About Kolon Plastics

Kolon Plastics—Growing with our customers as a POM Global Leader

Kolon Plastics was established in March 1996 as a joint venture between Kolon Industries Inc. in Korea and Toray Industries Inc. in Japan. Production began in 1998 with capacity and sales of 25,000MT/year. After the 2nd factory line was completed, we produce 57,000MT of POM and 50,000MT of the other compounding materials a year. As a specialist POM manufacturer with the engineering plastics technology. Our priority is to create customer solutions and to grow with our customers as a POM global leader.

Our management philosophy, which has been inherited from our parent company, emphasizes the role and social responsibility of the enterprise as well as an enlightened attitude toward each member of our organization.

Be an unflinching industrialist
Kolon Plastics has an unflinching spirit as a member of industry and constantly tries to contribute to industrial development.

With efficiency and originality
Kolon Plastics management standard attaches great importance to efficiency and originality.

A place to realize each individual’s potential
We help our members to improve their ability and try to make the organization a fruitful workplace.

Contribution to affluent human life and development of mankind
This is our ultimate goal.
Introduction of KOCETAL®

What is KOCETAL® - POM?
KOCETAL refers to polyacetal resin of a copolymer type. And is a material of an excellent quality with features of excellent anti-friction/anti-wear, chemical-resistance, heat-resisting stability, precise dimensions and molding abilities. It is mainly applied in gear or roller, and is used for various purposes over the fields of cars, office equipment and living materials.

Properties of KOCETAL® - POM?

Mechanical property
The resin is highly crystalline, and has a great combination of toughness and rigidity. It is also resistant to fatigue, creep, and to abrasion thanks to abrasion thanks to its property of self-lubrication.

Thermal property
Heat deflection temperature under load and deterioration are other properties to be considered with polymer. Amorphous resin deflects over the heat deflection temperature, but polyacetal that is crystalline, doesn't deflect a lot even over the heat deflection temperature. Thus, the limit of temperature should be considered after calculating the amount of creep deflection, depending on the design requirement.

The estimated life of resin can be extrapolated by temperatured with polymer. Amorphous resin deflects over the heat deflection temperature, but polyacetal that is crystalline, doesn't deflect a lot even over the heat deflection temperature. Thus, the limit of temperature should be considered after calculating the amount of creep deflection, depending on the design requirement.

The estimated life of resin can be extrapolated by measuring the change of property by temperature and using Arrhenius Plot.

Because thermal stability of acetal copolymer resin can be improved by addition of stabilizer, each grade shows different thermal stability. Homopolymer is more easily deteriorated than copolymer.
Introduction of KOCETAL®

Properties of KOCETAL® - POM?

Chemical resistance
The chemical resistance of a resin can be judged by examining the solubility to chemicals, the increase of weight through absorption, and the influence of chemicals on creep fracture.

Polyacetal isn’t penetrated by organic solvents due to its crystalline property, but gains its weight slightly to aromatic, chlorine, ketonic, and ester solvents, which can change its mechanical property and size. Exceptionally, hexafluoroacetone dissolves polyacetal. Polyacetal is resistant to gasoline and lubricant, but if acid additive is used to improve the performance, it may become less resistant.

Copolymer is resistant to alkali, but homopolymer is not resistant to alkali chemicals. Polyacetal is generally resistant to inorganic chemicals, but can be penetrated by ZnCl2 depending on temperature and concentration.

The life of resin should be decided by considering the concentration of chemicals and temperature. In case of resistance to hot water, homopolymer has fairly shorter life than copolymer.

Weatherability
Polyacetal resin is not resistant to ultraviolet, but can be improved by adding light stabilizer and ultraviolet absorber. The resistance to ultraviolet can be enhanced by staining carbon black and using proper pigment. However, in case of exterior use, the resin can be deteriorated by ultraviolet and influenced by SOx, NOx, ozone, etc. Therefore, serious consideration is needed for weatherability.

The accelerated weather resistance test is carried out by using Weather-OoMeter, Xenon arc, Fade-O-Meter. Good result doesn’t guarantee any crack or discoloration caused by exterior conditions.
Nomenclature of KOCETAL® - POM?

Characteristics
- **K** Standard grade
- **CB** Conductive grade with Special Carbon Black
- **CF** Conductive grade with Carvbon Fiber
- **DS** Hot Diesel Resistance improved grade
- **EL** Toughness modified grade with Thermoplastic Elastomer
- **GB** Glass Bead ro Milled Glass Fiber filled grade
- **GF** Highly stiff grade with Glass Fiber
- **LF** Low Friction grade with Special Polymer
- **LW** Low Friction grade with Special Polymer
- **MS** Low Friction grade with MoS2
- **SO** Low Friction grade with Silicon Oil
- **TC** Talc filled grade for dimensional stability
- **TF** Low Friction grade with Polytetrafluoroethylene powder
- **UR** Impact modified grade with Thermoplastic Polyurethane
- **VT** Anti-static grade
- **WH** Whisker filled grade for low friction and high stiffness
- **WR** Weather Resistance improved grade

**MI**
- 1 : MI = 2.5 (High Viscosity)
- 3 : MI = 9 (Medium Viscosity)
- 5 : MI = 14 (Medium Viscosity)
- 7 : MI = 27 (Low Viscosity)
- 9 : MI = 45 (Very Low Viscosity)

**Content**
- 1 : 5%
- 2 : 10%
- 3 : 15%
- 4 : 20%
- 5 : 25%
- 6 : 30%
- 8 : 40%

**Color**
- **LO** Low Odor(Low FA) grade
- **None** : Natural
- **BE** : Beige
- **BK, BBK** : Black
- **BL** : Blue
- **BN** : Brown
- **DG** : Dark Gray
- **GR, GY** : Gray
- **RD** : Red
- **WT** : White
- **YE** : Yellow

**Internal**
- **EW** : Slightly tough grade than standard
- **H** : Weather Resistance improved grade
LOW-VOCs POM

Why on earth should this be KOCTAL®?

Requirements of Auto makers
1. VDA 275 : 60°C, 3h [Formaldehyde gas emission measurements for molded products]
2. VDA 270 : 80°C, 2h [Sensory odor, Grades 1(no odor) ~ 6(unbearable odor)]
3. VDA 277 : Total Organics Emission

<table>
<thead>
<tr>
<th>Company</th>
<th>VDA275 [mg formaldehyde/kg sample]</th>
<th>VDA 270 [-]</th>
<th>VDA 277 [μg/cm]</th>
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<tbody>
<tr>
<td>Volks Wagen</td>
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<td>3</td>
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<td>Audi</td>
<td>10</td>
<td>3</td>
<td>10</td>
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<tr>
<td>Daimler/Chrysler</td>
<td>5(natural) / 20(colored)</td>
<td>3</td>
<td>-</td>
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<tr>
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<td>HMC</td>
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<td>3</td>
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Core Technique of Low VOCs POM

Minimizing FA gas Emission
1) Terminal degradation technique : Minimizing Semi, Unstable Ends
2) Minimizing VOCs (Controlling VOCs of Hydrocarbons)
   : Using porous nano reaction and absorption additives
3) German Automobile Association Standards (PV3900)
   : 2~2.5 Rank(General POM : 5 Rank)
   ▶ VOCs : Volatile Organic Compounds

FA Properties of Low VOCs POM

100% Recycle FA test result

Test results of Injection Temperature

Measurement Method : VDA275
FA : Formaldehyde  VOC : Volatile Organic Compounds
**Product Summary**

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<tr>
<th>Grade</th>
<th>Formaldehyde gas (ppm)</th>
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<td>K700LO</td>
<td>1 ↓</td>
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<tr>
<td>Weather Resistance</td>
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<tr>
<td>WR301LO</td>
<td>1 ↓</td>
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<tr>
<td>WR701LO</td>
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<tr>
<td>Impact Resistance</td>
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</tr>
<tr>
<td>UR302LO (PU 10%)</td>
<td>1 ↓</td>
</tr>
<tr>
<td>UR304LO (PU 20%)</td>
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</tr>
<tr>
<td>Wear resistance</td>
<td></td>
</tr>
<tr>
<td>LF301LO</td>
<td>3 ↓</td>
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<tr>
<td>Glass fiber reinforced</td>
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</tr>
<tr>
<td>GF302LO (GF 10%)</td>
<td></td>
</tr>
<tr>
<td>GF304LO (GF 20%)</td>
<td>3 ↓</td>
</tr>
<tr>
<td>GF705LO (GF 25%)</td>
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</table>

**Technology of Low-VOCs POM**

- **End-Group Degradation Technology**
- **Inhibition of Yellowish**
- **Production Technology (Low Cost, Low Energy)**
- **Formaldehyde Capturing**

**Low-VOCs KOCETAL**
### Typical Property data of KOCETAL®

<table>
<thead>
<tr>
<th>Properties</th>
<th>Item</th>
<th>Method (ASTM)</th>
<th>Unit</th>
<th>General purpose grade</th>
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<tbody>
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<td></td>
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<td>K100</td>
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<td>Physical properties</td>
<td>Specific gravity</td>
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<td></td>
<td>Water absorption (23°C, water, 24hr.)</td>
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<td>%</td>
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<tr>
<td></td>
<td>Mold shrinkage</td>
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<td>%</td>
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<tr>
<td></td>
<td>Melt index (190°C, 2160g)</td>
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<tr>
<td></td>
<td>Melting point</td>
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<td>°C</td>
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<td>Heat distortion</td>
<td>D648</td>
<td>°C</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>Linear thermal expansion</td>
<td>D696</td>
<td>X10⁻⁶/°C</td>
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<td></td>
<td>Flammability</td>
<td>UL-94</td>
<td></td>
<td>HB</td>
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<td>Thermal properties</td>
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<td>MPa</td>
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<td>Elongation at break</td>
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<td>%</td>
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<td>Impact strength (Izod Notched)</td>
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<td>J/m</td>
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<tr>
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<td>Rockwell hardness</td>
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<td>Volume resistivity</td>
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<td></td>
<td>Dielectric dissipation factor (10⁶ Hz)</td>
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<td>0.006</td>
</tr>
</tbody>
</table>

1. The above properties are estimated by Kolon Plastics, not guaranteed fully.
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<table>
<thead>
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<th>General purpose grade</th>
<th>Toughened grade</th>
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<td>$1 \times 10^{16}$</td>
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<td>$1 \times 10^{16}$</td>
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## Typical Property data of KOCETAL®

### Properties

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<th>Item</th>
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<th>Unit</th>
<th>TC704</th>
<th>WH704</th>
<th>MS301</th>
<th>SO301</th>
<th>TF302</th>
<th>TF304</th>
<th>LF301</th>
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</table>

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<table>
<thead>
<tr>
<th>Low friction grade</th>
<th>Special Grade</th>
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</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

KOETAL POLYETHYLENE Engineering Plastic
Kocetal is stable over a wide temperature range (-40 to 100°C) and has superior chemical resistance against window washing agent, anti-freeze, gasoline and diesel oil. It is being widely used for parts such as various types of clips which require wear and creep resistance.

**Chemical resistance of Kocetal K300**

(Condition 23°C, 1 year-immersion, unit %)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Weight loss</th>
<th>Dimension change</th>
<th>Change of tensile strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>0.45</td>
<td>0.15</td>
<td>1.54</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.19</td>
<td>0.02</td>
<td>4.62</td>
</tr>
<tr>
<td>Light oil</td>
<td>0.10</td>
<td>0.01</td>
<td>3.08</td>
</tr>
<tr>
<td>Engine oil</td>
<td>-0.50</td>
<td>-0.06</td>
<td>4.62</td>
</tr>
<tr>
<td>Break oil</td>
<td>0.87</td>
<td>0.27</td>
<td>0.00</td>
</tr>
<tr>
<td>Windows washer fluid</td>
<td>0.74</td>
<td>0.20</td>
<td>3.08</td>
</tr>
</tbody>
</table>

**Diesel immersion test**

(120°C, 520hrs)

Fuel Pump

Fuel tank cap

Ball Joint

Fuel Neck
Kocetal is strongly recommended for the car interior parts as its surface is not glossy and has superior color stability and weatherability (light fastness). It also has low odor due to low formaldehyde content in the formed product and has superior thermal stability.

**Generation of formaldehyde by conditions**

<table>
<thead>
<tr>
<th>Test condition</th>
<th>K300</th>
<th>K300LO</th>
<th>WR301LO</th>
</tr>
</thead>
<tbody>
<tr>
<td>65˚C X 2 hours</td>
<td>1.45 &lt;</td>
<td>&lt; 0.04</td>
<td>No detect</td>
</tr>
<tr>
<td>80˚C X 2 hours</td>
<td>1.45 &lt;</td>
<td>&lt; 0.07</td>
<td>&lt; 0.04</td>
</tr>
<tr>
<td>100˚C X 2 hours</td>
<td>1.45 &lt;</td>
<td>&lt; 0.18</td>
<td>&lt; 0.18</td>
</tr>
<tr>
<td>240˚C X 15 minutes</td>
<td>-</td>
<td>&lt; 60.0</td>
<td>&lt; 90.0</td>
</tr>
<tr>
<td>VDA 275(60˚C X 3 hours)</td>
<td>8.70</td>
<td>&lt; 0.70</td>
<td>&lt; 0.50</td>
</tr>
<tr>
<td>Remark</td>
<td>STD</td>
<td>STD</td>
<td>UV resistant</td>
</tr>
</tbody>
</table>

Low Insertion Force

Seat Belt Button

Seat slide guide

Clip

Dispenser pump

Speaker Grill

Seat Belt Part
Kocetal is high quality material and is recommended for high-tech machine parts which require high precision and functionality.

**Crystallization rate of Kocetal**

![Graph showing crystallization rate](image)

- **K300**
- **Other POM1**
- **Other POM2**

**Applications**

- Laundry Leg
- Laundry Fitting
- CD Changer Part
- Gear
- OA Gears
Kocetal is manufactured with crystallization-regulating technology, which enables fast crystallization and the formation of small, homogenous crystals. This creates a material of excellent wear resistance and mechanical strength, marking it suitable for OA equipment and consumer electronic parts.

Wear resistant properties of Kocetal

Test condition: Pressure - 1.5 kg/cm², speed - 30 cm/s (Same body)

- Specific wear
- Specific wear (Counter part)
- Coefficient of dynamic friction

Key Board Frame  Fan Neck Part  Printer Gears
Laundry Machine Gear  CD-ROM
Kocetal is being widely used for industrial equipments, agricultural machinery, construction machinery among other applications due to its balanced properties such as mechanical strength, friction/wear resistance, light weight, corrosion resistance, chemical resistance and weatherability.

**Property in chlorine water**

![Graph showing property in chlorine water](image)

**Hydrolysis resistance of Kocetal**

![Graph showing hydrolysis resistance of Kocetal](image)

Laundry Machine Neck Part

Toilet bowl
Kocetal has excellent resistance to chemicals and hydrolysis, and is used for various types of containers, piping and pipe-connectors.

**Tensile strength of Kocetal according to temperature variation**

![Graph showing tensile strength of Kocetal](image)

Cable Protector  
Pipe Fitting

Printer Gears
Kocetal has exceptional fatigue resistance and is the optimum material for parts that are subjected to repeated bending, stress, impact or vibration.

**Creep resistance on several loads at 80°C**

![Creep resistance graph](image)

**Melt viscosity at 230°C**

![Melt viscosity graph](image)
Kocetal displays a well-balanced spectrum of mechanical and physical properties over a wide temperature range. It also offers excellent moldability and is used in a diverse variety of parts. Our reinforced grades are suitable for application that require higher strength.

**Color change as molding temperature**

**Color change as molding time**
**Mechanical property**

Kocetal is a plastic material with excellent mechanical strength, durability, and a well-balanced range of properties. Compared to Nylon and PBT, it shows little change in mechanical properties over a wide temperature range (-50~80°C). Kocetal has lower Mechanical Stiffness than homo polymers, but it is more flexible and has superior impact resistance, thermal property and weatherability. It also has high intensity and heat resistance.

**Creep resistance**

Kocetal has excellent creep resistant, its properties remain stable even under load for an extended period. Buckles and various types of valves are good examples of making use of this property.

**Fatigue resistance**

Kocetal has excellent elasticity recovery and fatigue resistant properties and is used extensively in applications such as zippers and tape reels. Polycarbonate and m-PPO have weak resistance to organic solvent and oils, but Kocetal has no such limitations.
**Wear and friction resistance**

Kocetal is self-lubricating and has superior friction and wear resistance compared to other resins. Kocetal has less ‘creak’ noise than metals and is the optimum material for machine parts such as gears, cams, bearings and gate rollers.

**Thermal stability**

Kocetal has developed thermal stability, a weakness in most polyacetal resins, and this brings about the following effects.

1. Improved workplace environment due to less formaldehyde emission
2. Reduction in mold deposits, lowering mold maintenance costs and improving quality stability of formed product.
3. Property degradation and discoloration is minimal even when the resin is left inside the molding machine or if regrind material is used on it.
4. Because of improved weatherability and UV resistance, it is possible to use in applications which are left outdoors for extended periods.

![Graph showing wear and friction resistance and thermal stability effects](image-url)
**Hot water resistance**

Kocetal can be adopted for the products used in high temperature/humidity environments as there is less dimensional and material property change in hot water immersion tests, compared to acetal homopolymer, nylon or PBT resin.

**Electrical property**

With its superior electrical properties including high insulation, Kocetal is featured with low temperature dependency on resistivity, electric permittivity, dissipation factor and the Dielectric Strength.

**Dimension stability**

Kocetal molded products become dimensionally stable within a short period of time (24 hours) at room temperature. It can be used for high precision products because it shows only minor dimensional change according to the environment due to its low water absorption and shows long-term dimensional stability.

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**Graphs and Tables**

- **Dissipation factor by temperature**
- **Mold shrinkage compared to other plastics**
- **Retention of tensile strength by hot water immersion**
- **Change of dimension by water absorption**

---

**Table: Mold shrinkage compared to other plastics**

<table>
<thead>
<tr>
<th>Material</th>
<th>Mold Shrinkage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kocetal K300</td>
<td>0.6</td>
</tr>
<tr>
<td>PBT (240)</td>
<td>1.0</td>
</tr>
<tr>
<td>PA6 (240)</td>
<td>1.0</td>
</tr>
<tr>
<td>PA66 (250)</td>
<td>1.0</td>
</tr>
<tr>
<td>PC (250)</td>
<td>1.0</td>
</tr>
<tr>
<td>ABS (240)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

---

**Graph: Dissipation factor**

- **1KHz**
- **10KHz**

---

**Graph: Retention of tensile strength**

- **Kocetal K300**
- **PA6**
- **PBT**
- **PA66**
- **homo-DM**
Weatherability
When products made from conventional acetal resins are left outdoor for 6 months, aging will cause discoloration, surface cracking and degradation. In environments where there is prolonged exposure to sunlight and ultraviolet rays, we recommend the use of UV resistant grades. However if exposure is not excessive it is possible to use standard grades.

Chemical Resistance
Kocetal has an excellent tolerance to organic chemicals, oils, fats and synthetic detergents.

<table>
<thead>
<tr>
<th></th>
<th>Soft acid</th>
<th>Strong acid</th>
<th>Soft alkali</th>
<th>Strong alkali</th>
<th>Aromatic</th>
<th>Halogen</th>
<th>Alcohol</th>
<th>Ester</th>
<th>Ketone</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kocetal</td>
<td>△</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Homo-POM</td>
<td>△</td>
<td>×</td>
<td>△</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>PBT</td>
<td>○</td>
<td>△</td>
<td>○</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>◯</td>
<td>◯</td>
</tr>
<tr>
<td>PA</td>
<td>○</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>△</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>PPO</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>×</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>PC</td>
<td>◯</td>
<td>△</td>
<td>○</td>
<td>×</td>
<td>×</td>
<td>△</td>
<td>×</td>
<td>×</td>
<td>△</td>
<td>△</td>
</tr>
</tbody>
</table>

○ : Excellent  ◯ : Usable  △ : Usable with caution  × : Not usable

Discoloration by weather resistance test
Retension of tensile strength by weather resistance test
Application of KOCTAL®

Automobiles

Engine Part

Fuel Pump
Resin: KOCTAL® K300
Composition : POM
Characteristics
- Excellent processability
- Oil resistance
- Dimensional stability

Exterior Part

FUER NECK
Characteristics
- Good chemical-resistance
- Optimized toughness & strength
- Dimensional stability
Grade: K300BK, D5500

FUEL CAP
Characteristics
- Excellent chemical-resistance
- High-toughness
- Dimensional stability
Grade: K300

BUMPER BRACKET
Resin: KOCTAL® K300HBK
Composition : POM, Modifier
Characteristics
- Excellent Dimensional stability
- Optimized toughness & strength
- Good chemical-resistance

FUEL FILLER CAP RING
Resin: KOCTAL® EL304
Composition : POM, Modifier
Characteristics
- Excellent Chemical-resistance
- High-toughness
- Dimensional stability
Interior Part

**SAFETY BELT**
- Characteristics
  - Color stability
  - Excellent wear resistance
  - Good dimensional stability
  - Low odor
- Grade: K300HRD

**ACTUATOR GEAR**
- Resin: KOCETAL® LW702
- Composition: POM Wear Modifier
- Characteristics
  - Excellent wear resistance
  - Balanced toughness & strength
  - Good dimensional stability

**CUP HOLER**
- Resin: KOCETAL® LF302
- Composition: POM, Modifier
- Characteristics
  - Good dimensional stability
  - Excellent color stability
  - Low odor

**STEERING ROLL CONNECTOR**
- Characteristics
  - Excellent wear resistance
  - Good flowability
  - Good dimensional stability

**SLIDE GUIDE**
- Resin: UR302, K300
- Composition: POM
- Characteristics
  - Impact-resistance
  - Good processability
  - Dimensional stability

**SPEAKER GRILLE**
- Resin: KOCETAL® WR701LO, WR901LO
- Composition: POM, UV-additive
- Characteristics
  - Excellent UV-resistance
  - Low Formaldehyde gas emission
  - Good flowability

**DOOR LATCH HOUSING**
- Resin: KOCETAL® K300EW BBK
- Composition: POM black
- Characteristics
  - Dimensional stability
  - Wear resistance
  - Good strength

**HAVC SWITCH SHAFT & CAM**
- Resin: KOCETAL® K300LO, K300
- Composition: POM
- Characteristics
  - Excellent dimensional stability
  - Optimized toughness & strength
  - Low odor

**TRIM CLIP**
- Resin: KOCETAL® UR304
- Composition: POM, Modifier
- Characteristics
  - Optimized toughness & strength
  - Excellent color stability

**AIR CONDITIONER VENT GRILLE & KNOB**
- Resin: KOCETAL® WR301LO
- Composition: POM, Weather Resistance
- Characteristics
  - No color changes under UV
  - Low Formaldehyde gas emission at high Temperature
  - Excellent surface

**LUMBER SUPPORT**
- Resin: KOCETAL® K300LO
- Characteristics
  - Low odor
  - Dimensional stability
  - Excellent creep-resistance
The chart shows the general condition of injection molding for Kocetal resin.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Units</th>
<th>Standard resin</th>
<th>Reinforced resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder temperature</td>
<td>°C</td>
<td>160–180</td>
<td>170–190</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>180–190</td>
<td>190–210</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>190–200</td>
<td>190–210</td>
</tr>
<tr>
<td>Mold temperature</td>
<td>°C</td>
<td>60–80</td>
<td>70–120</td>
</tr>
<tr>
<td>Injection pressure</td>
<td>kg/cm²</td>
<td>500–800</td>
<td>700–1,200</td>
</tr>
<tr>
<td>Second pressure</td>
<td>kg/cm²</td>
<td>300–500</td>
<td>1,000</td>
</tr>
<tr>
<td>Back pressure</td>
<td>kg/cm²</td>
<td>10–30</td>
<td>20–50</td>
</tr>
</tbody>
</table>

To set the best condition for injection molding of Kocetal, Melt flow rate, shrinkage, dimensional stability, uniformity, and economic efficiency should be considered before manufacturing a mold.

- Set the injection temperature a bit higher than 165°C, the melting temperature of Kocetal. Stay below 220°C to restrain formaldehyde gas generation caused by thermal decomposition.
- Generally, increase injection velocity for thin, multi-cavity mold, or dimension of product is important but, decrease injection velocity for thick product to avoid problem.
- Set the cooling time to the point that the product may not deform or have plate mark when extracting it with ejector pin.

\[ \text{Cooling time} = \text{Measuring time} + \alpha \]

**Drying condition**

General case: Heated-air drying at 80°C × 3 hours or more

If period of mold cleaning is short: Heated-air drying at 100°C × 3 hours or more