

## Low temperature sintered dielectric materials Electronic ceramic materials

Low temperature sintered dielectric materials

Utilizing the ceramic powder manufacturing process technology acquired in the development of barium titanate ( $\text{BaTiO}_3$ ), Nippon Chemical Industrial has successfully developed high dielectric materials that can be co-fired at low temperature.

As a result of optimizing the manufacturing process by adding additives to the perovskite-type complex oxides—such as barium titanate—constituting the main component, materials that exhibit high dielectric constant and low dielectric loss have been achieved, even at relatively low sintering temperatures.

We have succeeded in obtaining ceramic materials with the highest ever dielectric constants for the 700–860°C sintering temperature range and, for each of these, the corresponding temperature characteristics fulfill the X7R specification in the EIA Standard ( $-55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $\pm 15\%$ ).

Table 1 Dielectric property ( $25^\circ\text{C}$ , 1 kHz, 1 V).

Sintering temperature( $^\circ\text{C}$ )	700	750	800	850	860
Dielectric constant (—)	1,100	1,600	2,100	2,900	3,300
Dielectric loss (%)	0.67	0.65	0.64	0.89	0.87

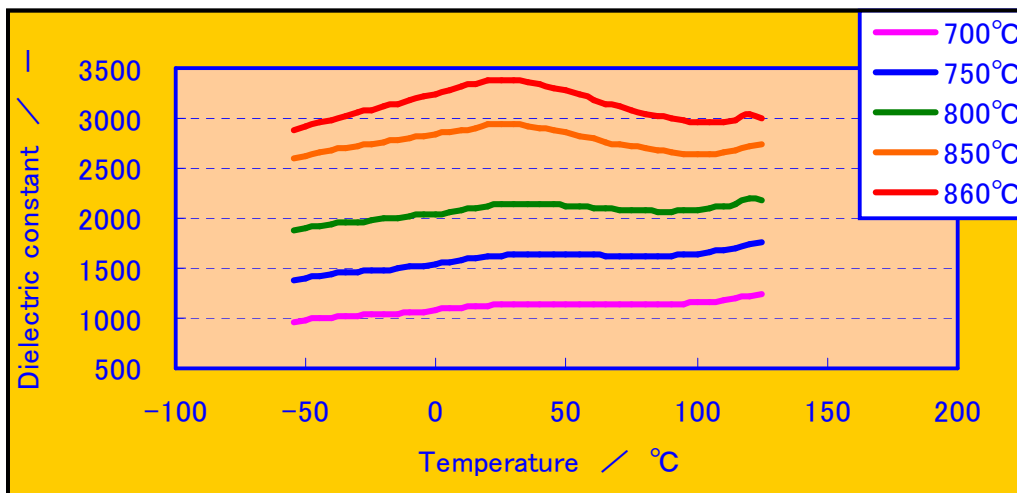


Fig. 1 Dielectric constant.

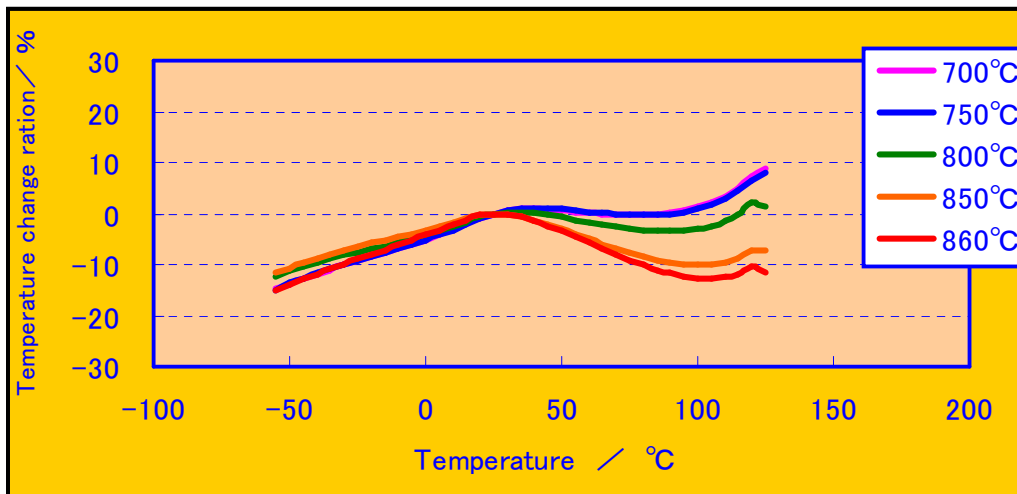


Fig.2 Permittivity, Temperature change ratio.

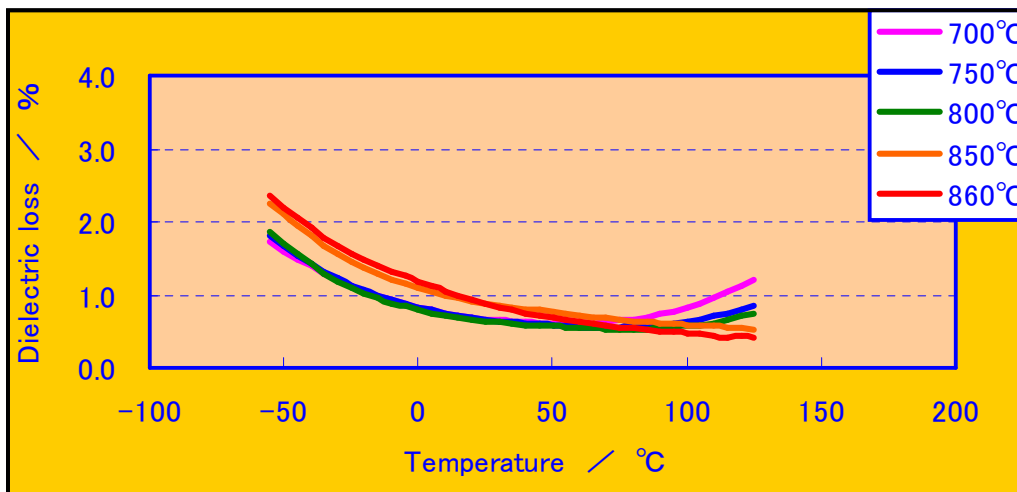


Fig.3 Dielectric loss.

#### Applications

Materials for high dielectric LTCCs (Low Temperature Co-fired Ceramics)

Substrate materials, etc.

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