ProPell™ Low Friction Compounds
About Coefficient of Friction (CoF)

• Physical property commonly used to define lubricity of a medical device

• Ratio of the force of friction between two bodies and the force pressing them together

• Also a system property

• Affected by environmental conditions such as temperature and moisture

• Dependent on the material used
Significance of Low Friction

- Low CoF implies improved lubricity in medical devices
- Increased lubricity contributes to ease of insertion & removal from the body
- Medical device applications requiring low friction:
  - Catheter Tubing
  - Handle Triggers
  - Buttons
  - Gears
ProPell™ Low Friction Technology

- Uses non-migratory additives to enhances the surface to reduces inherently high friction of soft polymers
- Retains desired mechanical properties
- Improves manufacturing and application performance
- Reduces tackiness of flexible medical device components
- Well-suited for extrusion and injection molding applications
- USP Class VI compatible
# ProPell™ Pebax® Compounds

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Units</th>
<th>ProPell PEBA 72D 0118A</th>
<th>Pebax* 7233 (control)</th>
<th>ProPell PEBA 35D 0114B</th>
<th>Pebax* 3533 (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile Strength @ break</strong></td>
<td>ASTM 638</td>
<td>psi</td>
<td>8,640</td>
<td>7,870</td>
<td>5,580</td>
<td>5,340</td>
</tr>
<tr>
<td><strong>Tensile Elongation @ break</strong></td>
<td>ASTM 638</td>
<td>%</td>
<td>205</td>
<td>215</td>
<td>825</td>
<td>920</td>
</tr>
<tr>
<td><strong>Tensile Modulus</strong></td>
<td>ASTM 638</td>
<td>psi</td>
<td>159,670</td>
<td>131,470</td>
<td>1,670</td>
<td>1,020</td>
</tr>
<tr>
<td><strong>Static Coefficient of Friction</strong></td>
<td>ASTM D1894</td>
<td>-</td>
<td>0.035</td>
<td>0.041</td>
<td>0.085</td>
<td>0.531</td>
</tr>
</tbody>
</table>

Pebax® is a registered trademark of Arkema
# ProPell™ Pellethane® Compounds

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Units</th>
<th>ProPell TPU 55D 0118A</th>
<th>PUET 55D (control)</th>
<th>ProPell TPU 80A 0118J</th>
<th>PUET 80A (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength @ break</td>
<td>ASTM 638</td>
<td>psi</td>
<td>10,940</td>
<td>11,010</td>
<td>7,170</td>
<td>5,435</td>
</tr>
<tr>
<td>Tensile Elongation @ break</td>
<td>ASTM 638</td>
<td>%</td>
<td>375</td>
<td>420</td>
<td>530</td>
<td>550</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>ASTM 638</td>
<td>psi</td>
<td>18,500</td>
<td>12,740</td>
<td>1,790</td>
<td>1,820</td>
</tr>
<tr>
<td>Static Coefficient of Friction</td>
<td>ASTM D1894</td>
<td>-</td>
<td>0.031</td>
<td>0.041</td>
<td>0.051</td>
<td>0.151</td>
</tr>
</tbody>
</table>

*Pellethane® is a registered trademark of Lubrizol*
ProPell™ Low Friction Advantage

- ProPell™ TPU parts have a dry coefficient of friction of 0.05 representing a 66% reduction compared to the unmodified polymer with a hardness of 80 Shore A.

- ProPell™ PEBA parts have dry coefficient of frictions of .084 representing a 84% reduction than the unmodified polymer with a hardness of 35 Shore D.
Additional Low Friction Technologies

Perfluoropolyether Synthetic Oil

- Colorless, odorless, nonflammable, radiation stable, chemically inert additive that meets USP Class VI biocompatibility.
- Performs as a processing aid for polymers to prevent gels in film applications
- Very low addition level
- Good bondability after addition
Additional Low Friction Technologies

PTFE Additives

• Low – high additions (up to 15%) into melt processible polymers significantly improve dynamic frictional properties in dry conditions.

• Good bondability with adhesives

• Good low friction results when used in conjunction with perfluoropolyether technology