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**Sintered metal materials, excluding  
hardmetals — Metallographic preparation  
and examination**

*Matériaux métalliques frittés, à l'exclusion des métaux-durs — Préparation  
métallographique et examen*



## 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.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 14321, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 3, *Sampling and testing methods for sintered metal materials (excluding hardmetals)*.

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## Introduction

Examining a micrographic cross-section of a sintered metal using an optical microscope can be useful in evaluating the porosity and microstructure. The techniques for sampling and surface preparation by polishing and etching are similar to those used for the examination of solid material. Because of the existence of porosity in most sintered materials, special precautions must be taken during these operations. These precautions are intended to :

- avoid interference with pore size and shape, i.e. smearing of porosity with metal or abrasives, rounding or break-out of pore edges,
- ensure that the surface observed with the microscope is truly representative of the real texture and microstructure of the material.

This technical report is therefore more particularly concerned with the method recommended for correctly preparing the surface under examination. The methods for etching and observation which are conventional, are only indicated as a reminder.

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**WARNING :** This technical report does not purport to address safety problems, if any, associated with its use. It is the responsibility of the user of this technical report to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

## 1 Scope

The purpose of this technical report is to describe the optimum methods for sample taking, polishing and etching, with a view to preparing a micrographic surface which accurately represents the sintered metal part, when viewed using an optical microscope.

This technical report applies to all sintered metals including those submitted to core or surface heat treatment. It does not apply to hard metals, for which reference shall be made to ISO 4505 and ISO 4499.

It can be applied to metal materials containing a substantial amount of non-metallic components (e.g. friction materials and cermets). The special procedures required for these materials are given in 4.6.3.

NOTE — The methods described may also be used for the micrographic examination of unsintered powder compacts. In such a case, the procedures should be adapted to the material, e.g. : cleaning (removing pressing lubricant), impregnation, sectioning or cut-off. It is also possible to examine the morphology or the structure of loose compact powder (see 4.4).

## 2 Normative references

The following standards contain provisions, which through reference in the text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2738:—<sup>1)</sup>, *Permeable sintered metal materials — Determination of density, oil content and open porosity.*

ISO 4499:1978, *Hardmetals — Metallographic determination of porosity and uncombined carbon.*

ISO 4505:1978, *Hardmetals — Metallographic determination of porosity and uncombined carbon.*

ISO 13944:1997, *Lubricated metallic powder mixes — Determination of lubricant content — Modified Soxhlet extraction method.*

1) To be published. (Revision of ISO 2738:1987)