Bioabsorbable Polymers
PLL, PGA, PCL, and More Exclusively Used for Absorv® Extrusions

OVERVIEW

Zeus makes Absorv® products with bioabsorbable polymers that have unique absorption profiles giving medical engineers the ability to develop customizable solutions. These products match healing rates of tissue. These extrusions are typically made of poly-L-lactic acid (PLLA) or poly(glycolic acid) (PGA), copolyesters of poly(ε-caprolactone) (PCL), trimethylene carbonate (TMC), or poly(p-dioxanone) (PPDO) and can also be made from combinations of these polymers.

The bioabsorbable materials we use are made from natural and synthetic materials and easily degrade via hydrolysis or naturally occurring enzymes within the body. Because these well-characterized biodegradable materials disappear over time, they require no secondary surgery to remove them; they are biocompatible and toxicologically safe.

Zeus bioabsorbable products are highly customizable, and we can control such attributes as morphology (crystallinity) and orientation (axial, lateral) during the extrusion process and through different combinations of our bioabsorbable. The end result is that you have a product tailored to almost any degradation time frame. For neurovascular, cardiovascular, and even peripheral applications, we specialize in tight tolerance tubing extrusions with walls that are extremely thin yet strong.

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APPLICATIONS
- Scaffolding
- Orthopedic
- Dental
- Tissue engineering
- Support for tissue in-growth
- Controlled drug delivery
- Replacement for metals

PRODUCTS
- Tubing
- Custom profiles
- Monofilament
- Drawn fiber
- Ribbon

KEY PROPERTIES
- Controlled degradation rates
- Capable of safely existing in and being absorbed by the body
- FDA-approved resins for medical devices
- Cost-effective compared to metals
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The information presented in this publication is believed to be accurate and is not intended to constitute a specification. Property characteristics are dramatically impacted by geometry and processing method, thus properties of extruded parts may vary. In some instances, data may not be available for publication and will be notated as “na” where applicable. These tables are meant to serve as a general guideline only. Users should evaluate the material to determine suitability for their own particular application.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>GLASS TRANSITION $T_g$ (°C)</th>
<th>MELT TEMP $T_m$ (°C)</th>
<th>YOUNG’S MODULUS E (GPa)</th>
<th>ULTIMATE TENSILE STRENGTH $\sigma$ (MPa)</th>
<th>TOTAL MASS LOSS (MONTHS)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLLA</td>
<td>60</td>
<td>180 – 190</td>
<td>3.0 – 4.0</td>
<td>65</td>
<td>18 – 36</td>
</tr>
<tr>
<td>PGA</td>
<td>40</td>
<td>215 – 225</td>
<td>6.0 – 7.0</td>
<td>95</td>
<td>4 – 6</td>
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<tr>
<td>PDLLA</td>
<td>55</td>
<td>amorphous</td>
<td>1.0 – 3.0</td>
<td>40</td>
<td>12 – 16</td>
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<tr>
<td>PCL</td>
<td>-60</td>
<td>55 – 65</td>
<td>0.2 – 0.4</td>
<td>25</td>
<td>24 – 36</td>
</tr>
<tr>
<td>PLGA (85L/15G)</td>
<td>55</td>
<td>140 – 150</td>
<td>2.0 – 4.0</td>
<td>65</td>
<td>12 – 18</td>
</tr>
<tr>
<td>PLGA (82L/18G)</td>
<td>50</td>
<td>135 – 145</td>
<td>2.0 – 4.0</td>
<td>60</td>
<td>12 – 16</td>
</tr>
<tr>
<td>PLGA (10L/90G)</td>
<td>42</td>
<td>202 – 210</td>
<td>3.0 – 6.0</td>
<td>45</td>
<td>3 – 4</td>
</tr>
<tr>
<td>PDLGA (50DL/50G)</td>
<td>45</td>
<td>amorphous</td>
<td>2.0 – 4.0</td>
<td>45</td>
<td>1 – 2</td>
</tr>
<tr>
<td>PLDLA (80L/20DL)</td>
<td>60</td>
<td>115 – 130</td>
<td>2.0 – 4.0</td>
<td>50</td>
<td>12 – 18</td>
</tr>
<tr>
<td>PLC (70L/30C)</td>
<td>20</td>
<td>105 – 115</td>
<td>0.02 – 0.04</td>
<td>3</td>
<td>12 – 24</td>
</tr>
</tbody>
</table>

Approximate values based on representative resin data.

- OVER 50 YEARS OF INDUSTRY SOLUTIONS -
Zeus delivers precision polymer solutions that transform businesses, markets and lives. We have dedicated ourselves to building partnerships, products and services for the benefit of our customers.

Headquartered in Orangeburg, South Carolina, Zeus employs approximately 1,300 people and operates multiple facilities around the world.