VMX®

Easypeelable Sealant Resin

Performance Polymers Department
Performance Polymers Laboratory

Ver3. Oct 1 2007
VMX is the resin for easy peel sealant of lid mainly for food package or container.

VMX shows high peeling performance, easy, clean, and smooth. Mitsubishi Chemical’s technology of fine distribution of polymerization and compounding in micrometer size realized it.
Examples of Layer Structure

Top Coating

Anchor Coating

Extrusion-coating on Base Film

Extrusion-coating on PE

Dry-lamination

Extrusion-coating on Base Film

Extrusion-coating on PE

Dry-lamination

Extrusion-coating on Anchor Coat

Pet

Pe

Vmx

Paper

Aluminum Foil

Pe

Vmx

Pet

Aluminum Foil

Pet

Vmx

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General Requirements for LID

<table>
<thead>
<tr>
<th>General Requirements</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ver3. Oct 1 2007
1. **Smooth Peelability**
   No knocking, no zippy, smooth peeling performance.

2. **Clean Surface**
   Clean and flat surface after peeling.

3. **Easy Handling of Converted Products**
   Less blocking in converted films.

4. **Less Smell**
   No smell of Vinyl Acetate.

5. **Excellent Peelability in Wide Temperature**
   Stable peelability from chilled to microwave environment.

6. **Wide Sealing Temperature**
   Stable peelability in wide sealing temperature.

7. **Wide Processability**
   Good processability in extrusion coating, lamination.

8. **Safe and Hygienic**
   Approved by Japanese regulation for food contacting packaging container.
   Some grades meet FDA regulation.
<table>
<thead>
<tr>
<th>ADHERENT MATERIAL</th>
<th>GRADE</th>
<th>CHARACTER</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS/PET/ PVC/PP</td>
<td>Z100F</td>
<td>Standard Transparent</td>
<td>Yogurt, Jelly</td>
</tr>
<tr>
<td></td>
<td>Z150X</td>
<td>Higher Performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z180F</td>
<td>Peeling Stability in Freezing</td>
<td>Freezed Foods</td>
</tr>
<tr>
<td>PP</td>
<td>X150F</td>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X250F</td>
<td>Heat Resistance</td>
<td>Jelly, Pudding</td>
</tr>
<tr>
<td></td>
<td>X270F</td>
<td>Heat Resistance Transparent</td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>Y150F</td>
<td>Standard</td>
<td>PE Coated Paper Cup, VMX to VMX</td>
</tr>
<tr>
<td></td>
<td>Y100F</td>
<td>Middle Seal Strength</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y80F</td>
<td>Lower Seal Strength</td>
<td></td>
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</tbody>
</table>
### Properties

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>UNIT</th>
<th>METHOD</th>
<th>for PS/PET/PVC/PP</th>
<th>for PP</th>
<th>for PE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Z100F</td>
<td>Z150X</td>
<td>Z180F</td>
</tr>
<tr>
<td>MFR(190 ºC)</td>
<td>g/10min.</td>
<td>ISO R-1133</td>
<td>12</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>ISO R-1183</td>
<td>0.906</td>
<td>0.94</td>
<td>0.93</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>MPa</td>
<td>ISO R-527</td>
<td>19</td>
<td>10</td>
<td>13</td>
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<tr>
<td>Tensile Elongation</td>
<td>%</td>
<td>ISO R-257</td>
<td>880</td>
<td>700</td>
<td>630</td>
</tr>
<tr>
<td>Olzen Flexural Strength</td>
<td>MPa</td>
<td>ASTM D-747</td>
<td>150</td>
<td>110</td>
<td>54</td>
</tr>
<tr>
<td>Melting Point(Peak)</td>
<td></td>
<td>ASTM D-696</td>
<td>100</td>
<td>108</td>
<td>106</td>
</tr>
<tr>
<td>VICAT Softening Point</td>
<td></td>
<td>ISO R-306</td>
<td>75</td>
<td>65</td>
<td>67</td>
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<tr>
<td>Haze(30µ)</td>
<td>%</td>
<td>JIS K6714</td>
<td>3</td>
<td>-</td>
<td>56</td>
</tr>
</tbody>
</table>

Values indicated in the table only describe typical properties.
Peeling Strength - Type Z (HIPS) -

Adherent: HIPS Sheet 300μ
Layer Structure: PET12/PE20/VMX30
Sealing Condition: Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.

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This graph shows peeling strength depends on atmosphere temperature.

Adherent: HIPS Sheet 300μ
Layer Structure: PET16/PE20/VMX30
Sealing Condition: Temp.160DegC / Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.
Peeling Strength - Type Z (A-PET) -

Adherent: A-PET Sheet 300μ
Structure: PET12/PE20/VMX30
Sealing Condition: Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.

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Peeling Strength
- Type Z (PP) -

Adherent: PP Sheet 300μ
Layer Structure: PET12/PE20/VMX30
Sealing Condition: Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.
Peeling Strength - Type X (PP) -

Adherent: PP Sheet 300μ (*500μ: X250F)
Layer Structure: PET12/PE20/VMX30 (*PET16/PP50//VMX30: X250F)
Sealing Condition: Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.

Ver3. Oct 1 2007
### Heat Resistance Leak Test

**X250F**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>METHOD</th>
<th>UNIT</th>
<th>X250F</th>
</tr>
</thead>
<tbody>
<tr>
<td>M FR (230℃)</td>
<td>JIS-K7210</td>
<td>g/10min</td>
<td>7.0</td>
</tr>
<tr>
<td>M FR (190℃)</td>
<td>JIS-K7210</td>
<td>g/10min</td>
<td>3.1</td>
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<tr>
<td>Density</td>
<td>JIS-K7112</td>
<td>g/cm³</td>
<td>0.90</td>
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<tr>
<td>Tm</td>
<td>DSC</td>
<td>-</td>
<td>151</td>
</tr>
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</table>

**Leak Test**

**MCC method**

- **No Leakage**

(n = 5)

**Testing Condition:**

- **Lid Structure**: Ny15 / PP40 / VMX10
- **Adherent**: PP
- **Sealing Condition**: 180degC*1.5sec, filled with full of water
- **Heat Condition**: 120degC*30min.(with pressure outside)

Remarks: Result of this test does not guarantee any performance in heat resistance.
Peeling Strength
- Type Y (PE) -

Adherent: PE Sheet 300μ
Layer Structure: PET16/PE20/VMX30
Sealing Condition: Seal Bar 5mmw / Pressure 0.2MPa / Time 1 sec.
Peeling Condition: 180 deg. Peeling / Peeling Speed 300mm/min.
## Processing Condition

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>SS (rpm)</th>
<th>Z100F</th>
<th>Z150F</th>
<th>Z180F</th>
<th>X150F</th>
<th>X250F</th>
<th>X270F</th>
<th>Y80F</th>
<th>Y100F</th>
<th>Y150F</th>
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</thead>
<tbody>
<tr>
<td>Motor Load(A)</td>
<td>100</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>12</td>
<td>11</td>
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<tr>
<td>Extrusion Pressure (kg/cm²)</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>-</td>
<td>57</td>
<td>56</td>
<td>56</td>
<td>45</td>
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<td>38</td>
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<tr>
<td>Melt Ductility *2</td>
<td>100</td>
<td>150</td>
<td>150</td>
<td>130</td>
<td>55</td>
<td>75</td>
<td>90</td>
<td>100</td>
<td>105</td>
<td>110</td>
</tr>
<tr>
<td>Neck-In(mm) *3</td>
<td>100</td>
<td>45</td>
<td>45</td>
<td>55</td>
<td>33</td>
<td>54</td>
<td>42</td>
<td>70</td>
<td>74</td>
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<td>150</td>
<td>40</td>
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<td>31</td>
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<td>60</td>
<td>64</td>
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<td>200</td>
<td>34</td>
<td>34</td>
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<td>30</td>
<td>43</td>
<td>37</td>
<td>54</td>
<td>56</td>
<td>40</td>
</tr>
</tbody>
</table>

### MACHINE ABSTRACT:
- **Extruder**: 40mm L/D = 26
- **Screw**: Metering Type
- **Die**: Straight Manifold, Lip 0.8mm/Width 360mm/Lip Land 2mm
- **Cooling Roll**: Semi Mat
- **Press Roll**: Silicon Rubber

### EXTRUSION CONDITION:
- **Resin Temp.**: 280 deg.C (just under die)
- **Set Up Temp.**: C1=230/C2=260/C3=285/A=300/D1=300/D2=300/D3=300
- **Air Gap**: 60mm

Ver3. Oct 1 2007
1. **Example of Anchor Coat Material**
   General Purpose : Polybutadiene Type
   ex) “Titabond T180” by Nippon Soda
       T180 : Water : Methanol = 1 : 2 : 7
   For Boiling Application : Isocyanate Type
   ex) “Titabond T150” by Nippon Soda
       T150 : T122(Curing Agent) : Ethylacetate
          = 1 : 1: 10
       Aging Condition : 35 – 40 deg.C, 24hrs
   Note : Ozone treatment is necessary to laminate VMX directly onto base film. There should be PE basement under VMX when no facility of ozone treatment.

2. **Purging**
   PE to VMX : Start sampling after 5 to 10kg of VMX extrusion
   VMX to PE : Purge with 10 to 15kg of LDPE of MFR 4 to 5.