SLOVENSKI STANDARD
oSIST prEN IEC 62276:2023
01-oktober-2023

Enokristalne rezine za površinske zvočnovalovne naprave (SAW) - Specifikacije in merilne metode

Single crystal wafers for surface acoustic wave (SAW) device applications - Specifications and measuring methods

Einkristall-Wafer für Oberflächenwellen-(OFW-)Bauelemente - Festlegungen und Messverfahren

Tranches monocristallines pour applications utilisant des dispositifs à ondes acoustiques de surface (OAS) - Spécifications et méthodes de mesure

Ta slovenski standard je istoveten z: **prEN IEC 62276:2023**

ICS:

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IEC TC 49 : Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection

Secretariat:	Secretary:
Japan	Mr Masanobu Okazaki

Of interest to the following committees:

Proposed horizontal standard:
☐
Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

Functions concerned:
☐ EMC ☐ Environment ☒ Quality assurance ☐ Safety

☒ Submitted for CENELEC parallel voting

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

☐ Not submitted for CENELEC parallel voting

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Title:

Single crystal wafers for surface acoustic wave (SAW) device applications - Specifications and measuring methods

Proposed stability date: 2027

Note from TC/SC officers:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SINGLE CRYSTAL WAFERS FOR SURFACE ACOUSTIC WAVE (SAW) DEVICE APPLICATIONS – SPECIFICATIONS AND MEASURING METHODS

FOREWORD

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IEC 62276 has been prepared by IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The terms and definitions, the technical requirements, sampling frequency, test methods and measurement of transmittance, lightness, colour difference for LN and LT are added in order to meet the needs of industry development;

b) The terms and definitions of inclusion mentioned in Clause 5.4 and 6.9 is added because they are for lack of definition in Clause 3;

c) The specification of LTV and PLTV, and the corresponding description of sampling frequency for LN and LT are added, because they are the key performance parameters for the wafers;

d) The tolerance of Curie temperature specification for LN and LT are added in order to meet the development requirements of the industry;

e) Measurement of thickness, TV5, TTV, LTV and PLTV are completed, including measurement principle and method of thickness, TV5, TTV, LTV and PLTV ;

f) The format of bibliography has been improved in accordance with the latest edition of ISO 690.

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

A variety of piezoelectric materials are used for surface acoustic wave (SAW) filter and resonator applications. Prior to an IEC meeting in 1996 in Rotterdam, wafer specifications were typically negotiated between users and suppliers. During this meeting, a proposal was announced to address wafer standardization. This standard has been prepared in order to provide industry standard technical specifications for manufacturing piezoelectric single crystal wafers to be used in surface acoustic wave devices.

SINGLE CRYSTAL WAFERS FOR SURFACE ACOUSTIC WAVE (SAW) DEVICE APPLICATIONS – SPECIFICATIONS AND MEASURING METHODS

1 Scope

This document applies to the manufacture of synthetic quartz, lithium niobate (LN), lithium tantalate (LT), lithium tetraborate (LBO), and lanthanum gallium silicate (LGS) single crystal wafers intended for use as substrates in the manufacture of surface acoustic wave (SAW) filters and resonators.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60758:2016, Synthetic quartz crystal – Specifications and guidelines for use

ISO 2859-1:1999, Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Single crystals for SAW wafer

3.1.1
as-grown synthetic quartz crystal
synthetic quartz crystal prior to grinding or cutting

3.1.2
lithium niobate
LN
single crystal approximately described by the chemical formula $LiNbO_3$, grown by the Czochralski (crystal pulling from melt) or other methods

3.1.3
lithium tantalate
LT
single crystal approximately described by the chemical formula $LiTaO_3$, grown by the Czochralski (crystal pulling from melt) or other methods

3.1.4
lithium tetraborate
LBO
single crystal described by the chemical formula $Li_2B_4O_7$, grown by the Czochralski (crystal pulling from melt), the vertical Bridgman, or other methods

3.1.5
lanthanum gallium silicate
LGS
single crystal described by the chemical formula $La_3Ga_5SiO_{14}$, grown by the Czochralski (crystal pulling from melt) or other methods

3.2 Terms and definitions related to LN and LT crystals

3.2.1

Curie temperature

T_c

phase transition temperature between ferroelectric and paraelectric phases measured by differential thermal analysis (DTA) or dielectric measurement

3.2.2

single domain

ferroelectric crystal with uniform electric polarization throughout

3.2.3

polarization process

electrical process used to establish a single domain crystal

3.2.4

reduction process

process comprising a reduction-oxidation (REDOX) reaction to increase conductivity to reduce the harmful effects of pyroelectricity

3.2.5

reduced LN

LN treated with a reduction process

Note 1 to entry: Reduced LN is sometimes referred to as “black LN”.

3.2.6

reduced LT

LT treated with a reduction process

Note 1 to entry: Reduced LT is sometimes referred to as “black LT”.

3.2.7

transmittance

τ

the ratio of transmitted power through the sample to incident power on the sample, expressed in percent

3.2.8

lightness

L^*

the relative light-dark properties of the object surface

Note 1 to entry: In the CIE LAB colour space, L^* is the coordinates representing the lightness of the colour of the object.

3.2.9

colour difference

$\triangle E^*_{ab}$

the difference in colour at different parts of the object surface

Note 1 to entry: In the CIE LAB colour space, $\triangle E^*_{ab}$ is the value representing the colour difference of different parts of the object surface.

3.3 Terms and definitions related to all crystals

3.3.1

lattice parameter

lattice constant

length of one unit cell along the major crystallographic axis

Note 1 to entry: The lattice parameter is measured by X-ray diffraction using the Bond method.

3.3.2

congruent composition

chemical composition of a single crystal in a thermodynamic equilibrium with a molten solution of the same composition during the growth process

3.3.3

twin

two or more same single crystals which are combined together by the law of symmetrical plane or axis

Note 1 to entry: Twins exhibit symmetry that may be classified as reflection across a mirror plane (twin plane), rotation around an axis (twin axis), or inversion through a point (twin center).

Note 2 to entry: Optical twins (growth twins) and electrical twins (transformation twins) are the most relevant to SAW wafers. Optical twins arise from defects related to growth. Electrical twins may result from extreme conditions (temperature and pressure, for example) during processing.

3.4 Flatness

3.4.1

fixed quality area

FQA

central area of a wafer surface, defined by a nominal edge exclusion, X, over which the specified values of a parameter apply

Note 1 to entry: The boundary of the FQA is at all points (e.g. along wafer flats) the distance X away from the perimeter of the wafer of nominal dimensions as shown in Figure 1.

3.4.2

reference plane

plane used as a reference for flatness measurements

Note 1 to entry: The reference plane can be one of the following types:

a) for measurements in which the wafer is clamped, the reference plane is the flat chuck surface that is identical with the back surface of the wafer;

b) for measurements in which the wafer is not clamped, the reference plane is defined by the surface height at three points on the front surface of the wafer within the FQA;

c) for measurements in which the wafer is not clamped, the reference plane is defined by the least-squares fit to the front surface of the wafer using the surface height at all measured points within the FQA.

3.4.3

site

square area on the front surface of the wafer with one side parallel to the OF

Note 1 to entry: Flatness parameters are assessed either globally for the FQA, or for each site individually.

3.4.4

thickness variation for five points

TV5

difference between the maximum thickness and the minimum thickness at the centre and four peripheral points of the wafer as shown in Figure 1

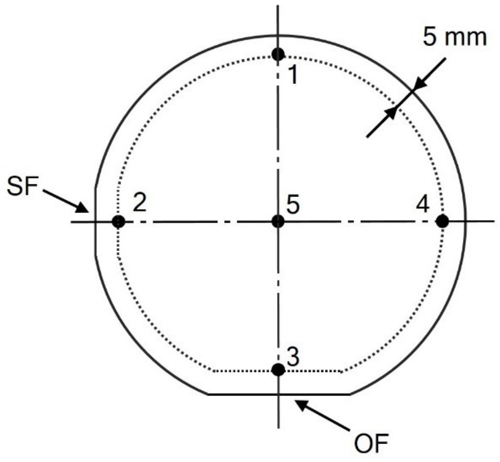

Figure 1 – Wafer sketch and measurement points

3.4.5

total thickness variation

TTV

difference between the maximum thickness d_1 and the minimum thickness d_2 of a wafer as shown in Figure 2