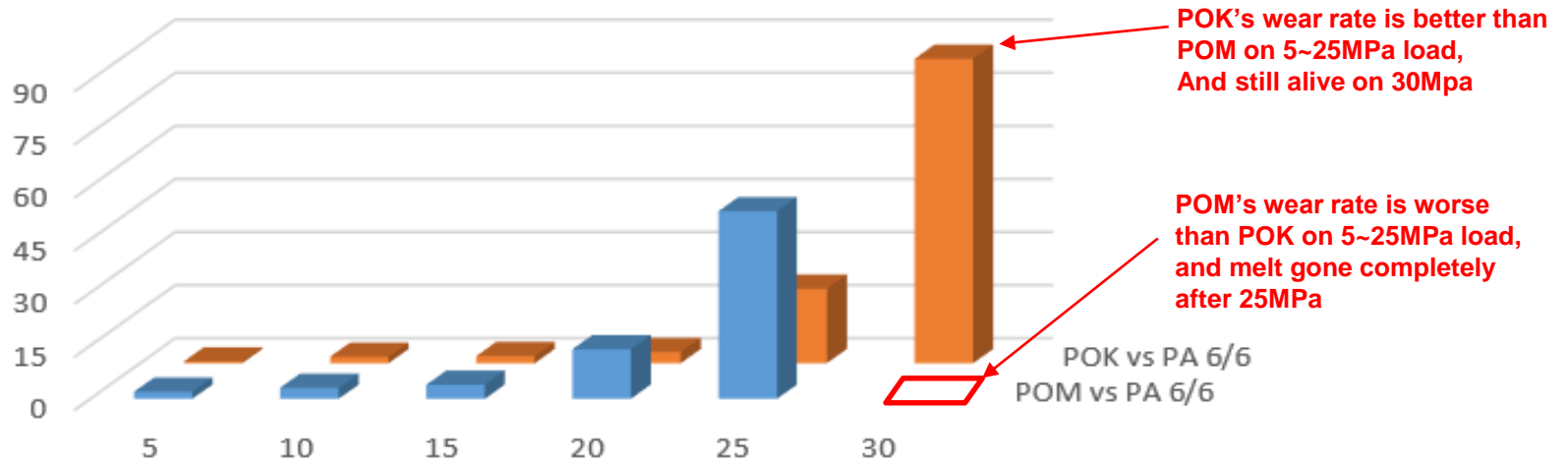
Case I.			Case II.			Case III.			Condition			
Block	Ring	Abrasion loss (um/hr)	Block	Ring	Abrasion loss (um/hr)	Block	Ring	Abrasion loss (um/hr)	Pressure (MPa)	Speed m/s (rpm)	Temp(°C)	Time (hr)
PK	PK	1	POM	POM	164	PA66	PA66	66	0.1	1.00 (380)	23	1
		21			202			156		1.25 (470)		1
		<b>86</b>			<b>263</b>			<b>466</b>		<b>1.50 (570)</b>		1

- 1) Materials : **PK** = M630A base resin, **POM** = Duracon M90-44 base resin, **PA66** = Zytel 101 base resin
- 2) However, PK wear rate is dramatically worse than higher condition of 1.5m/s speed, 0.1MPa load.
  - Abrasion loss (1.75m/s, 0.1MPa) : PK=1,078um/h, POM=619um/h, PA66=1,135um/h
  - Abrasion loss (1m/s, 0.175MPa) : PK=48,226um/h, POM=49um/h, PA66=149um/h

② Different material of block and ring (Block PK / POM , Ring PA66)  
- Temp 130 °C, Load (5~30MPa), Rotational Speed (0.07m/s fixed)



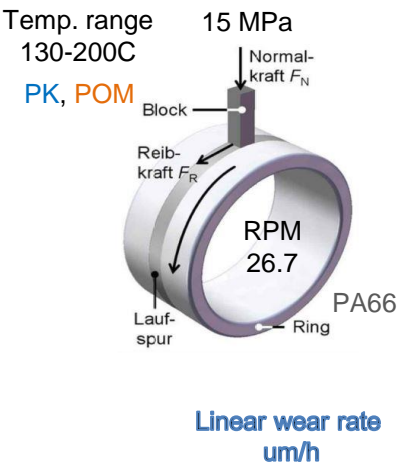
PK vs PA66, POM vs PA66 (0.07m/s)



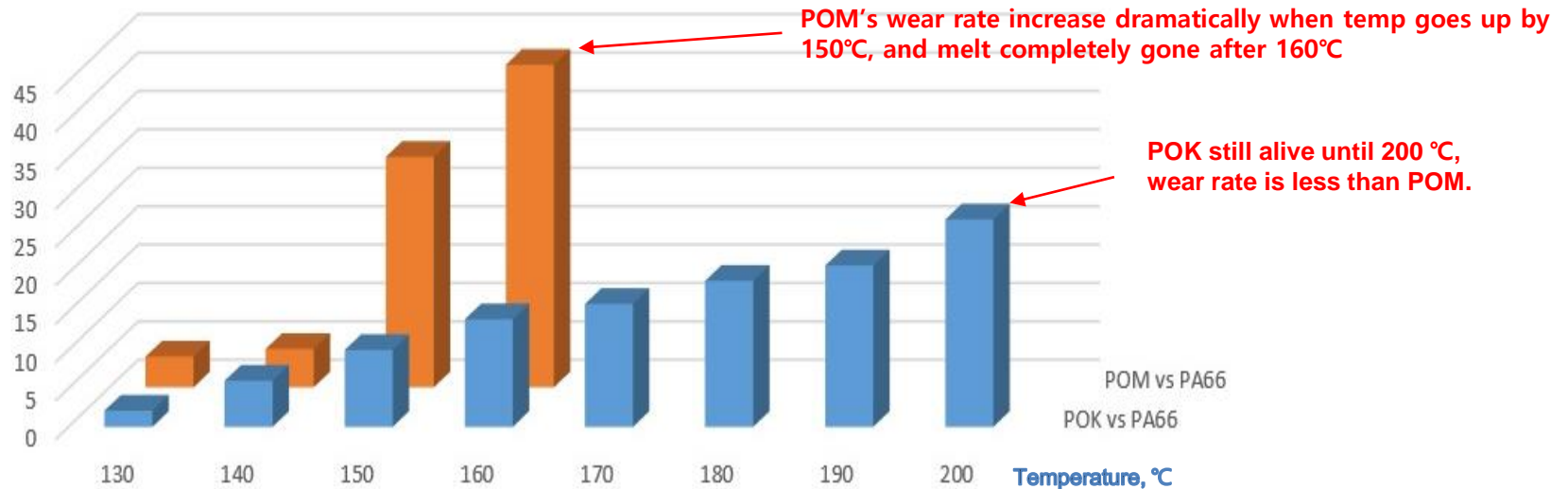
Case I.			Case II.			Condition			
Block	Ring	Abrasion loss ( $\mu\text{m/hr}$ )	Block	Ring	Abrasion loss ( $\mu\text{m/hr}$ )	Pressure (Mpa)	Speed	Temp ( $^{\circ}\text{C}$ )	Time (hr)
PK	PA66	0.5	POM	PA66	2.0	5	0.07m/s (26.7 rpm)	130	1
		1.8			3.1	10			1
		2.0			4.0	15			1
		3.1			14.0	20			1
		21.0			53.0	25			1
		86.0			-	30			1
		-			-	35			1

1) Material : **PK** = M630A base resin, **POM** = Duracon M90-44 base resin, **PA66** = Zytel 101 base resin

③ Different material of block and ring (Block PK / POM , Ring PA66)  
– Temp 130~200°C, Load 15Mpa, Rotational Speed (0.07m/s fixed)



PK vs PA66, POM vs PA66 (130~200°C)



Case I.			Case II.			Test Condition			
Block	Ring	Abrasion loss (um/hr)	Block	Ring	Abrasion loss (um/hr)	Pressure (MPa)	Speed	Temp (°C)	Time (hr)
PK	PA66	5	POM	PA66	6	15	0.07m/s (26.7 rpm)	140	1
		10			30			150	1
		14			42			160	1
		16			3,202			170	1
		19			-			180	1
		21			-			190	1
		27			-			200	1

1) Material : **PK** = M630A base resin, **POM** = Duracon M90-44 base resin, **PA66** = Zytel 101 base resin

- THANK YOU -

# Comparison properties major engineering resin

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## *“High Impact Strength”*

- More than 230% higher impact strength compared to Nylon, PBT.
- No deterioration due to good hydrolysis resistance.

Items		Unit	PK	PA6	PA66	PBT	POM
Density		g/cm <sup>3</sup>	1.24	1.14	1.14	1.30	1.41
Melting Temperature		°C	220	220	260	220	160
Impact Strength		KJ/m <sup>2</sup>	10	5.2	4.1	5.0	6.5
Tensile Strength	Dry	MPa	65	80	80	55	65
	Conditioned		65	55	70	-	-
	Wet		60	35	50	-	-
Elongation at Break	Dry	%	270	17	19	16	35
	Conditioned		270	40	60	-	-
	Wet		390	360	370	-	-
Flexural Modulus	Dry	MPa	1,400	2,600	2,900	2,400	2,500
	Conditioned		1,400	1,200	2,200	-	-
	Wet		1,350	600	1,100	-	-

\* Dry: 23°C, 50% RH, 24hrs    Conditioned: 23°C, 50% RH, 60days    Wet: 23°C, 90% RH, 60days

\*\* PK : Hyosung POKETONE M330A properties

\*\*\* There may have different result depends on evaluation environment between specific other materials

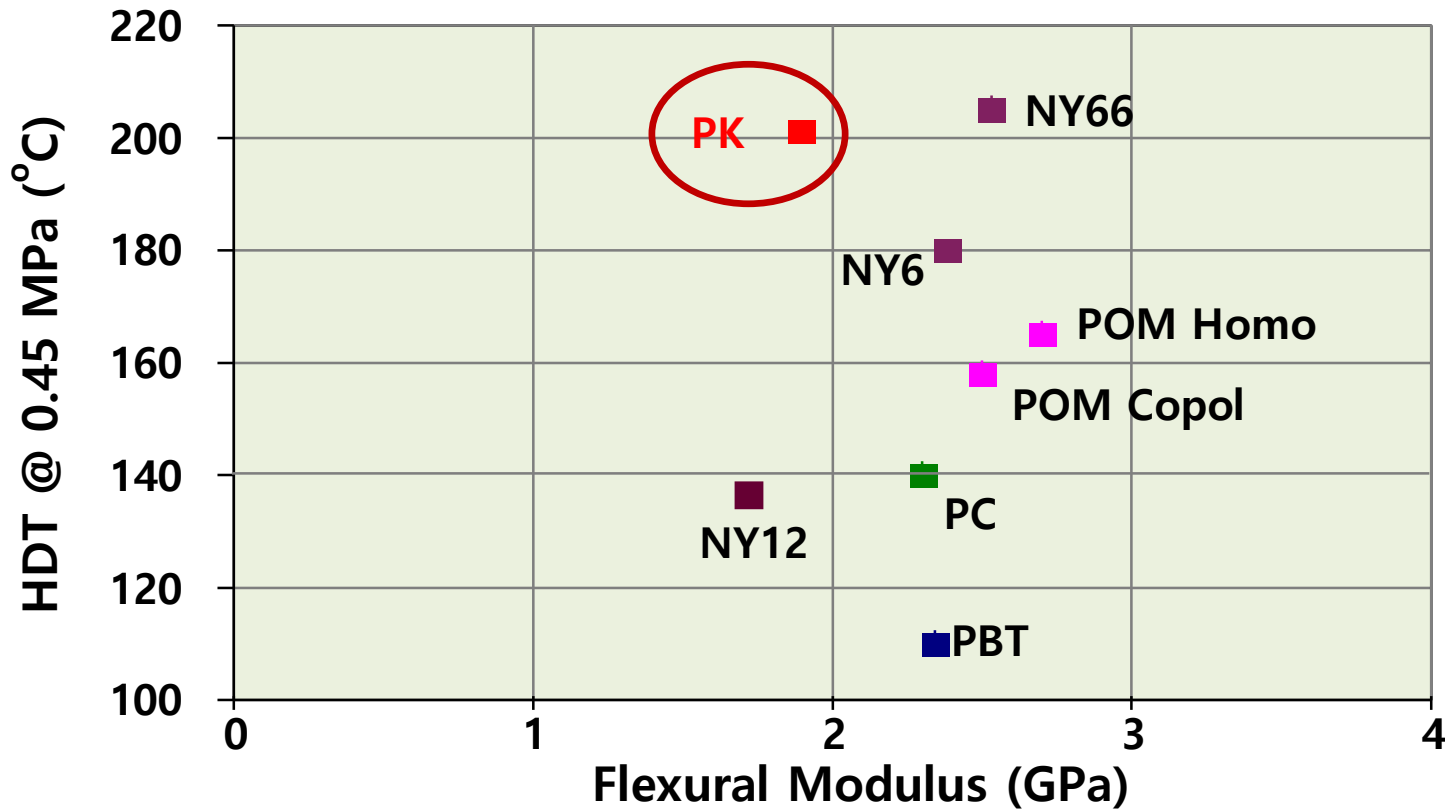


# Comparison properties major engineering resin

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## "High Heat Deflection Temperature(HDT)"

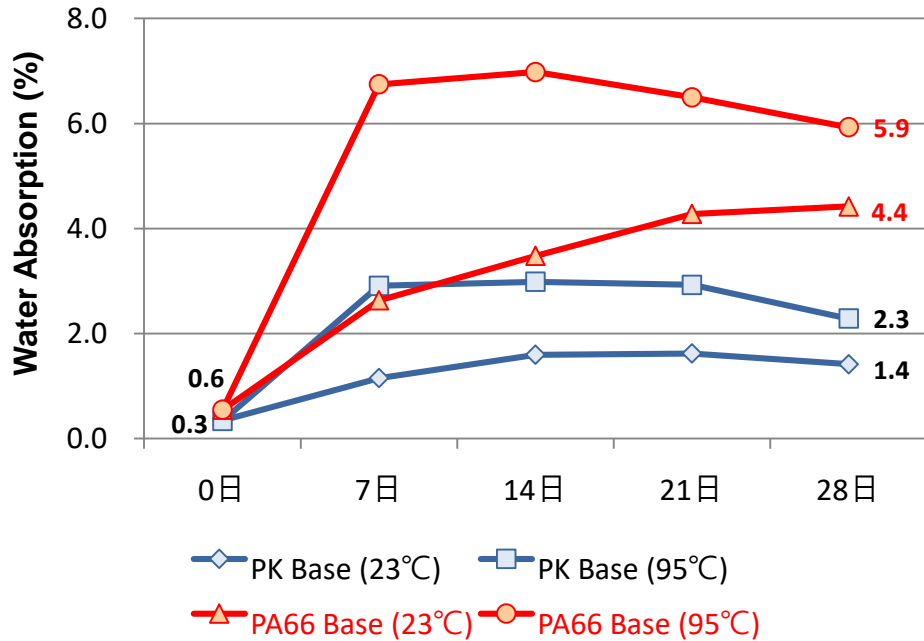
- Polyketone's HDT is 205°C, superior to other material, possible to use at high temperature circumstance.



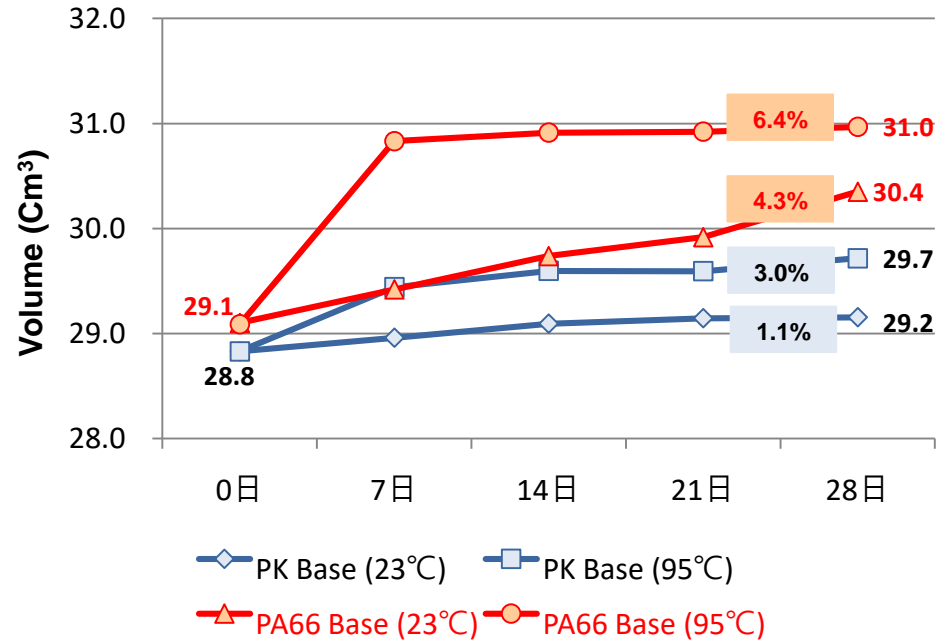
# 3 The Hydrolysis Resistance for Water Applications

## PK Base vs PA66 Base, @23°C, 95°C, 28days

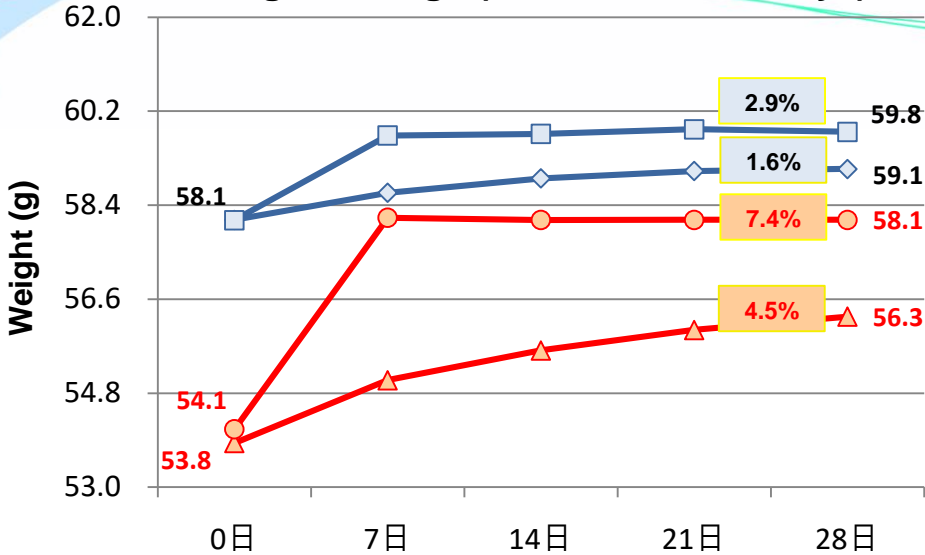
Water Absorption (@23°C, 95°C / 28days)



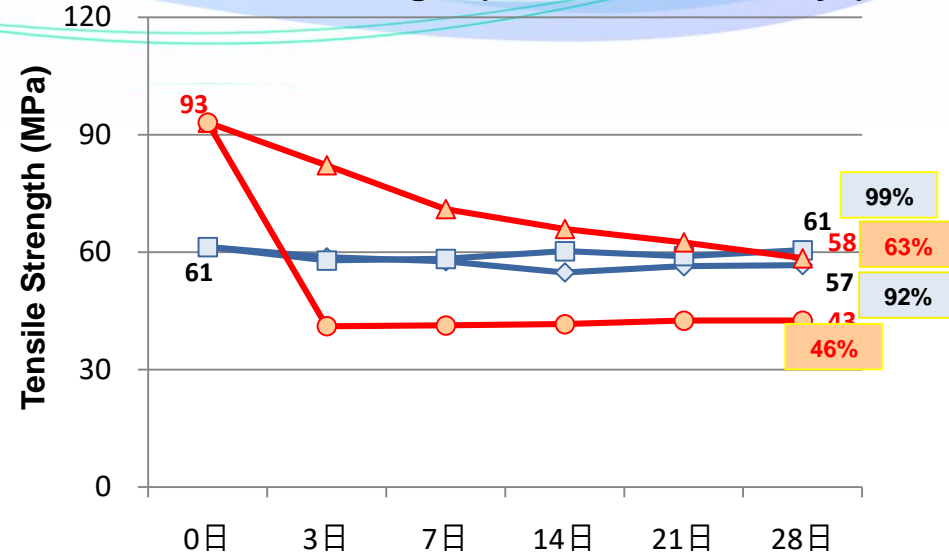
Volume Change (@23°C, 95°C / 28days)



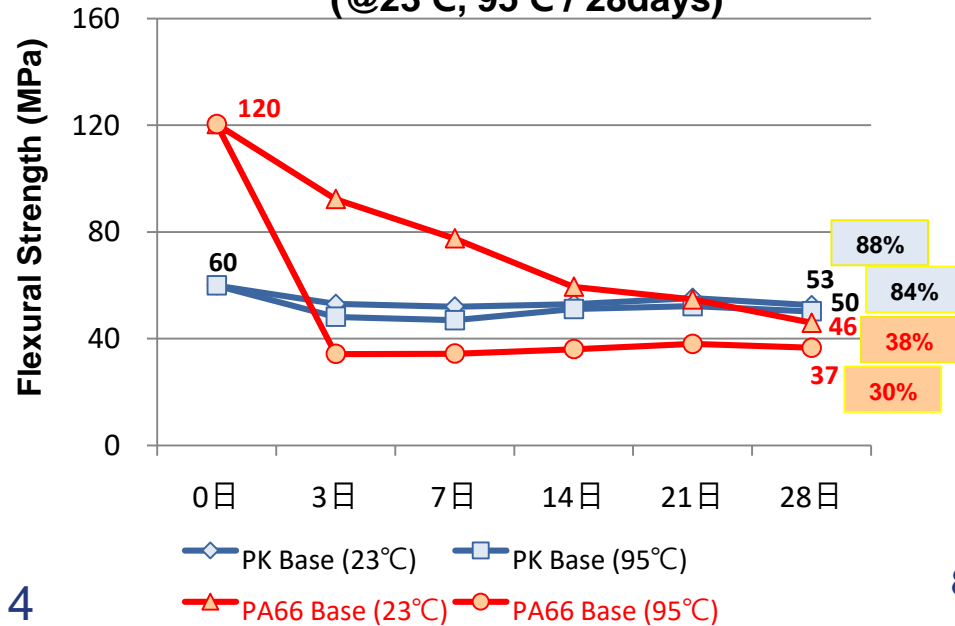
### Weight Change (@23°C, 95°C / 28days)



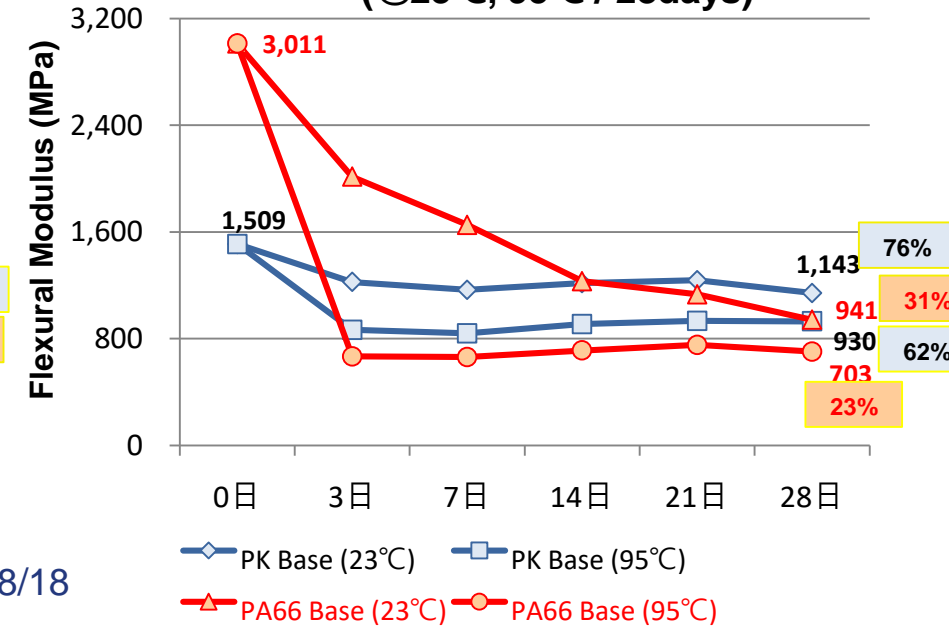
### Tensile Strength (@23°C, 95°C / 28days)



### Flexural Strength (@23°C, 95°C / 28days)



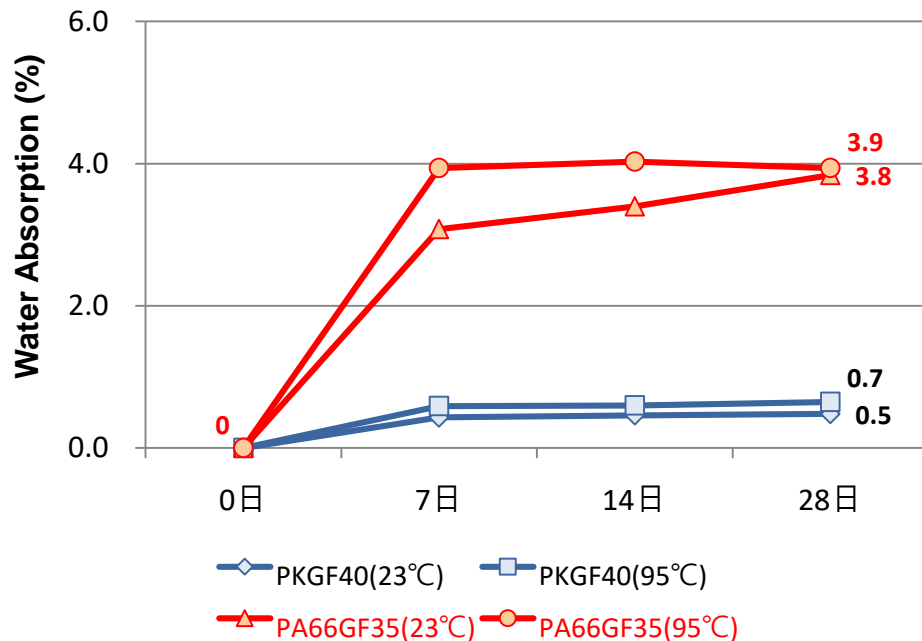
### Flexural Modulus (@23°C, 95°C / 28days)



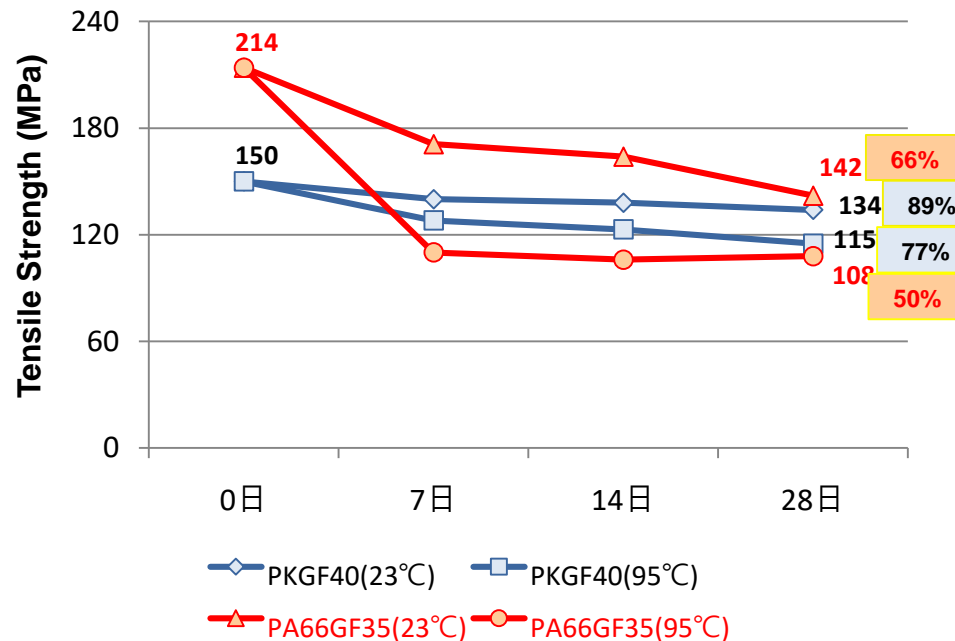
# The Hydrolysis Resistance for Water Applications

PK/GF40% vs PA66/GF35%, @23°C, 95°C, 28days)

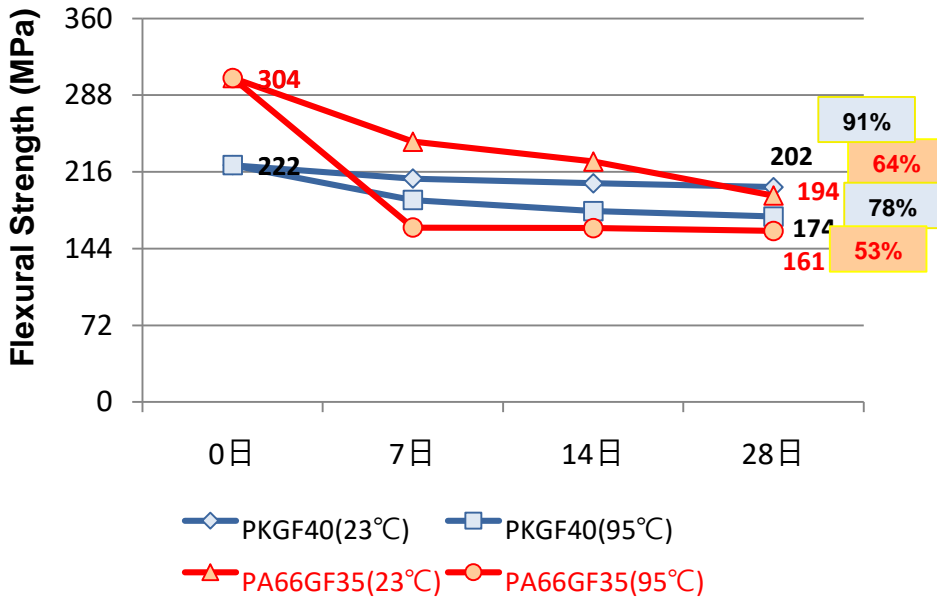
Water Absorption (@23°C, 95°C / 28days)



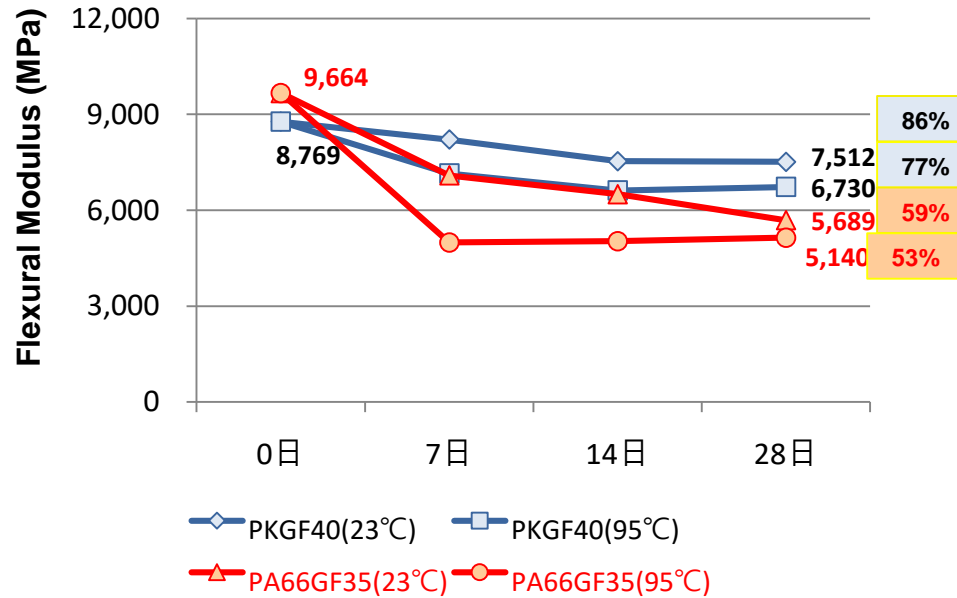
Tensile Strength (@23°C, 95°C / 28days)



### Flexural Strength (@23°C, 95°C / 28days)

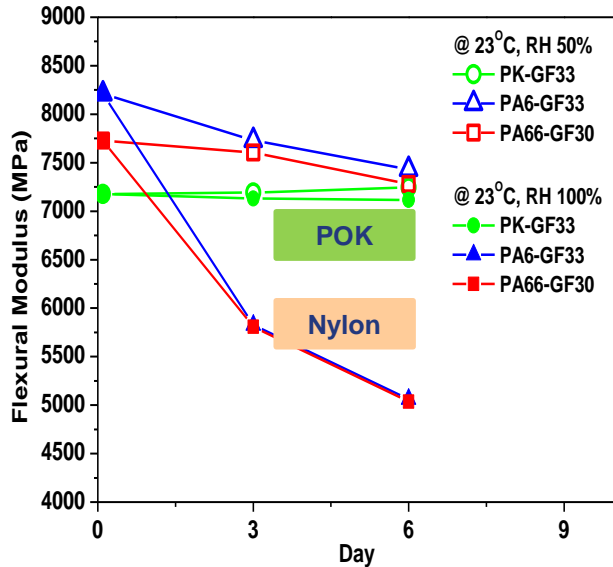


### Flexural Modulus (@23°C, 95°C / 28days)

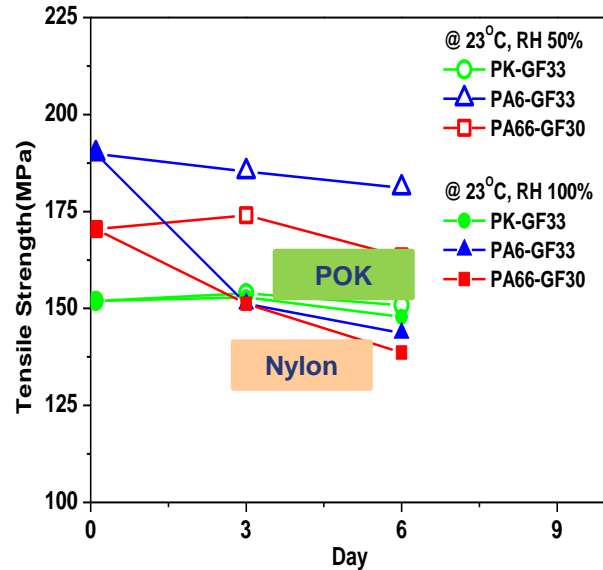


## The Mechanical Properties in Conditioned and Wet Environment (23°C, 50% & 100% RH)

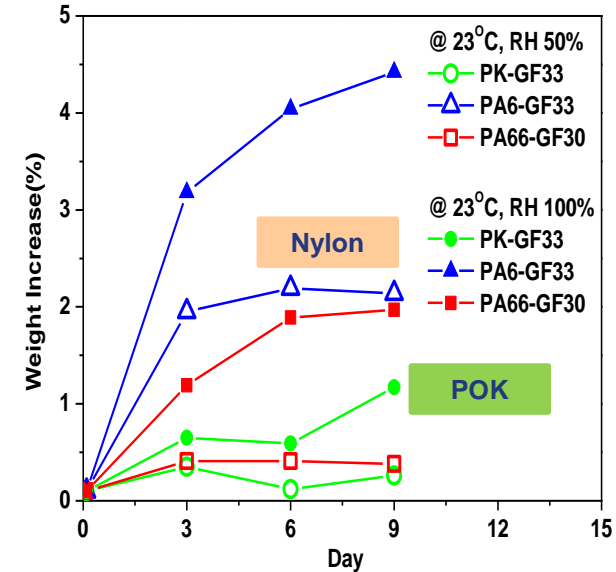
[Flexural Modulus]



[Tensile Strength]

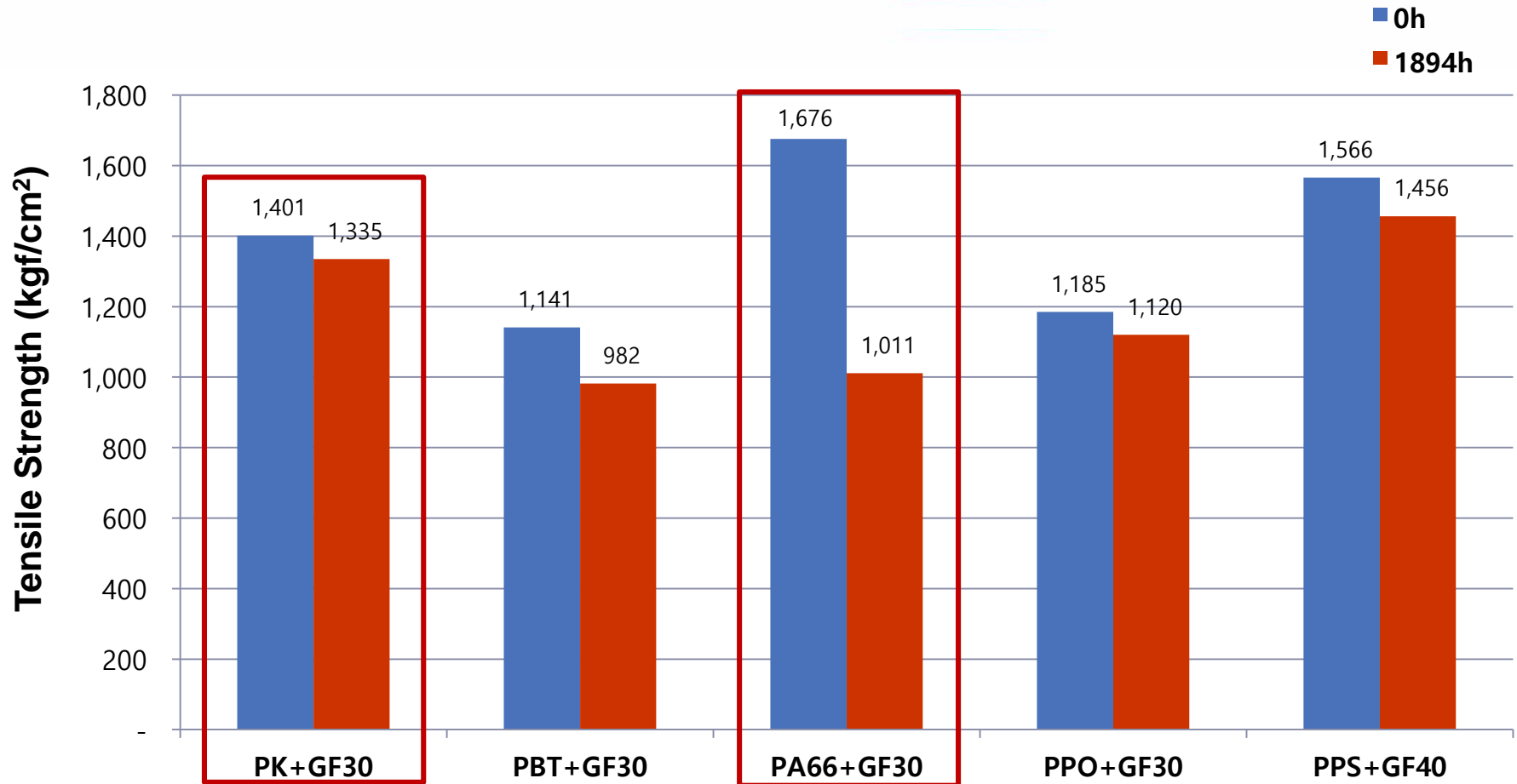


[Water Absorption]



### <POKETONE Values>

- Excellent Hydrolysis Resistance : Stable Maintenance of Mechanical Properties
- Good Dimension Stability : Low Volume & Weight Change in Water Immersion
- Suitable To Use Real Environment : Conditioned and Wet Environment



Test Method : SAE J2527 Weathering Test (1,894 Hours, 2,500kJ/m<sup>2</sup>)

## 6 Chemical Resistance (PK vs PA66)

- PK's chemical resistance is much stable than PA66.
- Less drops in properties due to the resistance to acidic/basic solutions.

