POKETONE™
HYOSUNG POLYKETONE

HYOSUNG

# Automotive

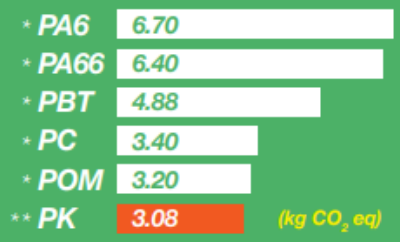
## Connector

**Non Toxic**
**High Efficiency**

EARTH FRIENDLY

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

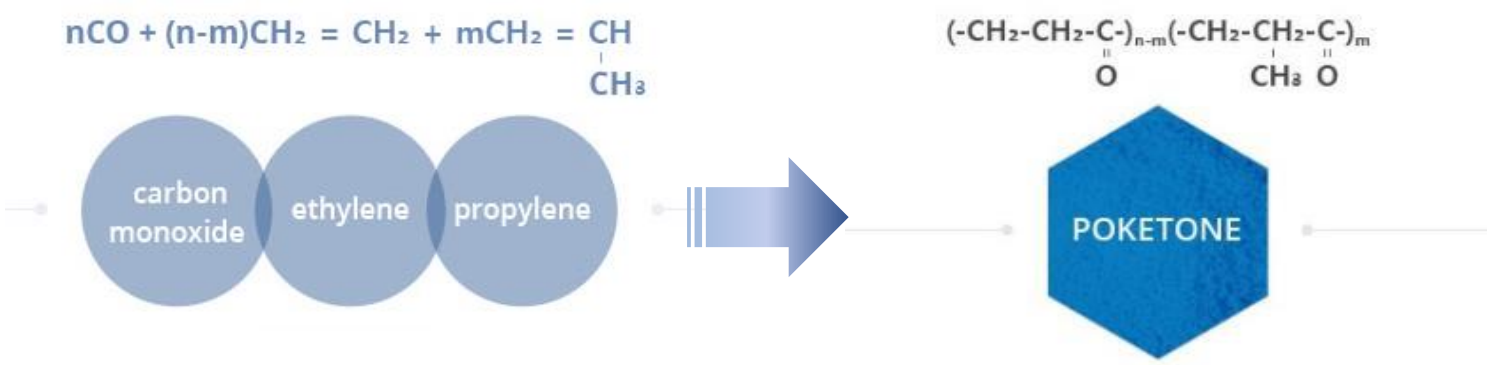
**Global Warming Potential**




* *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.*

# 7 Key Values of POKETONE for Automotive




- ☐ Excellent Chemical Resistance for Fuel parts vs PA6, PA66, PBT
- ☐ Better NVH(Noise, Vibration, Harshness) Performance vs PA6, PA66, PBT
- ☐ Low VOCs, Low Odor for Interior Parts vs ABS, POM
- ☐ Better Scratch/Wear resistance for Interior Parts vs ABS, POM
- ☐ Better Dimensional Stability at various Environmental Conditions vs PA6, PA66, POM
- ☐ Excellent impact performance vs PA6, PA66, PBT, POM
- ☐ Superior Hydrocarbon Barrier for Fuel Tube vs PA12

# Why PK for Connector

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✓ ***Development Background***

- In the cold weather environment, connector parts were broken in process of handling and delivery
- Needed a new material for connectors which has better impact strength at low temperature

✓ ***PK Characteristics***

- Better impact strength at -30℃ to solve breakage of connector at low temperature
- Higher MFI gives better Thin-wall processability
  → PK can be a solution for thin-wall and small size connector development for Electric Vehicle
- Light weight compare to PBT with less specific gravity (1.24 vs 1.31)

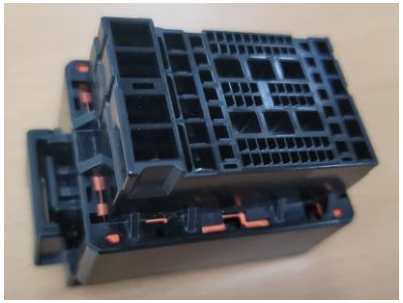
✓ ***Current Status***

- Approved by Hyundai and Kia motors for Non-waterproof type (Commercialized)
- Applied for BYD Connectors for Electric Vehicle
- Material Improvement (140℃, Long-term heat stability) is in process for waterproof type connector

# Connector

## *Project Information*

- Application : Connector
- Current material : PBT
- Product : PK compound
- Customer : Hyundai motors
- Part weight : 0.1kg



## *Customer Requirements*

- Excellent flowability
- Impact Resistance
- Dimensional stability
- Electrical properties
- Meet Insertion/Extraction force, Terminal holding force

## *Value In Use*

- Better impact resistance at low temperature (-30℃)
- Better processability for thin wall
- Weight Reduction: "6%" lighter than PBT
- Less deformation by heat
- Shorter cycle time

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## 1. Mechanical property : Better impact resistance at low temperature (-30℃)

| Item | | Unit | Method | PK | PBT |
|---|---|---|---|---|---|
| Charpy Notched Impact strength | 23℃ | KJ/m$^2$ | ISO 179/1eA | 18.5 | 3.0 |
| | -30℃ | | | 4.5 | 0 |

* Drop Impact Test (-30℃)

<PK>

<PBT type 1>

<PBT Type 2>

## 2. Flowability : Better processability for thin wall

| Item | unit | Method | PK (240℃, 2.16kg) | PBT (250℃, 2.16kg) |
|---|---|---|---|---|
| Melt Flow Index | g/10min | ASTM D1238 | 60 | 28 |

* Spiral flow


<PK>

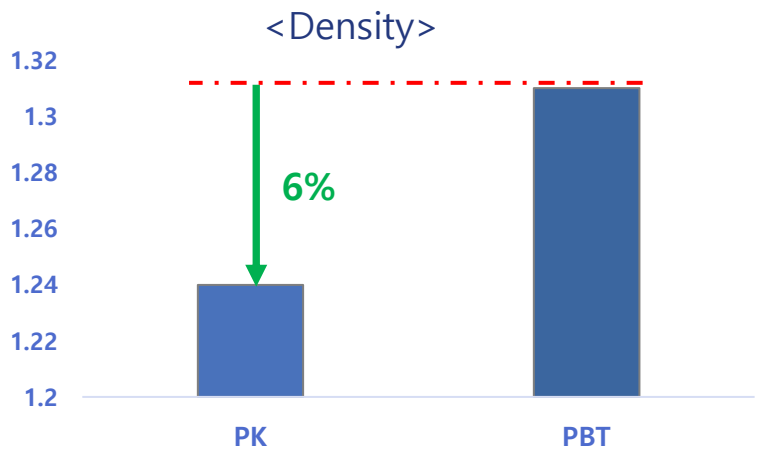

<PBT>

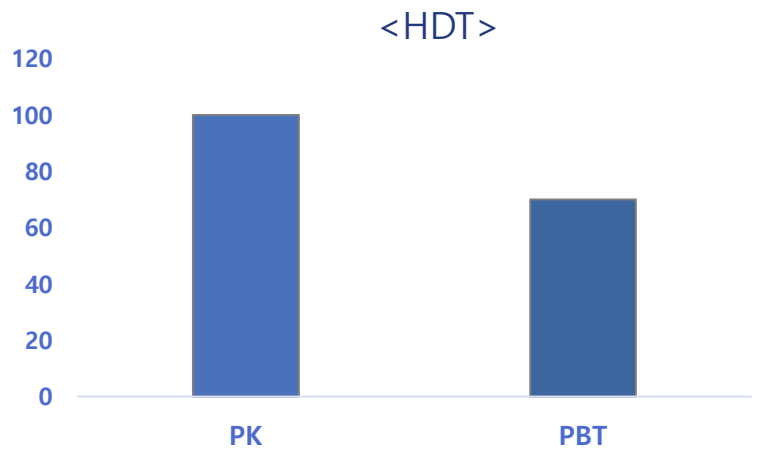
# PK Advantages

## 3. Weight reduction : “6%” lighter than PBT

## 4. Good Thermal property : Less deformation by heat

| Item | unit | Method | PK | PBT |
|---|---|---|---|---|
| Density | $g/cm^3$ | ASTM D792 | 1.24 | 1.31 |
| Heat Deflection Temperature (1.82MPa) | ℃ | ASTM D648 | 100 | 70 |



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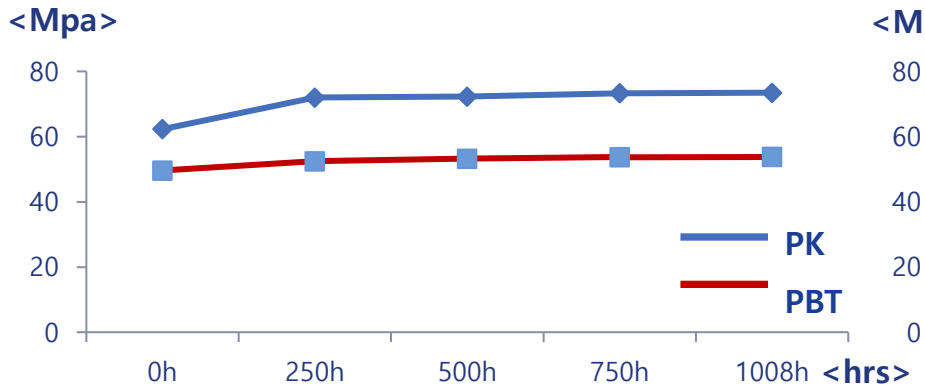
## 5. Physical and Electrical Property

| Item | | Unit | Method | PK | PBT |
|---|---|---|---|---|---|
| Density | | g/cm³ | ASTM D792 | 1.24 | 1.31 |
| Charpy Notched Impact strength | 23℃ | KJ/m² | ISO 179/1eA | ~10 | 4~8 |
| | -30℃ | | | | |
| Heat Deflection Temperature (1.82MPa) | | ℃ | ASTM D648 | 100 | 70 |
| Process temperature | | ℃ | - | 230~240 | 245~260 |
| Melt Flow Index | | g/10min | ASTM D1238 | MI 60 | MI 15~57 |

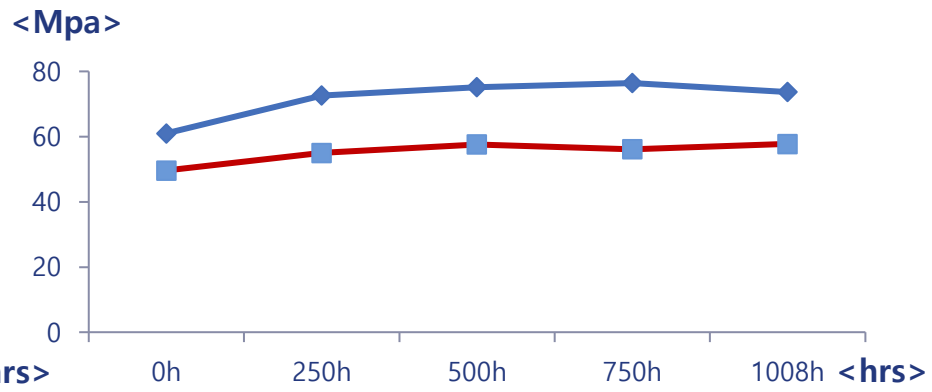
| Item | Unit | Method | PK | PBT |
|---|---|---|---|---|
| Dielectric strength | kV/mm | IEC 60243-1:2013-03 | 16 | 18.9 |
| Volume Resistance | Ω·cm | ASTM D 257:2007 | $1.27\times10^{16}$ | $1.28\times10^{17}$ |
| Surface Resistance | Ω/sq | ASTM D 257:2007 | $1.8\times10^{17}$ | $1.8\times10^{17}$ |
| Arc-Resistance | s | ASTM D 495:1999 | 202 | 130 |
| Comparative Tracking Index | V | IEC 60112:2009-10 | 600 | 575 |
| Glow-wire flammability test (GWFI) | ℃ | IEC 60695-2-12:2014-02 | 675 | 775 |
| Glow Wire Ignitability Temperature (GWIT) | ℃ | IEC 60695-2-12:2014-02 | 700 | 700 |

## 6. Heat Aging Test

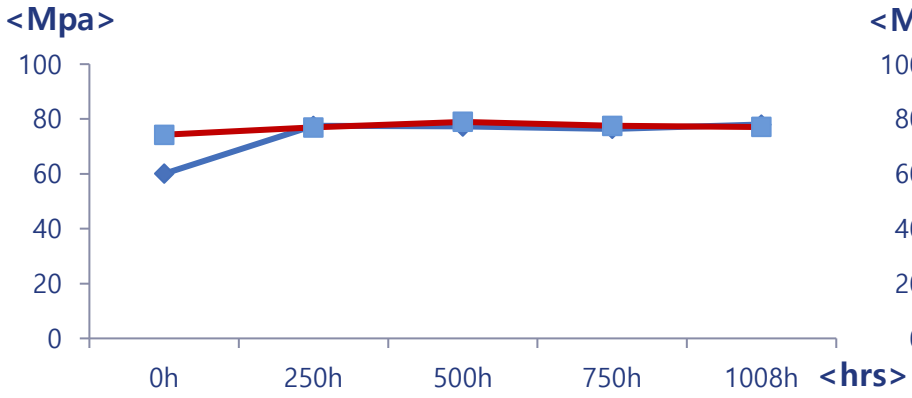
### *Tensile strength(80℃)*



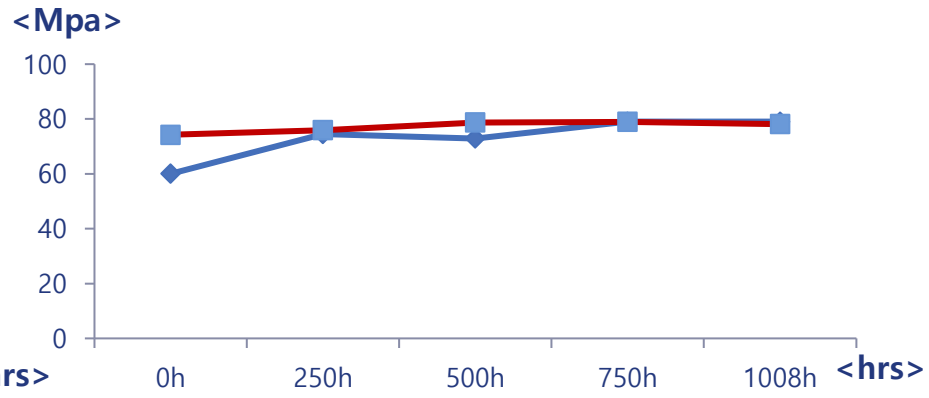

### *Tensile strength(120℃)*




### *Flexible strength(80℃)*




### *Flexible strength(120℃)*



# PK Opportunities

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**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) |

**BIG 5 WEAKNESS**

- High Price & Low HDT
- mPPO
- PA
- High Water Absorption
- PC
- PBT
- POM
- Weak Chemical Resistance
- Poor Hydrolytic Resistance
- Formaldehyde Emission

**High HDT** (1.82MPa/GF30%)
- PK GF 215
- mPPO GF 140℃

**Competitive Price**
- PK
- mPPO

**Excellent Chemical Resistance**
- PK ★★★★★
- PC ★

**Excellent Hydrolytic Stability** (85℃, 85% RH, 30days)
- PK 65MPa
- PBT 22MPa

**High Impact Strength** (kJ/m², Charpy)
- PK (M630) 15
- PBT 5.5

**Formaldehyde Free** (90℃, 24hr mg/L)
- PK 0.0
- POM 0.066

**Low Density(g/cm³)**
- PK 1.24
- POM 1.41

**Dimensional Stability** (Water Absorption, 23℃)
- PK 2.1%
- PA66 8.5%

**Stable Price** ('20 Oct~'22 Aug)



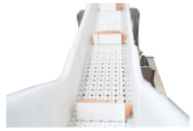
Water Purifier Tank


Pump Housing

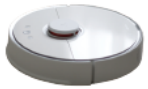

Electric Meter


Connector


Gear


Food Conveyor belt


Water Meter


Robot Vacuum Gear

**Non Toxic High Efficiency**

EARTH FRIENDLY

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