POKETONE™
HYOSUNG POLYKETONE

POKETONE

Tubing wear & corrosion Solution for Oil & Gas Industry

Global Warming Potential

* PA6	6.70	
* PA66	6.40	
* PBT	4.88	
* PC	3.40	
* POM	3.20	
** PK	3.08	(kg CO_2 eq)

* Other ETP data is based upon the Eco-profiles data from **www.plasticseurope.org**

** PK Data is based upon Korea LCI database and Ecoinvent database.

Non Toxic High Efficiency

Acrylate Free
Melamine Free
Bisphenol A Free
Formaldehyde Free
Lead/ Chrome/ Free
Phthalate Free

HYOSUNG CHEMICAL

POKETONE® THERMOPLASTIC POLYMERS- TOUGH ENOUGH FOR OIL AND GAS INDUSTRY

POKETONE Polymers are a new class of engineering plastics- semi-crystalline aliphatic polyketones(PK). The resulting molecular chains are linear, perfectly alternating carbon monoxide and alpha olefin structures that possess a unique balance of strength, chemical resistance an barrier properties, making POKETONE Polymers well-suited for a broad range of applications.

POKETONE Polymers' advanced extrusion grades have been designed to maintain dimensional stability under demanding conditions, including elevated temperatures and harsh chemical environments. These qualities make POKETONE Polymers well suited for many industrial corrosion control applications.

A UNIQUE BALANCE OF PERFORMANCE PROPERTIES

- Chemical resistance
- Barrier performance
- Corrosion protection
- Balance of strength and toughness
- Dimensional stability

HARSH CHEMICALS? NO PROBLEM

POKETONE Polymers are tough. With few known solvent, this new class aliphatic polyketones has good barrier properties and chemical resistance- even when exposed to extreme temperatures.

POKETONE Polymers are particularly resistant to:

- Salt solutions
- Hydrocarbons
- Oilfiled chemicals
- Weak acid and bases
- Soap and detergents

The chemical resistance and barrier performance properties of POKETONE Polymers are made possible by strong interchain forces, a hydrolytically stable structure and the presence of crystallinity. This chemical structure also gives POKETONE Polymers the strength to resist swelling when exposed to aqueous and oxygenated hydrocarbon solvents.

Table 1. POKETONE Polymer Properties

Property	Test method	Unit	M730R	M710F
Density	D792	g/cm^3	1.24	1.24
Melting Temp.	D3418	°C	222	197
HDT (0.45 Mpa)	D648	°C	195	155
Tensile strength	D638	Mpa	57	47
Elongation at break	D638	%	>240	>300
Flexural Strength	D790	MPa	50	45
Flexural Modulus	D790	MPa	1,250	1,100
Impact Strength	D256	J/m	240	200

POKETONE POLYMERS CAN TAKE THE HEAT

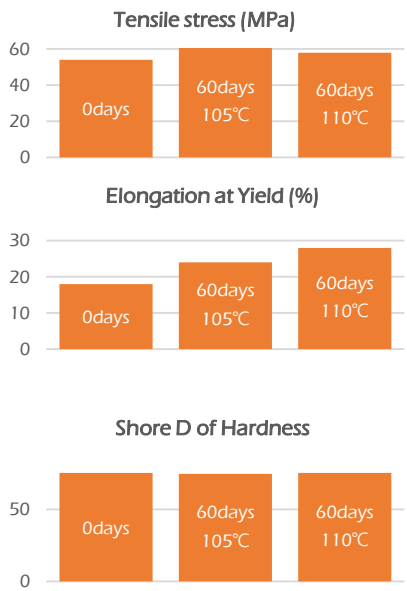
While many engineering thermoplastics perform well at room temperature, POKETONE Polymers were designed to work in real world. POKETONE Polymers maintain strength, toughness and barrier control properties over a broad temperature range. The hotter you go, the fewer material choices you have. Based on testing, POKETONE Polymers appear to have better thermal properties than PA11, PVDF and HDPE-with higher melt point, VICAT softening point and heat deflection temperature. Under standard, POKETONE have a heat deflection temperature of 210°C(410 °F at 66 psi, well above that of competing materials.

POKETONE Polymers retain toughness and impact resistance, even in extreme temperatures. The stress-strain curves demonstrate POKETONE Polymers' good balance of strength and ductility at temperature ranging from -50 to 175°C

Figure 1. Liner Performance Test

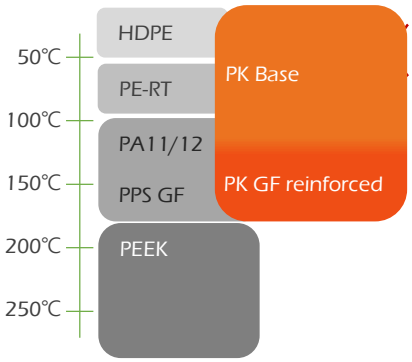
Test standard:
TM0185-2006, Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing, By SwRI

Gas concentration and test conditions
High gas concentration and test conditions 33% water + 42% Hydrocarbon (Aromatic, Aliphatic – Benzene 1%, Toluene 7%, Xylene 11%, Cyclopentene 6%, Cyclohexane 6%, C4-C5 17%, C6-C10 42%, C11 10%) + 25% "Ph4" Gas (CO2 10%+ H2S 5% + CH4 85%)



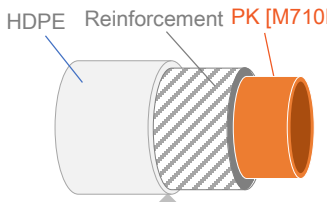
POKETONE IN THE OIL&GAS MARKET

Figure 1. Applicable Temperature

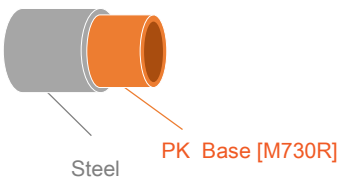


Many plastics have some of the properties, such as toughness, low permeability, elasticity and strength, that are required for use of with hydrocarbon or aggressive chemicals. However, POKETONE polymers are the unique material to cost-effectively combine all of these properties, eliminating many obstacles that previously limited plastic pipes from use in oil and gas applications.

Reinforced Thermoplastic Pipe (RTP)

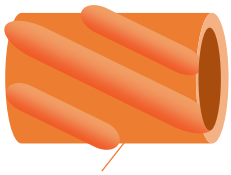


Down-hole Pipe Liner



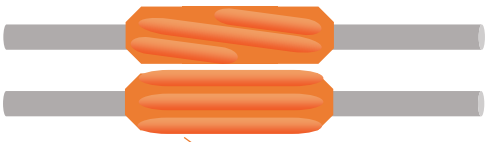
POKETONE lined down-hole pipe have successfully proven the use of POKETONE pipe in Oil&Gas applications since 2017. POKETONE lined pipes are currently installed in several operating wells in the Permian Basin. Operators are experiencing reductions in operating costs associated with rod-on-tubing wear and corrosion failures.
The low cost of POKETONE resin compared to PPS or PVDF polymers has made it an attractive option in corrosive wells. Also, POKETONE could be an option in wells that require hot oil treatments where HDPE is not viable.

Centralizer



PK Lubricated [M63AS1B]
PK GF reinforced[M33AG6A]

Sucker Rod Guide



PK Base [M630R]
PK GF reinforced[M33AG6A]

POKETONE pipes are also in test for Reinforced thermoplastic pipe, or RTP pipe, It is developed to replace medium pressure steel pipes in response to the growing demand for non-corrosive conduits for application in the onshore oil and gas industry.
The material currently used in the construction of RTP pipes is usually PE, PA-11 or PVDF, and the reinforcement is mainly Aramid or Polyester fiber.

POKETONE Polymers are also available in injection molding grades, including lubricated grade for rod guides and casing centralizers. POKETONE allows predictable, worry-free performance for wells operating and casing work with its high heat resistance, chemical resistance and wear resistance.

Table 1. PK Polymers On-shore Value Proposition

Competitive Material	PK FEATURES Over Competitive Material	PK Benefits Over Competitive Material
Steel Pipe-lines	Reduced Corrosion Easier to install liners On existing flowlines	Longer service life Less disruption on retrofit
PA 11 Liners	Lowers systems cost Easier to install on Retrofits or new	Economic advantage Less disruption on retrofit
HDPE Liners	Lower hydrocarbon Permeabilities	Greater dimensional Stability Environmentally friendly Niche applications only
Corrosion Inhibitors	Lower system cost over Multiple years Ease operation	Economic advantages In years 2+ Less costly maintenance

Table 2. PK Grade Selection

Property	Test method	Unit	Pipe Extrusion		Injection molding		
			Down-hole	RTP	Rod guide/Centralizer		
			M730R	M710F	M630R	M63AS1B	M33AG6A
Density	D792	g/cm^3	1.24	1.22	1.24	1.24	1.46
Melting Temp.	D3418	℃	222	197	222	222	222
HDT (0.45 Mpa)	D648	℃	190	155	195	190	215
Tensile Strength	D638	Mpa	56	43	58	58	140
Elongation at break	D638	%	>200	>200	>200	>200	4
Flexural Strength	D790	MPa	50	40	53	55	190
Flexural Modulus	D790	MPa	1,250	900	1,350	1,350	6,600
Impact Strength	D256	J/m	240	200	220	122	120