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PROOF/ÉPREUVE

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Foreword

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 PROOF/ÉPREUVE

Introduction

This document is intended to provide specifications and test methods for three crystal glass types (crystal glass, crystal, lead crystal) used in consumer goods in relation to tableware, containers, furniture, home decor, jewellery and any other decorative components in consumer goods. The purpose is to promote a global understanding of consumer quality requirements, together with corresponding methods to measure the specifications.

The three crystal glass types are determined based on three criteria: chemical composition, refractive index and density. A maximum lead content criterion is added for crystal and crystal glass.

The refractive index depends on the chemical composition of glass. While lead oxide remains the most efficient constituent to obtain a high refractive index because it favours general qualities (mass purity, high transparency for non-coloured glass), other components such as calcium oxide, barium oxide, zinc oxide may also contribute to a high refractive index.

Glass types — Crystal glass, crystal and lead crystal — Specifications and test methods

1 Scope

This document provides the specifications and specifies the requirements for the designation of three types of glass namely crystal glass, crystal, and lead crystal, according to their chemical composition, density and refractive index. This document also describes the test methods to measure the respective characteristics of these crystal glass types.

Given the potential lead contamination concerns in crystal glass and crystal, this document additionally stipulates a maximum permissible limit for lead content.

This document is applicable to the designated crystal glass types used as tableware, containers (e.g. bottles, decanters, perfume jars), giftware, home decor and any decorative components in consumer goods (e.g. glass components and/or parts used in jewellery, textile applications, and electrical and electronic equipment), furniture and luminaries.

This document does not apply to crystal glass types used within the areas of construction, healthcare and laboratories, and other technical uses of glass.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Specifications

4.1 General

The determination of the three crystal glass types is based on the following criteria:

— metal oxides composition;

— density;

— refractive index (n_D);

— a maximum lead (Pb) content for crystal glass and crystal.

For a summary of crystal glass types specifications, see Annex A.

The intentional addition of lead oxides is prohibited in batch compositions for both crystal glass and crystal. However, due to the omnipresence of lead ions in the natural environment, some lead ions are present in the glass matrix from trace elements in specific raw materials used for crystal glass or

crystal production, or through cross-contamination. Consequently, a maximum permissible limit for lead content is established to accommodate this unavoidable occurrence.

4.2 Specifications for crystal glass

Crystal glass shall have:

— metal oxides composition: zinc oxide (ZnO), barium oxide (BaO), potassium oxide (K_2O), strontium oxide (SrO), aluminium oxide (Al_2O_3), titanium oxide (TiO_2), zirconium oxide (ZrO_2), antimony oxide (Sb_2O_3), singly or together ≥ 10 %;

— density ≥ 2,45 g/cm^3;

— refractive index n_D ≥ 1,520;

— maximum permissible lead (Pb) content: 100 ppm[1)].

For glass to be defined as crystal glass, all these criteria shall be fulfilled.

4.3 Specifications for crystal

Crystal shall have:

— metal oxides composition: zinc oxide (ZnO), barium oxide (BaO), potassium oxide (K_2O), strontium oxide (SrO), aluminium oxide (Al_2O_3), titanium oxide (TiO_2), zirconium oxide (ZrO_2), antimony oxide (Sb_2O_3), calcium oxide (CaO), singly or together ≥ 24 %;

— density ≥ 2,67 g/cm^3;

— refractive index n_D ≥ 1,535;

— maximum permissible lead (Pb) content: 500 ppm[1)].

For glass to be defined as crystal, all these criteria shall be fulfilled.

4.4 Specifications for lead crystal

Lead crystal shall have:

— lead oxide (PbO) ≥ 24 %;

— density ≥ to 2,90 g/cm^3;

— refractive index n_D ≥ 1,545.

For glass to be defined as lead crystal, all these criteria shall be fulfilled.

5 Test methods

5.1 Chemical composition

Tests aimed at determining the chemical composition of crystal glass, crystal and lead crystal can be carried out using either of the following methods.

— Inductively coupled plasma optical emission spectrometry (ICP-OES), using

  — DIN 51086-2.

1) Parts per million.

NOTE A reference material can be used to validate the ICP-OES method [e.g. according to EUR 8137 EN (BCR-126) [7]].

— X-ray fluorescence (XRF) spectrometry, using either

  — DIN 51001 or

  — ASTM E1621.

Any other comparable testing methodology can be used.

In the event of dispute, ICP-OES based method shall be employed.

5.2 Physical determinations

5.2.1 Density

The density shall be measured by hydrostatic balance method with an accuracy of ± 0,01 g/cm^3.

A sample is weighed in air and weighed immersed in distilled water at 20 °C.

For density, the measurement can be performed in accordance with one of the following methods:

— ASTM C693;

— ASTM C729;

— use of a pycnometer.

NOTE 1 ASTM C729 does not impose minimum sample weight restrictions.

NOTE 2 A reference material can be used to validate the method for measuring the density [e.g. according to EUR 8137 EN (BCR-126) [7]].

5.2.2 Refractive index

The refractive index measurement is performed at 589,3 nm wavelength at ambient temperature with an accuracy of ± 0,001. An appropriate measurement method according to ASTM C1648 can be used, e.g. using an Abbe refractometer or a prism coupler.

NOTE A reference material can be used to validate the method for measuring the refractive index [e.g. according to EUR 8137 EN (BCR-126) [7]].

Annex A
(informative)

Crystal glass types specifications

Table A.1 provides a summary of crystal glass types specifications.

Table A.1 — Summary of crystal glass types specifications

Designation	Characteristics			
	Metal oxides composition	Density g/cm^3	Refractive index	Pb content
Crystal glass	ZnO, BaO, K_2O, SrO, Al_2O_3, TiO_2, ZrO_2, Sb_2O_3, singly or together ≥ 10 %	≥ 2,45	n_D ≥ 1,520	No intentional addition of lead oxides. Maximum Pb content of 100 ppm.
Crystal	ZnO, BaO, K_2O, SrO, Al_2O_3, TiO_2, ZrO_2, Sb_2O_3, CaO, singly or together ≥ 24 %	≥ 2,67	n_D ≥ 1,535	No intentional addition of lead oxides. Maximum Pb content of 500 ppm.
Lead crystal	PbO ≥ 24 %	≥ 2,90	n_D ≥ 1,545	N/A
ppm = parts per million.				

