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Glass and glass-ceramics — Knoop hardness test

Verres et vitrocéramiques — Essai de dureté Knoop



Reference number
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Foreword

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International Organization for Standardization
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Introduction

For testing the hardness of glass and glass-ceramics, two methods of test have been discussed, namely the Vickers hardness test and the Knoop hardness test. Both tests involve certain difficulties when carried out. The results of a round robin testing survey, carried out in 1974 by the International Commission on Glass (ICG) to compare both procedures, showed that, for the specific task of testing glass, the Knoop hardness test is preferable.

Glass and glass-ceramics — Knoop hardness test

1 Scope

This International Standard describes the method of test for determining the Knoop hardness number of glass and glass-ceramics.

The Knoop hardness number characterizes the behaviour of glass and glass-ceramics concerning a permanent change of the surface after indentation with a solid material.

2 Definition, symbol and designation

The Knoop hardness number, HK, is proportional to the quotient of test force F and the projected area A_p of the permanent indentation given by numerical value equation (1):

$$\begin{aligned} \text{HK} &= 0,102 \frac{F}{A_p} \\ &= 0,102 \frac{F}{d^2 \times 0,5 \left(\cot \frac{172,5^\circ}{2} \times \tan \frac{130^\circ}{2} \right)} \\ &= 14,229 \times \frac{0,102F}{d^2} \quad \dots (1) \end{aligned}$$

where

- F is the test force, in newtons;
- A_p is the projected area, in square millimetres, of the permanent indentation;
- d is the length, in millimetres, of the long indentation diagonal.

NOTE 1 The factor 0,102 in numerical value equation (1) became necessary through the introduction of the SI-unit newton for the test force instead of kilogram-force to avoid changing of the value of the Knoop hardness number.

This indentation is regarded as a straight pyramid with a base area as shown in figure 1, a long indentation diagonal d and identical transverse area angles to those of the indenter (see figure 2).



Figure 1 — Base area of the indentation produced by the Knoop indenter

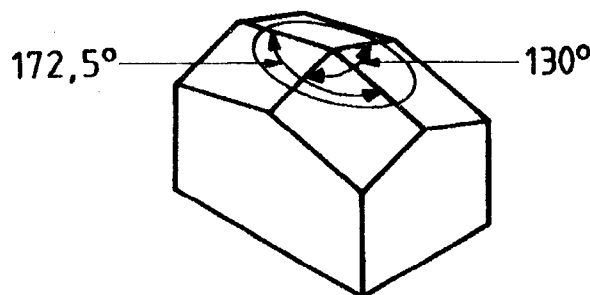


Figure 2 — Knoop Indenter

The symbol HK is supplemented:

- a) by a number indicating the test force used, expressed in newtons multiplied by 0,102 and therefore equal to the test force expressed in kilogram-force, and
- b) by a number indicating the duration of test force application in seconds.

EXAMPLE

490 HK 0,1/20 means the Knoop hardness number 490 HK resulting from an applied test force of 0,980 7 N ($\times 0,102$ equals 0,1). This test force was applied for 20 s.