



MRA Laboratories, Inc.

# TECHNICAL DATA SHEET

## "K"-22 COG dielectric

### "VLF-220Aq4"

VLF-220Aq4 is an environmentally friendly very low fire COG dielectric formulated from high purity sub-micron titanate compounds. It represents a refinement of MRA's popular VLF-220 series of COG materials. No compounds of lead, cadmium or bismuth are added when formulating this dielectric. VLF-220Aq4 is compatible with up to 100% Ag electrode systems and features the highest Q of commercially available COG dielectrics.

### Key Features

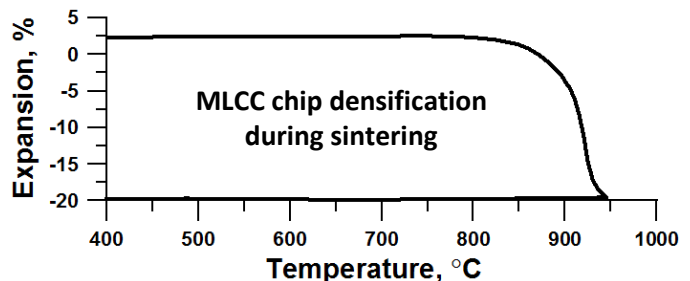
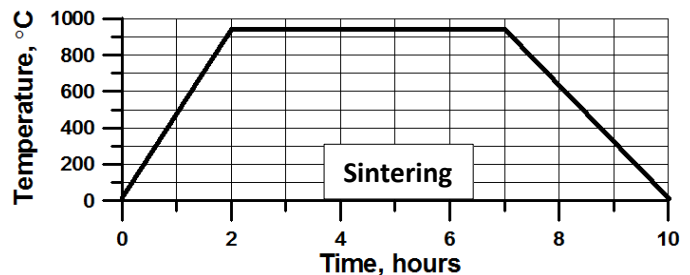
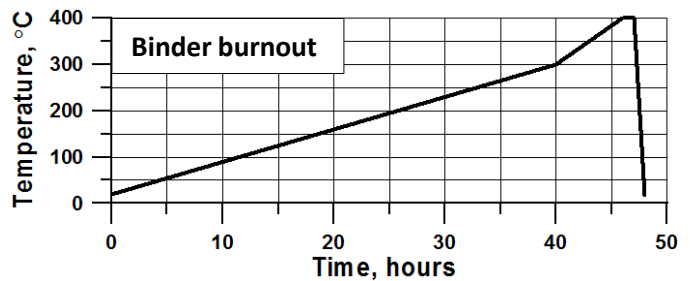
- ❖ Environmentally friendly (RoHS compliant)
- ❖ Compatible with up to 100% Ag electrode systems
- ❖ Aqueous compatible
- ❖ Highest Q of commercial COG materials ( $Q \cdot f$  greater than 25,000 @ 10.5 GHz on ceramic only)
- ❖ Excellent lot to lot uniformity

### Typical powder properties

- Powder density,  $g/cm^3$   $\geq 4.00$
- Surface area,  $m^2/g$   $4.00 \pm 1.00$
- Particle size,  $\mu m$ 
  - $D_{90} \leq 1.90$
  - $D_{50} 0.675 \pm 0.175$
  - $D_{10} 0.375 \pm 0.125$
- LOI (650°C, 6 hours), %  $\leq 1.00$

### Sintering conditions

- Binder burnout up to 400°C in air
- Sintering 940°C/5 hours in air
- Heating rate 10°C/min
- Open  $Al_2O_3$  setter or crucible
- Fired density  $\geq 4.00 g/cm^3$

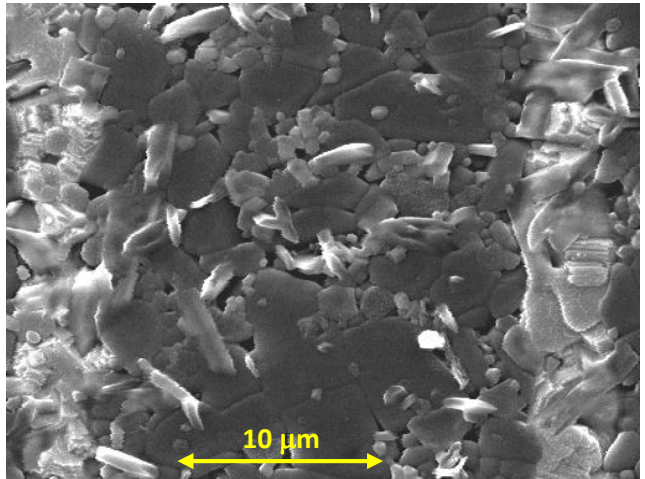
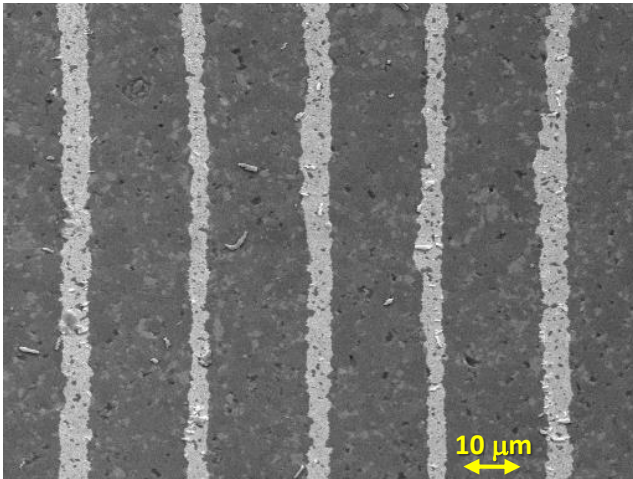


**MRA - committed to excellence in multi-layer ceramic device technology.**

ISO 9001:2008  
BUREAU VERITAS  
Certification



## Typical cross-sectional microstructure of sintered MLCC chip



### Mechanical properties of the dielectric

- Coefficient of thermal expansion from 200°C to 600°C,  $\mu\text{m}/\text{m}^*\text{K}$  **10.1**

### Typical MLCC characteristics

- Chip size **0805**
- Active layers **10.5**
- Electrode: **98% Ag / 2% Pd or 100% Ag**
- Dielectric thickness,  $\mu\text{m}$  **~20**
- Dielectric constant  **$23 \pm 2$**
- Dissipation factor, %  **$\leq 0.02$  @ 1kHz, 1Vrms**  
 **$\leq 0.08$  @ 1MHz, 1Vrms**
- Insulation resistance at 300V and 125°C,  $\Omega$   **$> 10^{11}$**
- Dielectric withstanding voltage, V/ $\mu\text{m}$   **$\geq 60$**

### Temperature variation of capacitance

TCC COG ( $\pm 30\text{ppm}/^\circ\text{C}$  from  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$ )

*The data presented is based on our research and is considered to be fair representation of this product. MRA makes no warranties, expressed or implied, as to its accuracy and assumes no liability out of its use by others.*

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