Mitsui 1-Hexene technology

Mitsui Ethylene Trimerization, MET Process
MET Process

is the On Purpose 1-hexene manufacturing technology which combines

Ideal Process & Original Catalysts
Development history

In 2007, Mitsui Chemicals, Inc. (MCI) started to explored catalysts which trimerize ethylene to 1-hexene, in order to:
- reduce co-monomer cost for m-LLDPE, avoiding market impact and
- enhance the variety of ethylene derivatives for cracker optimization

In 2008, laboratory scale continuous operation test facility for trimerization was on service. Also internal project team was formed, consisted of R&D team and Engineering team in order to perform R&D and Engineering parallely, optimizing the lead time before commercial operation.

In 2009, “MET process” was set up and plant construction was started, following up the test results which were from:
- batch wise laboratory test
- laboratory scale continuous operation
- bench scale test
- pilot scale test

In 2011, MET plant is in commercial service.
**Advantage of “MET Process”**

◆Comparison table

<table>
<thead>
<tr>
<th>Process</th>
<th>Full range oligomerization</th>
<th>Selective trimerization</th>
<th>Coal to liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6 selectivity (%)</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Plant Capacity (KTA)</td>
<td>Large</td>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td>Capex (million $)</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Catalyst</td>
<td>AlEt₃, NiCl₂, ZrCl₄</td>
<td>Cr</td>
<td>MCI catalyst</td>
</tr>
<tr>
<td>Op. condition</td>
<td>High Pressure High Temperature</td>
<td>medium Pressure medium Temperature</td>
<td>Low Pressure Low Temperature</td>
</tr>
<tr>
<td>Process owner</td>
<td>Company S, I, P</td>
<td>Company P</td>
<td>MCI</td>
</tr>
</tbody>
</table>

**MCI catalyst features**
- **Higher activity** in comparison to Cr
- **Higher C6” selectivity**

**MET process features**
- **Less** severe operation condition
- **Less** investment and compact plant

**MCI license features**
- In the world, trimerization process license is open from MCI and other companies
- In the world, **only MCI** is the licensor which has operating plant as plant owner
Summary

The best process, in view of process itself and catalyst

1. Mild operation conditions lead safety and less CAPEX.
2. Higher activity and selectivity contribute to less OPEX.

Rich experience and further more development

1. Reliable technical support based on existing plant in Japan.
2. R&D is continued for further more technology updating, to keep leading edge.

MCI’s contribution to project and future plant operation

1. MCI supports licensee with its experience and the close relationship among its licensees.