Achieve Higher Performance and Improved Processing with LM Polyol

VORANOL™ 223-060LM polyol is a newly developed polyether polyol that offers enhanced mechanical performance, abrasion and long-term durability compared to conventional propylene glycol (PPG) systems (PPG+). It enables optimized microphase separation from conventional urethane hard segment chemistries to permit formulation of high-performance polyurethane systems. This innovative upgrade continues to offer the excellent processing performance of standard polyether materials.

The combination of low viscosity at room temperature and high primary hydroxyl content can reduce production costs through fast cure and process cycle times and low processing temperatures.

Its low viscosity also contributes to easier process and storage management across a broad temperature range.

VORANOL™ 223-060LM polyol is the result of development of PPG polyether polyls with low unsaturation for cost-effective use in coatings, adhesives, sealants and elastomers (CASE) and thermoplastic polyurethane (TPU) applications.

The material performance of VORANOL™ 223-060LM has been benchmarked against alternative PPG-based polyether polyls in cast elastomers and TPU and shown to deliver comparable performance.

The VORANOL™ Advantage
VORANOL™ 223-060LM polyol product advantages include:
- Ease of processing
- Ease of formulation
- High reactivity
- Excellent mechanical properties
- Consistent performance
- Broad processing latitude
- Superior performance compared to polyether polyls for elastomer applications
- Potential for use where higher performance requirements are present
- High pressure and high heat resistance
- High impact absorbance
- Balance of fast reactivity and water uptake
### Cast Elastomer Property Comparison

<table>
<thead>
<tr>
<th>Polyl Type</th>
<th>Shore A (D2240)</th>
<th>% NCO Prepolymer (D2572)</th>
<th>UTS @100% (psi)</th>
<th>TS @300% (psi)</th>
<th>Elongation (%)</th>
<th>T_g (ºC) (DMS)</th>
<th>Compression Set (% D395 B*)</th>
<th>Resilience (% Ball Rebound)</th>
<th>Mass Uptake % (7 day, 50ºC, Water)</th>
<th>% Retention of TS (7 day, 50ºC, Water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO-capped polyether polyol (2,000 g/mol)</td>
<td>84</td>
<td>12.3</td>
<td>5900</td>
<td>550</td>
<td>960</td>
<td>-19</td>
<td>43</td>
<td>47</td>
<td>~10</td>
<td>~50</td>
</tr>
<tr>
<td>VORANOL™ 223-060LM</td>
<td>85</td>
<td>14.0</td>
<td>5980</td>
<td>610</td>
<td>1030</td>
<td>-23</td>
<td>32</td>
<td>45</td>
<td>~4.5</td>
<td>~70</td>
</tr>
</tbody>
</table>

In all cases, (DXXXX) refers to ASTM utilized.

*70°C, 25%, 24 hours

### Cast Elastomer Application

One-shot process where polyol is mixed with chain extender, catalyst and MDI at room temperature and index of 1.05. Elastomers were cast into heated open mold at 80°C, demolded after 5 minutes and post cured at 100°C for 16 hours. Testing followed ASTM.

<table>
<thead>
<tr>
<th>% NCO</th>
<th>Viscosity @ 25 ºC (Pa.s)</th>
<th>Hardness (Shore A)</th>
<th>Tensile Strength (psi)</th>
<th>Tear Strength (pil)</th>
<th>Modulus @100% (psi)</th>
<th>Modulus @300% (psi)</th>
<th>Elongation (%)</th>
<th>Compression Set (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>9.38</td>
<td>90</td>
<td>3770</td>
<td>508</td>
<td>1044</td>
<td>1639</td>
<td>655</td>
<td>50</td>
</tr>
</tbody>
</table>

Full prepolymer synthesized using TDI-100 and cured with dimethylthioulenediamine at 1.05 index. Cast into heated open mold at 100°C and post cured at 100°C for 16 hours properties per JIS K3712.