### DEFINITIONS

**Dielectric:** A dielectric is a medium having the property of permitting the establishment of an electric field within it. It is non-conductive, in virtue of its capacity to store electric energy. Having energy stored in it from the medium, there is some dissipation of energy in the form of heat.

A non-magnetic dielectric material is defined by real and imaginary components of the Complex Permittivity:

\( \varepsilon^* = \varepsilon' - j\varepsilon'' \) 

- \( \varepsilon' \) is the relative permittivity or dielectric constant. It is the specific permittivity, inherent to a Dielectric Constant in the literature. It is plotted vertically on the chart and is a dimensionless quantity since it is relative to free space.
- \( \varepsilon'' \) is the relative loss factor. In general, the lower the specific DC resistivity, the more dissipation of energy. Dissipation Factor or Loss Tangent. A wide variety of dielectric properties is available to meet design requirements covering a k' range of 1.02 to 35 in low-loss and lossy dielectrics.

**Artificial Dielectrics**

- Conjugate or inductive materials formulated by specific, values of dielectric constant and loss tangent. A wide variety of dielectric properties is available to meet design requirements covering a k' range of 1.02 to 35 in low-loss and lossy dielectrics.

**Lossy Dielectrics**

Low-loss dielectrics are characterized by low dissipation factor and high dielectric constant. They are non-magnetic and exhibit electrical conductivity. Dielectric properties usually vary with frequency, it is possible to lower the specific DC resistivity, not that the frequency sensitivity. A frequency response of dielectrics is usually given as k' and k" with decreasing frequency.

**Loss Tangent**

- Loss Factor – k" is the relative loss factor. In the literature, it is usually given as Loss Factor. It should not be confused with Dissipation Factor or Loss Tangent. Note that the Loss Factor is the product of the Dielectric Constant and Dissipation Factor.

**LOSS TANGENT**

- The recognized global leader in microwave absorbing materials

**Typical Properties**

<table>
<thead>
<tr>
<th>Loss Factor</th>
<th>k&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.5</td>
</tr>
<tr>
<td>0.002</td>
<td>1.0</td>
</tr>
<tr>
<td>0.003</td>
<td>1.5</td>
</tr>
<tr>
<td>0.004</td>
<td>2.0</td>
</tr>
<tr>
<td>0.005</td>
<td>2.5</td>
</tr>
<tr>
<td>0.006</td>
<td>3.0</td>
</tr>
<tr>
<td>0.007</td>
<td>3.5</td>
</tr>
<tr>
<td>0.008</td>
<td>4.0</td>
</tr>
<tr>
<td>0.009</td>
<td>4.5</td>
</tr>
<tr>
<td>0.01</td>
<td>5.0</td>
</tr>
<tr>
<td>0.05</td>
<td>10.0</td>
</tr>
<tr>
<td>0.1</td>
<td>20.0</td>
</tr>
<tr>
<td>1.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**DIELECTRIC MATERIALS CHART — ECCOSTOCK® Low Loss Dielectrics & Other Common Materials**

<table>
<thead>
<tr>
<th>Dielectric Constant</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Polyethylene (uncured)</td>
</tr>
<tr>
<td>2.1</td>
<td>Teflon®</td>
</tr>
<tr>
<td>2.2</td>
<td>HT003 Polypropylene</td>
</tr>
<tr>
<td>2.3</td>
<td>Butyl Rubber (uncured)</td>
</tr>
<tr>
<td>2.4</td>
<td>CPE</td>
</tr>
<tr>
<td>2.5</td>
<td>Polyester</td>
</tr>
<tr>
<td>3</td>
<td>Silicone (uncured)</td>
</tr>
<tr>
<td>4</td>
<td>Silicone (uncured)</td>
</tr>
<tr>
<td>5</td>
<td>Mica</td>
</tr>
<tr>
<td>6</td>
<td>Beryllium Dioxide</td>
</tr>
<tr>
<td>8</td>
<td>Magnesium Dioxide</td>
</tr>
<tr>
<td>9</td>
<td>Aluminum Dioxide</td>
</tr>
<tr>
<td>15</td>
<td>Magnesium Oxide</td>
</tr>
<tr>
<td>16</td>
<td>Magnesium Oxide</td>
</tr>
<tr>
<td>20</td>
<td>Titanium Dioxide (rutile)</td>
</tr>
<tr>
<td>50</td>
<td>Strontium Titanate</td>
</tr>
<tr>
<td>&gt;100</td>
<td>Barium Titanate</td>
</tr>
</tbody>
</table>

** Typical Properties **

- **Dielectric Constant:**
  - 2.0: Polyethylene (uncured)
  - 2.1: Teflon®
  - 2.2: HT003 Polypropylene
  - 2.3: Butyl Rubber (uncured)
  - 2.4: CPE
  - 2.5: Polyester
  - 3: Silicone (uncured)
  - 4: Silicone (uncured)
  - 5: Mica
  - 6: Beryllium Dioxide
  - 8: Magnesium Dioxide
  - 9: Aluminum Dioxide
  - 15: Magnesium Oxide
  - 16: Magnesium Oxide
  - 20: Titanium Dioxide (rutile)
  - 50: Strontium Titanate
  - >100: Barium Titanate

- **Loss Factor:**
  - 0.001: 0.001
  - 0.002: 0.002
  - 0.003: 0.003
  - 0.004: 0.004
  - 0.005: 0.005
  - 0.006: 0.006
  - 0.007: 0.007
  - 0.008: 0.008
  - 0.009: 0.009
  - 0.01: 0.01
  - 0.05: 0.05
  - 0.1: 0.1

- **Material:**
  - Polyethylene (uncured)
  - Teflon®
  - HT003 Polypropylene
  - Butyl Rubber (uncured)
  - CPE
  - Polyester
  - Silicone (uncured)
  - Silicone (uncured)
  - Mica
  - Beryllium Dioxide
  - Magnesium Dioxide
  - Aluminum Dioxide
  - Magnesium Oxide
  - Magnesium Oxide
  - Titanium Dioxide (rutile)
  - Strontium Titanate
  - Barium Titanate

- **Other Common Materials:**
  - Polystyrene
  - HiK
  - Cross-linked polystyrene
  - Silicone Rubber
  - Polyurethane
  - Polyethylene
  - Polypropylene
  - Silicone
  - Teflon®
  - Mylar®
  - Lexan®
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene
  - Polyethylene

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