
Hardmetals — Palmqvist toughness test

Métaux durs — Méthode d'essai de dureté de Palmqvist

Sample Document

get full document from standards.iteh.ai



Reference number
ISO 28079:2009(E)

© ISO 2009

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2009

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Symbols and units	1
4 Test pieces and sample preparation.....	2
4.1 Test piece size and sampling	2
4.2 Surface preparation	2
4.3 Surface condition.....	2
5 Apparatus	3
5.1 General.....	3
5.2 Indentation.....	3
5.3 Indentation and crack measurement	3
6 Procedure and conditions of testing	3
6.1 Indentations.....	3
6.2 Indentation and crack length measurement	3
6.3 Test validity	5
7 Analysis	6
7.1 Vickers hardness	6
7.2 Toughness.....	6
8 Measurement uncertainty	6
9 Test report	7
Annex A (informative) Report pro forma — Palmqvist toughness measurements on hardmetals	8
Bibliography	10

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 28079 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 4, *Sampling and testing methods for hardmetals*.

Sample Document

get full document from standards.iteh.ai

Introduction

Good test methods are those which enable a user or manufacturer to clearly discriminate between different materials.

Fracture toughness values are required for three reasons:

- a) for product design and performance assessment;
- b) for selection of materials;
- c) for quality control.

A specific International Standard for the toughness of hardmetals ¹⁾ has not been developed to date, primarily because of the difficulty of introducing stable precracks into these tough but hard materials. However, Palmqvist tests for toughness are widely used because of their perceived apparent simplicity. Cracks are formed at the corners of Vickers hardness indentations and these can be used to calculate a nominal surface toughness value. This value is sensitive to the method of measurement and to the method of surface preparation of the sample. This International Standard outlines good practice to minimize uncertainties due to these issues.

There are several possible methods for the measurement of the fracture toughness of hardmetals. The results can be expressed either as a stress intensity factor, in $\text{MN}\cdot\text{m}^{-3/2}$, or as a fracture surface energy, in $\text{J}\cdot\text{m}^{-2}$. The range of values for typical WC/Co hardmetals is from $7 \text{ MN}\cdot\text{m}^{-3/2}$ to $25 \text{ MN}\cdot\text{m}^{-3/2}$. There is a general inverse trend of hardness against fracture toughness (see [1] and [2] in the Bibliography).

When applied unqualified to hardmetals, “toughness” can have several meanings.

- a) Plane-strain fracture toughness, K_{IC} , in $\text{MN}\cdot\text{m}^{-3/2}$, is a value obtained from tests on specimens with appropriate geometries for plane-strain conditions and containing a well-defined geometry of crack. There is no standard method for hardmetals and different organizations use different test methods for introducing the precrack.
- b) Strain-energy release rate (or work of fracture), G , is an alternative expression for toughness, often obtained by converting plane-strain toughness, K , to G [i.e. $G = K^2/E(1 - \nu^2)$, where E is Young's modulus and ν is Poisson's ratio]. G has units of $\text{J}\cdot\text{m}^{-2}$. Again, there is no standard method.
- c) Palmqvist toughness, W , is a value obtained by measuring the total length of cracks emanating from the four corners of a Vickers hardness indentation. For a given indentation load, the shorter the crack, the tougher the hardmetal.
- d) Finally, toughness is also widely used, in a loose sense, to describe the empirical relation between perceived resistance to dynamic impacts. This is neither standardized nor quantified, but is clearly important for many industrial applications of hard materials. Also, principally for hardmetals, it can be more realistically assessed through either fatigue tests or high-rate strength tests, rather than a conventional fracture toughness test.

1) Terminology — There is a range of terms used for this type of material, especially including cemented carbides and/or cermets, as well as hardmetals. The word “hardmetals” has been used in this document. It includes all hard materials based on carbides that are bonded with a metal. In ISO 3252 terminology, “hardmetal” is stated to be “a sintered material characterized by high strength and wear resistance, comprising carbides of refractory metals as the main component together with a metallic binder phase”. “Cemented carbide” is synonymous with “hardmetal”. A “cermet” is defined as “a sintered material containing at least one metallic phase and at least one non-metallic phase, generally of a ceramic nature”.