Introduction of L-MODU™ for Nonwoven Fabrics

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Idemitsu Kosan Co., Ltd.
What is L-MODU?

Low Melting Point and Low Crystalline Polypropylene
### What is L-MODU? ~ Properties ~

<table>
<thead>
<tr>
<th>Property</th>
<th>Method</th>
<th>L-MODU&lt;sup&gt;TM&lt;/sup&gt;</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>Melting Point (°C)</td>
<td>DSC  (Idemitsu method)</td>
<td>80</td>
</tr>
<tr>
<td>Softening Point (°C)</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.
**What is L-MODU? ~ Outlook ~**

**General PP**

**Amorphous PP**

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**L-MODU**

- S901 (MFR: 50)
- S600 (MFR: 390)
- S400 (MFR: 2600)

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You can buy **ALL GRADES** of L-MODU in PELLETS.
Concepts and Benefits for Nonwoven

What are your requests?

- To Produce Softer and Silky touch Nonwovens
- To Produce Good-Looking Nonwovens
- Cost Down
- To Produce Higher Hydrostatic Head Nonwovens
- To Produce Advanced Nonwovens for Filter Properties
- To Produce Elastic Nonwovens by PP
To Produce Softer and Silky touch Nonwovens

- How about Fine Denier Fiber by L-MODU?
- How about Fine Light Weight Fabric with same Tensile Modulus by L-MODU?
- How about Low Embossing Temperature by L-MODU?
- How about Silky-Touch with small amount of Erucamide by L-MODU?
- How about BICO(PE-PP) by L-MODU?
To Produce Good-Looking Nonwovens

- How about Uniformity UP made by Fine Denier Fiber by L-MODU?
- How about Low Embossing Temperature by L-MODU?
- How about Reducing Linting by L-MODU?
Cost Down

- How about Thin Nonwoven with same Tensile Modulus by L-MODU?

- How about Reducing a short stop because of Fiber Breaking by L-MODU?

- How about Saving Electricity Cost by Lowering Calendar Temperature by L-MODU?
To Produce Higher Hydrostatic Head Nonwovens

- *How about Improving Hydrostatic Head with Fine Denier Fiber by L-MODU?*

- *How about Improving Hydrostatic Head by Lowering Calender temperature by L-MODU?*

To Produce Elastic Nonwovens by PP

- *How about Improving Elasticity with BICO by L-MODU?*
To Produce Advanced Nonwovens for Filter Properties

- How about Improving Filter Property with Fine Denier Fiber by L-MODU?

To Produce Elastic Nonwovens by PP

- How about Improving Elasticity with Soft Nonwoven by L-MODU?
- How about Thin Nonwoven with same Tensile Modulus by L-MODU?
Cost Down

- *How about Reducing the number of Shot and Fly by L-MODU?*

- *How about Thin Nonwoven with same Tensile Modulus by L-MODU?*
Mechanism of making Fine Denier Fiber

Solidification position of the spin-line is shifted to downstream and neck-like deformation is suppressed by blending L-MODU™.

The wide process window could be obtained

You can arrange the process condition to make a Fine Denier Fiber
**Concepts and Benefits for Nonwoven**

**Fine Denier Nonwoven (SSS) ~ SEM and Properties ~**

**Only General PP**

- Weight: 15 gsm
- Diameter: 1.7 denier
- Tensile Modulus
  - MD: 35 N/5cm
  - CD: 13 N/5cm

**General PP + L-MODU 10%**

- Weight: 13 gsm
- Diameter: 1.0 denier
- Tensile Modulus
  - MD: 41 N/5cm
  - CD: 18 N/5cm

*Fine Denier → The Number of Fiber in Emboss UP → Tensile Modulus UP!*
**Concepts and Benefits for Nonwoven**

Fine Denier Nonwoven (SSMMS) ~ SEM and Properties ~

**Only General PP**

- Weight: 8.0 gsm (S)  
  2.0 gsm (M)  
  Total: 10 gsm

- Diameter: 1.5 denier (S)  
- Calender temp.: 126°C / 127°C

- Hydrostatic Head: 106 mm Aq

**General PP + L-MODU 10%**

- Weight: 8.0 gsm (S)  
  2.0 gsm (M)  
  Total: 10 gsm

- Diameter: 1.3 denier (S)  
- Calender temp.: 108°C / 104°C

- Hydrostatic Head: 154 mm Aq

Fine Denier → Hydrostatic Head UP!
Bleed Model of Erucamide

Erucamide pass through amorphous regions to diffuse to the filament surface

L-MODU goes into Non Crystal Phase of General PP

Non Crystal Phase becomes larger

Erucamide can easily diffuse to the filament surface
How to make “Soft” PP?

- Addition of rubbers
- Copolymerization
- Stereoregularity control ← Concept for L-MODU™

[Diagram showing Metallocene Catalyst, Methyl Group, Carbon chain]
Idemitsu have achieved Unique PP, L-MODU, that have not only “Stereorandom” but “Sharp Molecular Weight Distribution” by Idemitsu original metallocene Catalyst.
* 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.
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* In case of the product being used for medical device, 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.