Brief Introduction of Zeon's Plastic Material
Cyclo Olefin Polymer (COP)

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Introduction of Cyclo olefin polymer (COP)

What is COP?
Cyclo Olefin Polymer (COP) is a high performance amorphous thermoplastic resin chemically synthesized from special cyclic olefin monomers.

What is COP used for?
COP offers excellent optical properties (high transparency) for creating optical parts for cameras, electronic displays, blue-ray & laser equipment.

COP's high purity is suitable for a wide range of bio-medical parts like as packaging, bag, syringe, vial / bottle, vessel / plate / cell / chip for blood / DNA / protein diagnostic test.

COP has exceptional electric properties like as insulating capacity, low electric permittivity and loss to use for parts of high frequency antennas, connectors, and so on.

ZEONEX®, ZEONOR®, ZEONOR FILM® are product name by ZEON CHEICALS L.P. / ZEON CORPORATION
COP for Optical Application

Exceptional Properties:
- Light weight
- Totally amorphous
- High heat resistance
- Low moisture absorption
- High transparency
- Low birefringence
- No fluorescing chromophore
- Good & fine moldability
- High purity
COP for Bio Medical Application

Exceptional Properties:
- Light weight
- High heat resistance
- Low moisture absorption
- Low moisture vapor permeability
- High acid/base resistance
- High transparency
- Good & fine moldability
- Low protein adsorption
- No fluorescing chromophore
- High purity
- Incineration disposable
COP for Electronic Application

Exceptional Properties:
- Light weight
- Low moisture absorption
- High acid/base resistance
- High transparency
- Good & fine moldability
- High purity
- Copper plating by UV process
More COP Information –

Please come to the website at:

http://www.zeonex.com/

or contact by

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Applications

Cycloolefin Polymer

\[
\begin{align*}
R_1 & \quad n & \quad R_2
\end{align*}
\]

Excellent electrical property!!

<table>
<thead>
<tr>
<th>Characterization</th>
<th>COP</th>
<th>PTFE</th>
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</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>1.01</td>
<td>2.14～2.20</td>
</tr>
<tr>
<td>Water adsorption (%)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Dielectric constant [1.0GHz]</td>
<td>2.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Dielectric dissipation factor [1.0GHz]</td>
<td>0.0003</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

Observation of Surface conductivity by MIC

- COP 上平滑銅めっき (ZF-16)
- 界面導電率
- COP > フッ素樹脂

- ◆ COP ZF-16 (本手法による)
- ● COP RS420
- ■ 市販国産高周波材料 (B社フッ素)
- ▲ 市販海外高周波材料 (フッ素)
- ■ 市販国産高周波材料 (C社フッ素)
- ▲ 市販国産高周波材料
UV irradiation process model

1. Insulation resin

2. O₃, Active oxygen
   UV
   Insulation resin

Insulation resin is oxidizing by UV light and Ozone gas. Polymer chain is cut by oxidization reactions.

3. Formation of nano-void layer.
   The catalyst penetrate into the nano-sized voids.

4. Then, the electroless deposition reaction is started in nano-sized void.

From these results, adhesion is based on the nano-level anchor effect by the diffusion of deposited copper metals into the nano-void layer in the resin.

5. Because, the cleaved surface of the insulating resin has a low molecular weight, it dissolves in alkaline degreaser.

Formation of nano-void layer.
## Experimental procedure

<table>
<thead>
<tr>
<th>UV irradiation</th>
<th>Accelerating</th>
</tr>
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<tbody>
<tr>
<td>▽</td>
<td>▼</td>
</tr>
<tr>
<td>Alkaline degreasing</td>
<td>Electroless Ni plating</td>
</tr>
<tr>
<td>▼</td>
<td>▼</td>
</tr>
<tr>
<td>Conditioning</td>
<td>Electroless Cu plating</td>
</tr>
<tr>
<td>▼</td>
<td>▼</td>
</tr>
<tr>
<td>Catalizing</td>
<td>Heat treatment</td>
</tr>
</tbody>
</table>

▼ : Water rinsing ▽ : No water rinsing
UV Irradiation Process

Low pressure Hg lamp

Distance from UV lamp: 15 mm
Light power density: 30 mW/cm²

Typical spectrum of low pressure Hg lamp

Generation and Decompose of Ozone

\[ O_2 + \text{hv} (184.9 \text{ nm}) \rightarrow 2O(^3\text{P}) \]
\[ O_2 + O(^3\text{P}) \rightarrow O_3 \]
\[ O_3 + \text{hv} (253.7 \text{ nm}) \rightarrow O(^1\text{D}) + O_2 \]

\( O(^3\text{P}) \): ground state triplet atomic oxygen
\( O(^1\text{D}) \): singlet atomic oxygen

Ozonolysis

Epoxy resin, Polyimide, Polyamide, ABS resin,
LCP film, COP film and other substrate