Selection and Specification of Permanent Magnet Materials

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Outline

• Motivation
• Basic Considerations
• Advanced Considerations
• Specification
• Checklist
• Conclusions
Motivation

- Gross oversimplification
- Errors of omission
- Lack of protocol
## Basic Considerations

<table>
<thead>
<tr>
<th>Property</th>
<th>Ferrite Ceramic 8</th>
<th>Alnico 5</th>
<th>SmCo 1-5</th>
<th>SmCo 1-5 TC</th>
<th>SmCo 2-17</th>
<th>NdFeB Bonded</th>
<th>NdFeB Sintered</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_r$ (kG)</td>
<td>4.0</td>
<td>12.5</td>
<td>9.0</td>
<td>6.1</td>
<td>10.4</td>
<td>6.9</td>
<td>13.4</td>
</tr>
<tr>
<td>$\alpha$ (%/°C)</td>
<td>-0.18</td>
<td>-0.02</td>
<td>-0.045</td>
<td>-0.001</td>
<td>-0.035</td>
<td>-0.105</td>
<td>-0.12</td>
</tr>
<tr>
<td>$(BH)_{max}$ MGOe</td>
<td>3.8</td>
<td>5.5</td>
<td>20</td>
<td>9</td>
<td>26</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td>$H_{ci}$ (kOe)</td>
<td>3.3</td>
<td>0.64</td>
<td>30</td>
<td>30</td>
<td>25</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>$\beta$ (%/°C)</td>
<td>+0.4</td>
<td>-0.015</td>
<td>-0.3</td>
<td>-0.02</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.6</td>
</tr>
<tr>
<td>$H_s$ (kOe)</td>
<td>10</td>
<td>3</td>
<td>20</td>
<td>40</td>
<td>30</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>$T_c$ (°C)</td>
<td>460</td>
<td>890</td>
<td>727</td>
<td>729</td>
<td>825</td>
<td>360</td>
<td>310</td>
</tr>
</tbody>
</table>
Advanced Considerations

- Physical
- Mechanical
- Corrosion
- Magnetizing

- Assembly
- Adhesives
- Testing

Spontaneous Materials
Safety First

FOR EMERGENCY USE ONLY!

Spontaneous Materials
Specification

• Two Approaches
  – What I have
  – What I need

• Avoid Contradictions

• Use IMA or IEC standards

• Supplier Reference, or equivalent

Spontaneous Materials
Checklist

Magnetic Parameters

Others

Flux Variations

Testing

Dimensions/Tolerances

Assembly

Magneitizing

Adhesive

Others

Coating

Testing

Others
Conclusions

• Many things to consider
• Thoroughness is important
• Use the checklist