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Materials and articles in contact with foodstuffs — Cutlery and table holloware —

Part 9: Requirements for ceramic knives

Matériaux et objets en contact avec les denrées alimentaires — Coutellerie et orfèvrerie de table —

Partie 9: Exigences relatives aux couteaux en céramique

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Foreword

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This document was prepared by Technical Committee ISO/TC 186, *Cutlery and table and decorative metal hollow-ware*.

A list of all parts in the ISO 8442 series can be found on the ISO website.

Materials and articles in contact with foodstuffs — Cutlery and table holloware —

Part 9: Requirements for ceramic knives

1 Scope

This document specifies material and performance requirements and test method of ceramic blades of knives intended for use in the preparation of food.

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.

ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 8442-1, *Materials and articles in contact with foodstuffs — Cutlery and table holloware — Part 1: Requirements for cutlery for the preparation of food*

ISO 8442-5, *Materials and articles in contact with foodstuffs — Cutlery and table holloware — Part 5: Specification for sharpness and edge retention test of cutlery*

ISO 14705, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for hardness of monolithic ceramics at room temperature*

EN 12875-1, *Mechanical dishwashing resistance of utensils — Part 1: Reference test method for domestic articles*

EN 1183:1997, *Materials and articles in contact with foodstuffs — Test methods for thermal shock and thermal shock endurance*

3 Terms and definitions

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

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

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

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

3.1
ceramic knife
knife for the preparation and serving of food, consisting of a ceramic blade with cutting edge and handle

3.2
ceramic blade
blade made from all types of ceramic raw materials

4 Materials and construction

4.1 Ceramic knives shall be made from materials that enable the finished products to meet all the performance requirements of this standard. The strength of ceramic blade, handle properties, and firmness of handle attachment shall meet the requirements of ISO 8442-1.

4.2 The porosity of ceramic blade shall be less than or equal to 1,5 %. The maximum projected length of the maximum pore (the maximum diameter of pore) shall be less than or equal to 25 µm. The inclusion or structure defects (e.g. micro-cracks, non-uniform distribution of pores) shall not be observed in the view of the pores which are observed. The test method can be seen in Annex A.

4.3 Ceramic blades shall not show any cracks, pores, damages or other defects after being submitted to the penetrant test in accordance with ISO 3452-1.

4.4 Ceramic knives shall not have any defects which may incur injuries during foreseeable use, such as deformation (distortion), deep scratches, cracks, burrs and chipping.

4.5 The cutting edge should be formed to an included angle no greater than 40° and should be no thicker than 0,46 mm when measured 1 mm from the extremity of the edge and not less than 25 mm from the handle.

5 Performance requirements

5.1 Hardness of ceramic blades

The hardness of ceramic blades shall be tested in accordance with ISO 14705 and the measurement points shall be tested in the areas “1, 2, 3” of the ceramic blade length and width trisection. At least one point shall be tested in each area. The test shall be carried out on a surface which is smooth, flat and free from foreign matter. The surface shall be polished to permit accurate measurement of the diagonal lengths of the indentation. Preparation shall be carried out in such a way that any alteration of the surface hardness is minimized. The Vickers hardness value of each point shall be not less than 1 100 HV3, and all indentations shall be acceptable and shall not reveal micro-cracks. The measurement points for hardness of ceramic blades are shown in Figure 1.

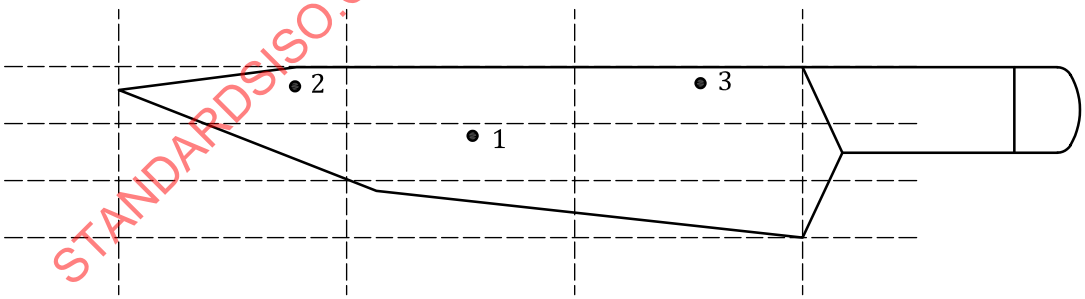


Figure 1 — Measurement points for hardness of ceramic blades

5.2 Sharpness and edge retention

The sharpness $z_{(3)}$ shall be more than or equal to 60 mm, and the edge retention $z_{(30)}$ shall be more than or equal to 300 mm. The test method shall be performed in accordance with ISO 8442-5.

5.3 Impact resistance of inclined plane of ceramic blades

5.3.1 General

There shall not appear any chips or cracks on the ceramic blade by visual observation after the test.

5.3.2 Apparatus

Use type D device of Leeb hardness tester according to ISO 16859-1 to impact the inclined plane of the blade.

NOTE A schematic diagram of impact resistance test is shown in Annex B.

5.3.3 Procedure

5.3.3.1 Impact 3 points when the blade length is less than 100 mm, impact 5 points when the blade length is more than or equal to 100 mm. The first impact position is 5 mm from the extremity of the tip, the second impact position is at the nearest location away from the handle, other positions are evenly distributed between the first and the second position; all the impact positions are 3 mm to 5 mm from the cutting edge.

5.3.3.2 In the impact process, one inclined plane of ceramic blade shall be stuck to the surface of auxiliary device, the blade shall be stable, without any shake. The impact device of Leeb hardness tester shall be positioned in normal direction to the inclined plane of the ceramic blade (impact in normal direction), impact one time for each point.

5.4 Bonding strength of the coating and printing of ceramic blades

5.4.1 General

Ceramic blades coated and printed on the surface shall meet this requirement. In the process of abrasion test, the ceramic blade shall not expose the ceramic substrate, the coating or printing of the blade shall not fall off.

5.4.2 Apparatus

An abrasive pad with a density of 180 kg/m^3 to 210 kg/m^3, containing aluminium oxide particles with a grain size of P180, bonded to a rigid plastic block, suitably loaded to apply a total downward intensity of pressure 0,007 MPa to the pad (the size of the abrasive pad and the magnitude of load can be changed according to the size of the blade).

NOTE 1 A suitable apparatus for the test is shown in Annex C.

NOTE 2 The grain size P180 is cited from ISO 6344-2:1998.

5.4.3 Procedure

5.4.3.1 Before the test, the blade surface shall be clean and dry.

5.4.3.2 Mount the blade under test rigidly on to the reciprocating support and apply the loaded abrasive pad to the blade surface. Keeping the loaded abrasive pad stationary, move the reciprocating support backwards and forwards over a distance of (40 ± 2) mm at an average speed of (6,5 ± 0,2) m/min, continue for 250 cycles. Renew the abrasive pad at 50 cycle intervals. The test shall be performed in the dry condition.

5.4.3.3 Remove the dust with a brush from the abraded surface and examine it for damage.

5.5 Dishwasher safety

For ceramic knives marked “Dishwasher safe”, a ceramic knife shall not show any damages or deformation or any visible changes when tested in accordance with the method described in EN 12875-1 after 125 cycles. The samples should be inspected every 25 cycles.

5.6 Resistance to thermal shock

Ceramic blades shall not show any cracks or deformation or any visible changes after the test. Test according to test method B of EN 1183, the temperature difference ($T_1 - T_2$) shall be 280 °C (test temperatures should be T_1 = 300 °C, T_2 = 20 °C).

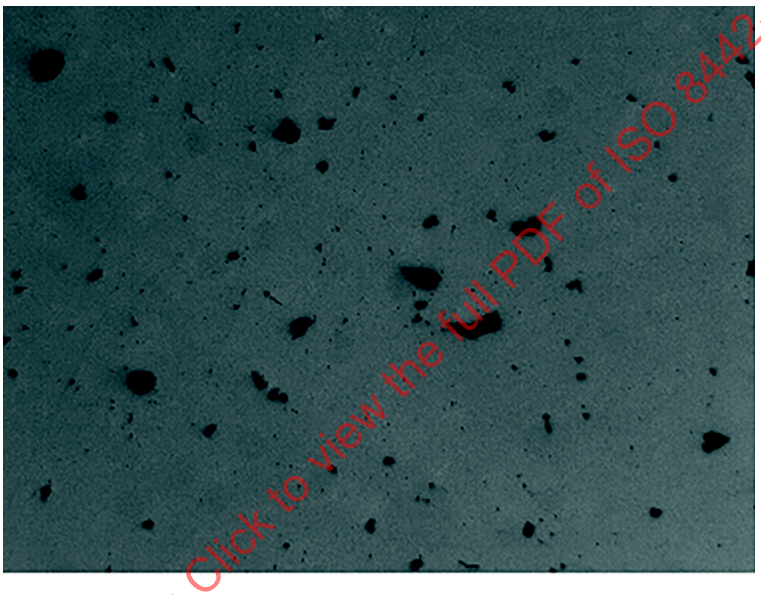
6 Safety instructions

The ceramic knife or the package or the product brochure in the package shall provide the information for safety use, such as avoid colliding, avoid dropping, do not use for hard food (e.g. frozen food, bones), store away from children, do not use damaged products, etc.

Annex A
(normative)

Metallography examination

Scan the entire surface using a microscope, the discovered microscopic inclusions or defects shall be recorded; the large pores shall be recorded and measured along the maximum transversal length; the porosity shall be measured by selecting the field containing the maximum number of pores. Porosity may be quantitatively determined with an image analyser and can also be evaluated by using standard diagram. For example, the porosity shown in Figure A.1 is 1,5 %.



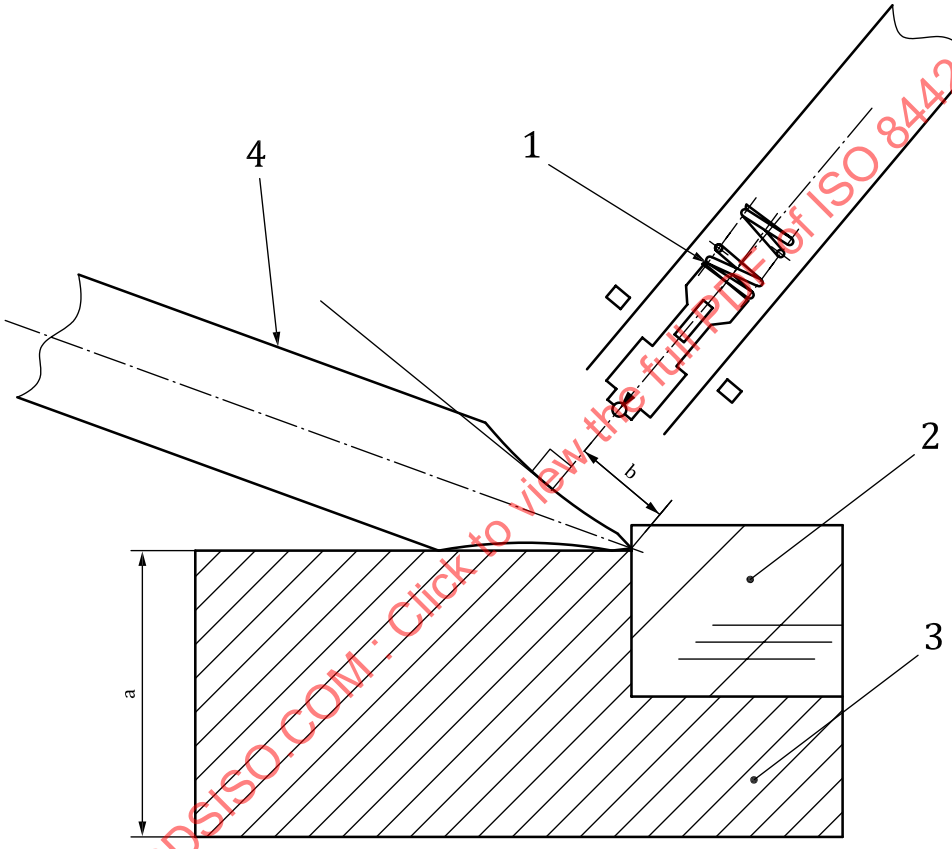
NOTE The dimension for the picture is 93,5 mm × 70,1 mm.

Figure A.1 — Example for the porosity of the ceramic blade (100×)

Annex B
(normative)

Schematic diagram of impact resistance of inclined plane of ceramic blade

B.1 Impact resistance test apparatus for inclined plane of ceramic blade

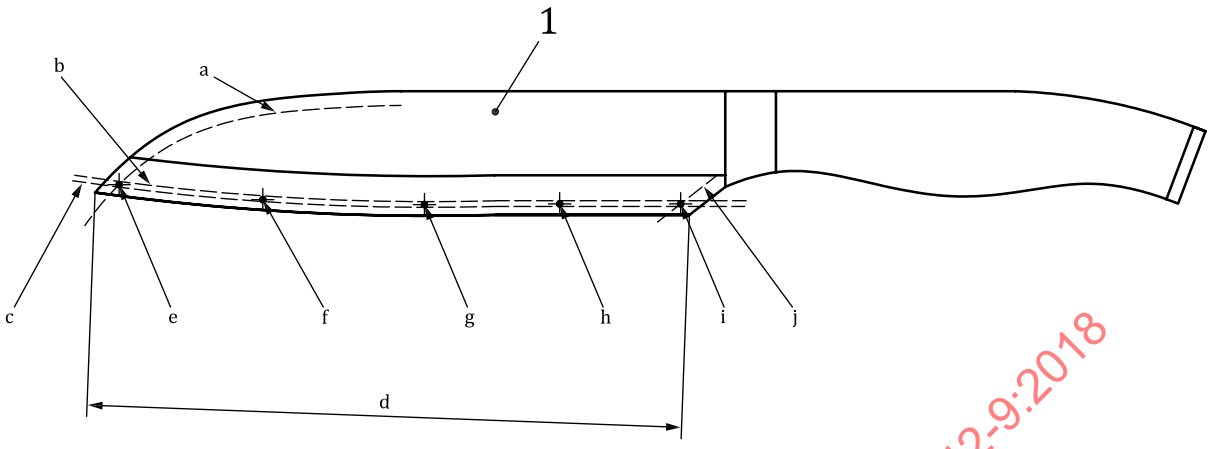


Key

1 leeb hardness tester
2 wood or rubber
3 steel
4 blade
a Thickness of the steel $d \geq 60$ mm.
b 3 mm to 5 mm from the cutting edge of blade.

Figure B.1 — Impact resistance test apparatus for inclined plane of ceramic blade

B.2 Impact position of the ceramic blade



Key

1	knife blade	d	Blade length.
a	5 mm equidistant line from the back of blade.	e-i	Impact points.
b	5 mm equidistant line from the cutting edge of blade.	j	5 mm equidistant line from the edge of blade.
c	3 mm equidistant line from the cutting edge of blade.		

Figure B.2 — Impact position of the ceramic blade