



MRA Laboratories, Inc.

# TECHNICAL DATA SHEET "K"-4400 X7R dielectric "SF-422"

SF-422 is a low fire X7R dielectric formulated from high purity sub-micron barium titanate. It features the highest dielectric constant in commercially available low fire X7R dielectrics ( $4600 \pm 200$ ) and very high breakdown strength. SF-422 has proven to be an excellent choice for volume production from standard voltage through high voltage products.

## Key Features

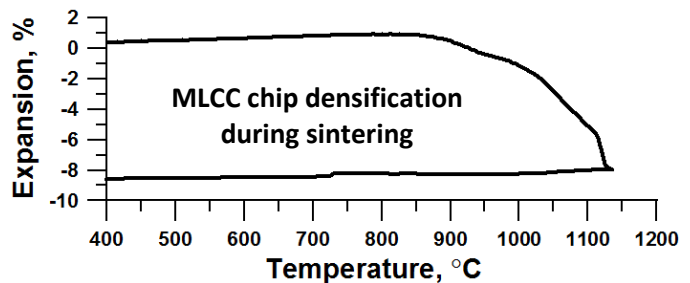
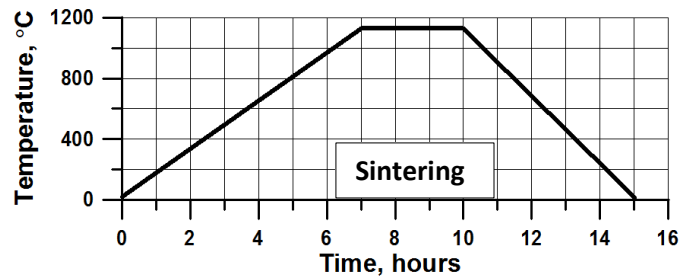
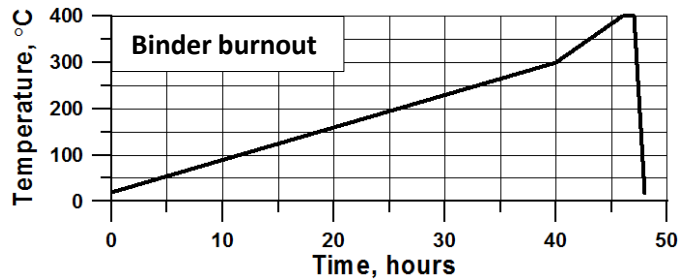
- ❖ Sintering temperature of 1130°C/3hours
- ❖ Compatible with up to 70% Ag / 30% Pd electrode systems
- ❖ Low dissipation factor and thin layer applicable
- ❖ Excellent high voltage performance for high dielectric constant materials
- ❖ Excellent lot to lot uniformity

### Typical powder properties

- Powder density, g/cm<sup>3</sup>  $\geq 5.85$
- Tap density, g/cm<sup>3</sup>  $2.15 \pm 0.25$
- Surface area, m<sup>2</sup>/g  $2.55 \pm 0.45$
- Particle size,  $\mu\text{m}$ 
  - $D_{90} \leq 2.50$
  - $D_{50} 0.650 \pm 0.250$
  - $D_{10} 0.375 \pm 0.125$
- LOI (650°C, 6 hours), %  $\leq 0.40$

### Sintering conditions

- Binder burnout up to 400°C in air
- Bisque at 800°C/1 hour in air
- Sintering 1130°C  $\pm 10^\circ\text{C}$ /3 hours in air
- Heating rate 3°C/min
- Closed Al<sub>2</sub>O<sub>3</sub> crucible
- Fired density  $\geq 5.80 \text{ g/cm}^3$

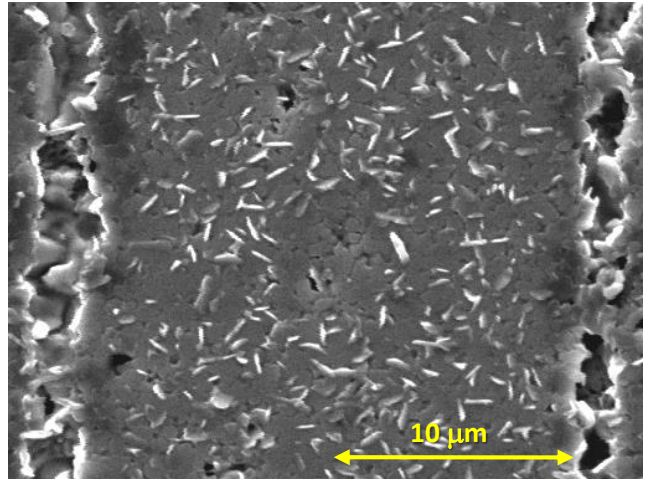
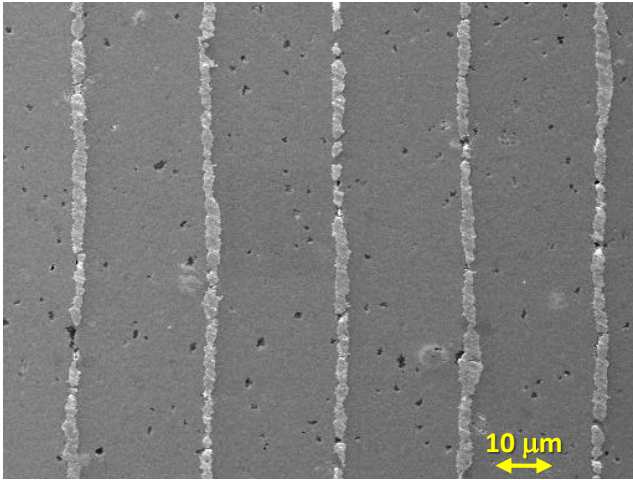


**MRA - committed to excellence in  
multi-layer ceramic device technology.**

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,  $\mu\text{m}/\text{m}^*\text{K}$  **11.4**

### Typical MLCC characteristics

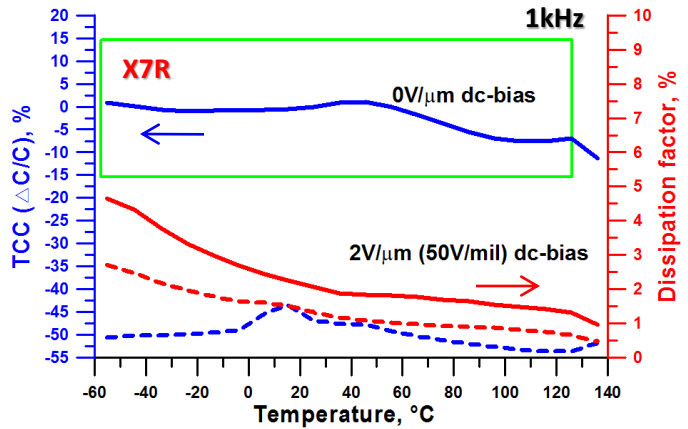
- Chip size **1206**
- Active layers **22**
- Electrode: **70% Ag / 30% Pd**
- Dielectric thickness,  $\mu\text{m}$  **~19**
- Dielectric constant  **$4650 \pm 350$**
- Dissipation factor, %  **$\leq 2.0$  @ 1kHz, 1Vrms**

- Insulation resistance at 150V and 125°C,  $\Omega\text{-F}$  **> 500**

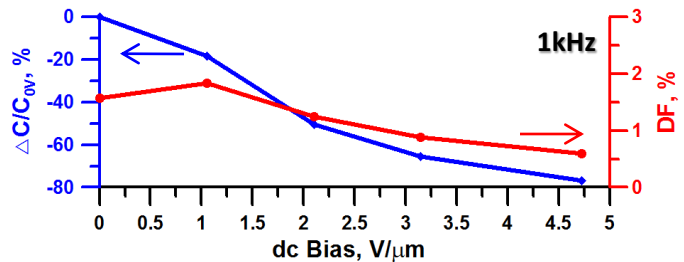
- Dielectric withstanding voltage, V/ $\mu\text{m}$   **$\geq 40$**

**TCC X7R ( $\pm 15\%$  from -55°C to +125°C)**

### Temperature and voltage variation of capacitance (50V rated MLCC chips)



### Voltage variation of capacitance at room temperature



*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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