The Performance of L-MODU™ for HMA Base Polymer Use

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Performance Materials Laboratories
Petrochemical Business Department
1. Introduction of L-MODU™

(1) New Polyolefin developed by IDEMITSU

New type of polypropylene was developed by using precise control technology of stereo-regularity and molecular weight.
1. Introduction of L-MODU™

(2) Control technology of Stereo-regularity and Molecular weight

- **High crystalline** – **High stiffness**
  - *Isotactic*
  - Conventional catalyst
  - **Middle Range**
  - Low crystalline – Soft
  - *Idemitsu Metallocene catalyst*
  - Homogeneous distribution

- **Atactic**
  - Amorphous
  - Heterogeneous distribution
1. Introduction of L-MODU™

(3) Relationship between Crystalline Structure and the Feature

High crystalline

- High Modulus
- High Strength
- Low Elongation

Low crystalline L-MODU

- Suitable Modulus
- Suitable Strength
- High Elongation
- Elastic behavior

Amorphous

- Low Modulus
- Low Strength
- High Elongation
1. Introduction of L-MODU™

(4) Typical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Method</th>
<th>L-MODU™</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S400</td>
</tr>
<tr>
<td>MFR (g/10min) (230°C, 2.16kg)</td>
<td>ASTM D 1238</td>
<td>2,600*</td>
</tr>
<tr>
<td>Molecular Weight (Mw)</td>
<td>GPC (Idemitsu method)</td>
<td>45,000</td>
</tr>
<tr>
<td>B-Viscosity (mPa·s) (190 °C)</td>
<td>ASTM D 3236</td>
<td>8,500</td>
</tr>
<tr>
<td>Density (kg/m³)</td>
<td>ISO1183</td>
<td>870</td>
</tr>
<tr>
<td>Softening Point (°C) (Ring-and-ball)</td>
<td>ISO4625</td>
<td>93</td>
</tr>
<tr>
<td>Tensile Modulus (MPa)</td>
<td>ASTM D 638</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>ISO527</td>
<td>90</td>
</tr>
<tr>
<td>Elongation at Break (%)</td>
<td>Idemitsu method</td>
<td>600</td>
</tr>
</tbody>
</table>

* MFR of S400 is converted from viscosity data.
2. The Performance of L-MODU™ for HMA use

*IDEMITSU L-MODU™ will bring Great Advantage for HMA !!*

1. **Excellent Sprayability** even at severer conditions (120°C Spiral, Ω Spray)
   ⋯ Page 7

2. **Strong Bond Strength**
   Saves up to approx. 30% of HMA
   ⋯ Page 8

3. **Producing Low Temperature Sprayable HMA**
   ⋯ Page 9

4. **Wide Formulation Ideas**
   ⋯ Page 10
2. The Performance of L-MODU™ for HMA use

(1) Excellent Sprayability

L-MODU™ based HMA has Excellent sprayability even at severe conditions such as 120°C, ΩSpray. This feature is attributed to the controlled Mw and Mw distribution which is brought by originally developed metallocene catalyst.

**Spiral Spray Test (4gsm, 150m/min)**

<table>
<thead>
<tr>
<th>L-MODU based HMA @120°C</th>
<th>APAO based HMA @120°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM-B (30/50/20)</td>
<td>APAO/TF=80/20</td>
</tr>
</tbody>
</table>

**ΩSpray Test (4gsm, 100m/min)**

<table>
<thead>
<tr>
<th>L-MODU based HMA @150°C</th>
<th>APAO based HMA @150°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM-A (50/40/10)</td>
<td>APAO/TF/oil=50/40/10</td>
</tr>
</tbody>
</table>
2. The Performance of L-MODU™ for HMA use

(2) Higher Bond Strength

L-MODU based HMA has good NW/PE bond strength and higher NW/NW bond strength compared with other type. This feature is attributed to excellent cohesion strength of L-MODU and anchor effect arising from appropriate crystallization speed after deeply penetrated to NW.

**Advantage:** Saves up to approx. 30% of HMA

L-MODU can achieve 300gf T-Peel strength with 3gsm others 4.5gsm.
2. The Performance of L-MODU™ for HMA use

(3) Sprayable at Lower Temperature

L-MODU based HMA is sprayable at lower temperature and produces good bond strength as well. This feature is attributed to lower melting point of L-MODU.

Advantage: Fitting for thin materials, Prolong maintenance term of application systems, Save energy cost, Securing staff safety.)
2. The Performance of L-MODU™ for HMA use

(4) Wide Formulation Ideas

L-MODU will perform good bonding strength with various oil content. For example if you would like to increase the oil content, “30%” is possible (LM-C).

Formulation (BP/TF/oil): Application Temp. | Oil content
---|---
LM-C | 30/40/30 | 150°C | 30%
LM-D | 30/50/20 | 130°C | 20%
LM-A | 50/40/10 | 145°C | 10%
LM-C | 30/40/30 | 150°C | 30%
LM-D | 30/50/20 | 130°C | 20%
LM-A | 50/40/10 | 145°C | 10%

T-Peel strength of each HMA (CD)

Film destruction

NW destruction
2. The Performance of L-MODU™ for HMA use

(4) Wide Formulation Ideas

L-MODU will perform good bonding strength with various tackifier content. If you would like to decrease the content of tackifier, “20%” is possible (LM-E).

<table>
<thead>
<tr>
<th>Formulation (BP/TF/oil)</th>
<th>Application Temp.</th>
<th>TF content</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM-E</td>
<td>70/20/10</td>
<td>20%</td>
</tr>
<tr>
<td>LM-F</td>
<td>60/30/10</td>
<td>30%</td>
</tr>
<tr>
<td>LM-D</td>
<td>30/50/20</td>
<td>50%</td>
</tr>
</tbody>
</table>

T-Peel strength of each HMA (CD)

NW destruction

Film destruction
(4) Wide Formulation Ideas

Both of paraffinic and naphthenic oils are suitable for formulation with L-MODU.
2. The Performance of L-MODU™ for HMA use

(4) Wide Formulation Ideas

All kinds of water white resins are possible to use as tackifier with L-MODU.
2. The Performance of L-MODU™ for HMA use

(5) Test Conditions

- **HMA Formulation**

<table>
<thead>
<tr>
<th>BP/TF/oil</th>
<th>L-MODU</th>
<th>Tackifier</th>
<th>DianaProcessOil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S400</td>
<td>S600</td>
<td>S900</td>
</tr>
<tr>
<td>LM-A</td>
<td>50/40/10</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>LM-B</td>
<td>30/50/20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>LM-C</td>
<td>30/40/30</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>LM-D</td>
<td>30/50/20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>LM-E</td>
<td>70/20/10</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>LM-F</td>
<td>60/30/10</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>LM-G</td>
<td>30/50/20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>LM-H</td>
<td>30/50/20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>LM-I</td>
<td>30/45/25</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>LM-J</td>
<td>30/50/20</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

TF-A: copolymer type  
TF-B: DCPD  
TF-C: C5

- **Spray Conditions**  
  Line speed: 150m/min  
  Nozzle size: 0.5mm  
  Adhesive weight: 3, 4, 5gsm  
  Application temperature: 120~150°C

- **Aging Conditions**  
  2 weeks at 50°C

- **Substrates**  
  SMS nonwoven (17 gsm)  
  Breathable polyethylene film (20gsm)
Data in this material shows sample figures measured under certain specific conditions.

Usage of products in this material does not warrant the successful results of applications of the product for specific usage.

In case of product being used for purpose and usage introduced in this material, please pay attention to industrial property rights of third party which may relate to such use.

In case of the product being used for medicine, medical device and cosmetic, please consult with the manufacturer before such use.

Please note that the content of this material may be altered from time to time according to improvement of products without prior notice.

Figures of physical characteristics of other resins than the products have been referred from other catalogues and sources thereof.