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Testing method for dielectric properties of fine ceramics at microwave frequency

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1. Scope This Japanese Industrial Standard specifies testing methods for dielectric properties in microwave band of fine ceramic materials for resonators of low loss dielectrics used mainly for microwave filter and oscillator.

Remarks: The following standards are cited in this Standard:

JIS B 0601 Surface roughness—Definitions and designation

JIS B 7502 Micrometer callipers

JIS R 1600 Glossary of terms relating to fine ceramics

2. Definitions For the purpose of this Standard, in addition to the definitions given in JIS R 1600, the following definitions apply:

(1) complex relative permittivity ε_r The quotient of the complex ratio of a.c. electric field strength E (V/m) to a.c. dielectric flux density D (C/m) expressed in vector, by the permittivity ε_0 in vacuum (8.854×10^{-12} F/m).

$$\varepsilon_r = \frac{D}{\varepsilon_0 E} \quad \cdots\cdots (1)$$

If real component of complex relative permittivity is denoted as ε' (called relative permittivity) and imaginary component as ε'', ε_r is expressed by the following formula:

$$\varepsilon_r = \varepsilon' - j\,\varepsilon'' \quad \cdots\cdots (2)$$

(2) loss factor $\tan\delta$ Tangent of dielectric loss angle δ. If real component and imaginary component of complex relative permittivity are used, $\tan\delta$ is expressed by the following formula:

$$\tan\delta = \frac{\varepsilon''}{\varepsilon'} \quad \cdots\cdots (3)$$

(3) temperature coefficient of permittivity $TC\varepsilon$ The quotient of the relative permittivity change due to temperature, by the corresponding temperature change.

$$TC\varepsilon = \frac{\varepsilon_T - \varepsilon_{ref}}{\varepsilon_{ref}(T - T_{ref})} \times 10^6 \quad \text{(ppm/K)} \quad \cdots\cdots (4)$$

where, ε_T: permittivity at temperature T (F/m)

ε_{ref}: permittivity at reference temperature T_{ref} (F/m)