Always pursue your happiness without hurting others

Group F
ENGINEERING
BIOMECHANICS OF
STENTS

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Objectives

- State and define Stents.
- Compare the mechanical properties of the materials that are used to make Stents.
Introduction

- What are stents?
- Procedure
- Side Effects
Introduction

- Types of Stents
  - Radioactive
  - Drug-eluting
- Materials used to make stents
  - SS 316L
  - Tantalum
  - Nitinol (Nickel-Titanium Alloy)
  - Cobalt Chromium Alloys
Comparison of Properties of Biomaterials: Density

![Density Graph](image-url)
Comparison of Properties of Biomaterials: E & G

![Graph showing Young's Modulus (E) & Shear Modulus (G) for different materials: SS 316L, Tantalum, Nitinol High, Nitinol Low, Cobalt Chromium. The graph indicates that SS 316L has the highest Young's Modulus and Nitinol Low has the lowest.]

- E - Young's Modulus
- G - Shear Modulus
Comparison of Properties of Biomaterials: Poisson’s ratio

<table>
<thead>
<tr>
<th>Material</th>
<th>Poisson's Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 316L</td>
<td>0.25</td>
</tr>
<tr>
<td>Tantalum</td>
<td>0.35</td>
</tr>
<tr>
<td>Nitinol</td>
<td>0.30</td>
</tr>
<tr>
<td>Cobalt Chromium</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Comparison of Properties of Biomaterials: Ultimate tensile strength

![Bar chart showing Ultimate Tensile Strength for different materials: SS 316L, Tantalum, Nitinol High, Nitinol Low, Cobalt Chromium. The chart displays the tensile strength in MPa for each material.](image-url)
Comparison of Properties of Biomaterials: Yield Tensile Strength

Yield Tensile Strength

Materials

- SS 316L
- Tantalum
- Nitinol High
- Nitinol Low
- Cobalt Chromium
Comparison of Properties of Biomaterials: Elongation %

![Elongation Bar Chart for SS 316L, Tantalum, Nitinol, and Cobalt Chromium](chart.png)
Comparison of Properties of Biomaterials: Fracture Modulus

- **SS 316L**: Fracture Modulus approximately 2000 MPa
- **Tantalum**: Fracture Modulus around 1000 MPa
- **Nitinol**: Fracture Modulus around 1500 MPa
- **Cobalt Chromium**: Fracture Modulus around 800 MPa
Comparison of Properties of Biomaterials: Coefficient of thermal expansion

![Coefficient of Thermal Expansion](image_url)

<table>
<thead>
<tr>
<th>Materials</th>
<th>Coefficient of Thermal Expansion (µm/m°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 316L</td>
<td>12</td>
</tr>
<tr>
<td>Tantalum</td>
<td>10</td>
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<tr>
<td>Nitinol</td>
<td>9</td>
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<tr>
<td>Cobalt Chromium</td>
<td>8</td>
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</table>
Comparison of Properties of Biomaterials: Hardness

<table>
<thead>
<tr>
<th>Hardness (Vickers)</th>
<th>SS 316L</th>
<th>Tantalum</th>
<th>Nitinol High</th>
<th>Nitinol Low</th>
<th>Cobalt Chromium</th>
</tr>
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<tr>
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<td>0</td>
<td>10</td>
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</tr>
</tbody>
</table>
Comparison of Properties of Biomaterials: Heat Capacity

Heat Capacity

Heat Capacity (J/g-°C)

Materials

- SS 316L
- Tantalum
- Nitinol
- Cobalt Chromium
Comparison of Properties of Biomaterials: Thermal Conductivity

<table>
<thead>
<tr>
<th>Materials</th>
<th>Thermal Conductivity (W/m-K)</th>
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</thead>
<tbody>
<tr>
<td>SS 136L</td>
<td>50</td>
</tr>
<tr>
<td>Tantalum</td>
<td>30</td>
</tr>
<tr>
<td>Nitinol</td>
<td>20</td>
</tr>
<tr>
<td>Cobalt Chromium</td>
<td>10</td>
</tr>
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</table>
Recommendations

- Find a more cost effective material so these products can be available for everyone who needs them regardless his/her economic situation.
- Find the materials that are more compatible for every human beings without causing side effects or any other health condition.
Contributors

- Jose Aviles Sr. – Quality Supervisor at Guidant Caribe Inc.
- Jeannette Santos – Professor of Engineering at University of Puerto Rico at Mayaguez.
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