Realization of Large Footprint Multilayer Capacitors Incorporating Novel Dielectric Materials and New Processing Routes.

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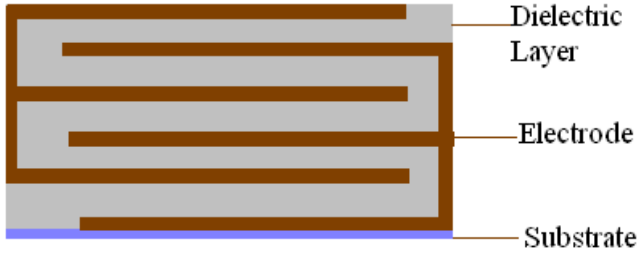
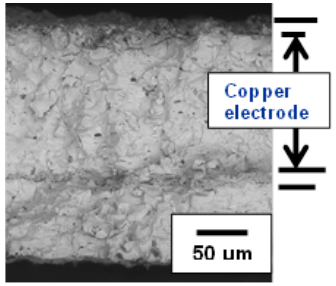
- **Objective:** To design, develop, and evaluate multilayer DC-link capacitors prepared using novel thermal spray coating technology, so as to meet the DOE energy storage requirements utilizing Power Inverters while achieving 5 microF/800V/125^{0}C performance.

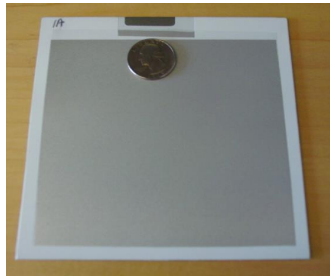


Highlights:

- Successfully proved the concept of multilayer coating capacitor



PS Barium Titanate with Copper



Notebook size MLCC

- $BaTiO_3$ depositions using conventional Plasma Spray (PS) and Solution Plasma Spray (SPS) leading to higher dielectric breakdown strength of the dielectric layers.
- MLCC structure established using the combination of PS and SPS techniques.

Purpose of Project: To fabricate larger high capacitance devices, where the conventional processing problems such as binder removal, electrode ceramic interactions and co-firing transient stresses limit larger device fabrication.

Highlights:

- Heat treatment at 120°C and oil soaking show improved resistance and breakdown strength
- Nanograined Alumina using Starck make powder has shown good breakdown strengths upon heat treatment at 120°C and oil soaking.
- We also accomplished multilayer coating on large area (5” x 5”) notebook size applications
- Use of sub micron and nanograined special alloy high k materials such as Barium Titanate and Calcium Titanate from Penn State group to enhance the coating properties
- Tried different coating systems like HVOF and Suspension plasma coating process to obtain denser coatings and to push the dielectric breakdown strength to higher values. Also, working on Cold Sintering for alternate low temperature technique for realization of MLCC.

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