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Fine ceramics (advanced ceramics, advanced technical ceramics) — Measurement method of piezoelectric strain at high electric field

Céramiques techniques — Méthode de mesurage de la contrainte piézoélectrique à champ électrique élevé

Reference number
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Foreword

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The committee responsible for this document is ISO/TC 206, *Fine ceramics*.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Measurement method of piezoelectric strain at high electric field

1 Scope

This International Standard specifies the measurement method of piezoelectric strain at high electric field for high power piezoelectric devices. This International Standard is intended to be used to determine the piezoelectric strain coefficient of the materials by measuring strain vs. electric field:

— applied electric field: 0 to 2 MV/m;

— frequency of electric field: 0,1 to 1 Hz.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60122-1, *Quartz crystal units of assessed quality — Part 1: Generic specification*

IEC 60483, *Guide to dynamic measurements of piezoelectric ceramics with high electromechanical coupling*

EN 50324-1, *Piezoelectric properties of ceramic materials and components — Part 1: Terms and definitions*

EN 50324-2, *Piezoelectric properties of ceramic materials and components — Part 2: Method of measurement — Low power*

3 Terms and definitions, and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60122-1, IEC 60483, EN 50324-1, EN 50324-2 and the following apply.

3.1.1
applied wave form
shape of voltage applied to specimen as a function of time

Note 1 to entry: Triangular waves are used in this International Standard.

3.1.2
signal generator
apparatus which controls the applied wave form

3.1.3
power source
high-voltage amplifier which generates an electric-field (E-field) applied to the specimen

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3.1.4
E-field induced strain
strain of the specimen which is induced by applying the E-field

Note 1 to entry: The value is given by the ratio of displacement to specimen thickness.

3.1.5
displacement meter
apparatus which measures the E-field induced strain

3.1.6
mobile contact
mobile electrode which simultaneously holds the specimen and applies voltage to the specimen

3.1.7
maximum E-field
E_{max}
maximum value of applied E-field

3.1.8
maximum strain
S_{max}
strain at maximum E-field

3.1.9
residual strain
S_r
strain when E-field is removed

3.1.10
strain vs. E-field curve
continuously plotted curve of strain as a function of E-field

3.2 Symbols

f	frequency
d_{max}	$= S_{max}/E_{max}$
E_h	electric field at which the strain difference between the up- and down-curves shows a maximum
S_h	strain difference between the up- and down-curves at E_h
H_{max}	$= S_h/S_{max}$

4 Measuring environment

The measurement should be carried out in an environment free from acoustic noise and vibrations. It is desirable to control the measurement temperature 25 ± 5 °C and relative humidity less than 60 %.

5 Specimens

5.1 General

The test specimen shall be of any ceramics that can be cut into desired shapes such as disks and quadrilateral plates. There is no limit in specimen size and shape, if the specimen is held horizontally with a small tilt.

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