Ceramic Powders and Formulations for Passive Components
Low Temperature Ceramic Formulations

Application
Ferro’s LCF mid-K and high-K ceramic formulations are designed for passive electronic component applications that include ESD/EMI filters, MLCC and single layer chip components.

LCF Series formulations are co-fireable with 100%Ag, 95 Ag/5Pd, and 90Ag/10Pd conductors.

Ferro’s LCF Ceramics are Pb/Cd free and are formulated and processed to be RoHS compliant.

Storage and Shelf-life: These products should be stored in tightly sealed containers at 10 - 25°C, in a dry place away from direct sunlight. Shelf life of a factory sealed container is minimum 2 years from date of shipment when properly stored.

Typical Processing Recommendations

Slurry Process:
- Powder size and surface area are designed for typical tape casting process.
- Dispersion: Ball mill 1/2” ZrO₂ Media
- First Stage Milling: Formulation Powder & Solvent
- Second Stage Milling: PVB-type Binder Solution

Lamination: 3000 psi at 70°C with a 10 minute dwell time; no pressure followed by a lamination time of 10 minutes.

Firing: Forced air/exhausted belt or box furnace.
- 2°C/min from 25°C to 450°C
- 2 Hr. soak @ 450°C
- 6-8°C/min from 450°C to peak temperature
- See table below for specific peak temperatures and soak times

<table>
<thead>
<tr>
<th>Product Code</th>
<th>LCF40</th>
<th>LCF75</th>
<th>LCF90</th>
<th>LCF1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant@ 1 MHz</td>
<td>40</td>
<td>75</td>
<td>90</td>
<td>1100 (^3)</td>
</tr>
<tr>
<td>Q-value@ 1 MHz</td>
<td>&gt; 4000</td>
<td>&gt; 2500</td>
<td>&gt; 2000</td>
<td>n/a</td>
</tr>
<tr>
<td>Particle Size D50 (\mu m)</td>
<td>0.95</td>
<td>0.85</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>Surface Area (m^2/g)</td>
<td>4.3</td>
<td>6.5</td>
<td>7.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Powder Density (g/cc)</td>
<td>4.8</td>
<td>5.5</td>
<td>5.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Loss-on-Ignition (LOI) wt-%</td>
<td>&lt; 1.3</td>
<td>&lt; 1.3</td>
<td>&lt; 1.3</td>
<td>&lt; 1.5</td>
</tr>
<tr>
<td>Peak Firing Temperature (°C)</td>
<td>830 - 870</td>
<td>860 - 900</td>
<td>940 - 980</td>
<td>850 - 900</td>
</tr>
<tr>
<td>Time at Peak Temperature (minutes)</td>
<td>30</td>
<td>30</td>
<td>60</td>
<td>30</td>
</tr>
</tbody>
</table>

1Bulk Ceramic
2Helium Pycnometer
3Measured at 1KHz

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