NOVEL HIGH PERFORMANCE POLYETHER BASED POLYURETHANE ELASTOMERS FOR DYNAMIC APPLICATIONS

Dow Polyurethanes

Subodh Jagtap$^1$, Rui Xie$^1$, Andrew Davies$^2$, Ian Mycock$^2$, Gareth Roberts$^2$, Andrew Gilbert$^2$, Rajat Duggal$^1$

$^1$Polyurethane R&D, The Dow Chemical Company, Freeport, TX 77541, US
$^2$Polyurethane TS&D, The Dow Hyperlast Ltd., Birch Vale, EN SK22 1BR, UK
Elastomers for Dynamic Applications

Dynamic elastomer applications account for 50% of the High Performance Cast Elastomer Market

Subjected to repeated deformations under load at a certain frequency

Conversion of Mechanical Energy to Heat

Heat Buildup Causes Failures

- Fatigue cracking
- Blow out
- Wearing, Tearing and Cut
PU Elastomers for Dynamic Applications

- **Key features**
  - Balanced mechanical properties
  - Retention of modulus at elevated temperature
  - Low heat buildup under load and repeat deformations
  - Resistance to harsh environments at elevated temperature, e.g. chemical and moisture resistance

- **Potential Applications**
  - Industrial wheels, such as forklift wheels, material cart wheels, escalator wheels
  - Industrial rollers, such as printing rolls, paper mill rolls, metal handling rolls
  - Automotive bushings, damper springs, and suspension pads
  - Industrial belts, such as drive belts, conveyor belts, and timing belts
Polyether Polyols for CASE Applications

- Polytetramethylene Ether Glycol (PTMEG)
  - Excellent stress-strain properties
  - Outstanding hydrolytic stability
  - Superior dynamic properties
  - Good abrasion resistance
  - Cost prohibitive in some applications
  - High viscosity for RT applications

- Polypropylene Glycol (PPG)
  - Low viscosity and versatile (wide range of functionality and Mw)
  - Cost effective
  - Lower mechanical properties, e.g. stress-strain properties, abrasion, and tear resistance
  - Lower reactivity (moisture sensitive)
PU Systems: Dow Polyurethane's Offering

<table>
<thead>
<tr>
<th>Dow’s System</th>
<th>Type</th>
<th>Polyol Backbone</th>
<th>Iso</th>
<th>Prepolymer</th>
<th>Curative</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HYPERLAST™</td>
<td>Quasi system</td>
<td></td>
<td>HYPERLAST™ 301</td>
<td>HYPERLAST™ C301</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High performance polyether polyol</td>
<td>MDI</td>
<td></td>
<td></td>
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<tr>
<td>B</td>
<td>HYPERLAST™</td>
<td>Quasi system</td>
<td>PTMEG</td>
<td>PTMEG Prepolymer</td>
<td>PTMEG Curative</td>
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<td></td>
<td></td>
<td>PTMEG</td>
<td>MDI</td>
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<tr>
<td>C</td>
<td>HYPERLAST™</td>
<td>Quasi system</td>
<td>Regular PPG</td>
<td>PPG Prepolymer</td>
<td>PPG Curative</td>
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<tr>
<td></td>
<td></td>
<td>Regular PPG</td>
<td>MDI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## HYPERLAST™ 301

### Mechanical Properties

- **Prepolymer:** HYPERLAST™ 301 @ 25 to 40 °C
- **Curative:** Curative @ 25 to 40 °C
- **Molding:** Demold at 1 hr (80 °C) and post-cure 16hrs (80 °C)

<table>
<thead>
<tr>
<th>Property</th>
<th>Units/Lab Method</th>
<th>90</th>
<th>85</th>
<th>70</th>
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</thead>
<tbody>
<tr>
<td>Hardness (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T.S. (MPa)</td>
<td>BS 903/A</td>
<td>29</td>
<td>22</td>
<td>22</td>
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<tr>
<td>% Elong. at Break</td>
<td>BS 903/A</td>
<td>483</td>
<td>678</td>
<td>691</td>
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<tr>
<td>100% Modulus (MPa)</td>
<td>BS 903/A</td>
<td>7.7</td>
<td>5.7</td>
<td>3.3</td>
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<tr>
<td>Resilience</td>
<td>Lupke Pendulum</td>
<td>32%</td>
<td>44%</td>
<td>49%</td>
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<tr>
<td>C-Tear Strength (N/mm)</td>
<td>Angle, BS903,Pt A3</td>
<td>92</td>
<td>77</td>
<td>56</td>
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<tr>
<td>Gel Time</td>
<td>100 g, 40 °C</td>
<td>4 min</td>
<td>4.25 min</td>
<td>4.5 min</td>
</tr>
<tr>
<td>DIN Abrasion (mm³)</td>
<td>DIN 53516</td>
<td>59</td>
<td>79</td>
<td>67</td>
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</tbody>
</table>

* Lab processed; not be construed as specifications

**HYPERLAST™ 301 has range of performance**
HYPERLAST™ 301 has low viscosity that can aid in processing
# HYPERLAST™ 301

## Dow Lab Tests: Systems Comparison

<table>
<thead>
<tr>
<th></th>
<th>PTMEG PU Elastomer</th>
<th>PPG PU Elastomer</th>
<th>HYPERLAST 301/85</th>
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</thead>
<tbody>
<tr>
<td>Hardness (A)</td>
<td>85</td>
<td>85</td>
<td>87</td>
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<tr>
<td>Polyol Type</td>
<td>PTMEG</td>
<td>Regular PPG</td>
<td>High performance Polyether polyol</td>
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<tr>
<td>T.S.(MPa)</td>
<td>BS 903/A</td>
<td>34</td>
<td>13</td>
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<tr>
<td>% Elong. at Break</td>
<td>BS 903/A</td>
<td>450</td>
<td>325</td>
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<tr>
<td>100% Modulus (MPa)</td>
<td>BS 903/A</td>
<td>6.2</td>
<td>5</td>
</tr>
<tr>
<td>Resilience</td>
<td>Lupke Pendulum</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Tear Strength (N/mm)</td>
<td>C-Angle, BS903,Pt A3</td>
<td>80</td>
<td>50*</td>
</tr>
<tr>
<td>Gel Time</td>
<td>100 g, 40 °C</td>
<td>4.5 to 6 min</td>
<td>7 to 9 min</td>
</tr>
<tr>
<td>Abrasion (mm³)</td>
<td>DIN 53516</td>
<td>45</td>
<td>155</td>
</tr>
<tr>
<td>CompressIon set (%) 22h @ 70 °C</td>
<td>ASTM D395</td>
<td>40</td>
<td>-</td>
</tr>
</tbody>
</table>

* ASTM D624, Nicked Crescent

**HYPERLAST™ 301 has excellent mechanical performance**
HYPERLAST™ 301 demonstrates similar performance window versus PTMEG based system
HYPERLAST™ 301
Stability in Humid Conditions (wet ageing @ 70°C)

HYPERLAST™ 301 demonstrates stable performance up to 70°C in water
Hydrolytic Stability of Elastomers Based on PTMEG System and HYPERLAST™ 301

Excellent hydrolytic stability. 70% retention of tensile strength after 28 days in water at 70°C.
Summary

- **Improved performance over conventional PPG Systems**
  - Excellent abrasion performance
  - Tear strength matches that of PTMEG based systems
  - Enhanced dynamic performance
  - Improved durability

- **Excellent processing**
  - Lower viscosity than PTMEG based systems
  - Broad range of hardness with a single prepolymer
  - Better reactivity profile

- **Excellent cost to performance**
HYPERLAST™ 301
What it is?

- Novel polyether polyol based Quasi-MDI pre-polymer system
- Curatives available for range of hardness (70 A, 85 A and 90 A)
- System processes at 25 to 40 °C
- Non-Hg catalyzed systems; Gel time in the range 3.5 to 4.5 min (hand mix @ at 40 °C on 100 gm). Room temp gel time ~ 7 to 8 min.
- Demold at 1 hr (80 °C) and post-cure 16hrs (80 °C)
QUESTIONS?

Thanks for your attention!!