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Standards

Irish Standard  
I.S. EN ISO 4491-4:2013

# Metallic powders - Determination of oxygen content by reduction methods - Part 4: Total oxygen by reduction-extraction (ISO 4491-4:2013)

## I.S. EN ISO 4491-4:2013

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English Version

**Metallic powders - Determination of oxygen content by reduction methods - Part 4: Total oxygen by reduction-extraction (ISO 4491-4:2013)**

Poudres métalliques - Dosage de l'oxygène par les méthodes de réduction - Partie 4: Oxygène total par réduction-extraction (ISO 4491-4:2013)

Metallpulver - Bestimmung des Sauerstoffgehaltes durch Reduktionsverfahren - Teil 4: Gesamt-Sauerstoffgehalt durch Reduktionsextraktion (ISO 4491-4:2013)

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## **Foreword**

This document (EN ISO 4491-4:2013) has been prepared by Technical Committee ISO/TC 119 "Powder metallurgy".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 24491-4:1993.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### **Endorsement notice**

The text of ISO 4491-4:2013 has been approved by CEN as EN ISO 4491-4:2013 without any modification.

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**Metallic powders — Determination  
of oxygen content by reduction  
methods —**

**Part 4:**  
**Total oxygen by reduction-extraction**

*Poudres métalliques — Dosage de l'oxygène par les méthodes de  
réduction —*

*Partie 4: Oxygène total par réduction-extraction*



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## 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 4491-4 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 2, *Sampling and testing methods for powders (including powders for hardmetals)*.

This second edition cancels and replaces the first edition (ISO 4491-4:1989), of which it constitutes a minor revision.

ISO 4491 consists of the following parts, under the general title *Metallic powders — Determination of oxygen content by reduction methods*:

- Part 1: General guidelines
- Part 2: Loss of mass on hydrogen reduction (hydrogen loss)
- Part 3: Hydrogen-reducible oxygen
- Part 4: Total oxygen by reduction-extraction

## Introduction

The determination of the oxygen content of metallic powders is of the utmost importance in many fields of powder metallurgy.

The standard methods described in ISO 4491-2 and ISO 4491-3 do not give the total oxygen content of the sample, as some oxygen-containing constituents are not reduced by hydrogen.

Therefore, a standard method for the determination of the total oxygen content is needed. The most frequently used method is reduction-extraction. It can be carried out with various commercially available instruments working according to different principles of extraction and measurement.

It should be emphasized that the results of the analysis depend on the type of equipment used and on the test parameters selected. However, as indicated in [Clauses 3 to 6](#), it is always possible, for a given type of metal powder, to optimize the test conditions to obtain reproducible and accurate results with any of the commercially available instruments, provided they are designed for testing the metal powder considered.

It is not possible to standardize one or more particular instruments. However, certain basic points of procedure are recommended for the analysis of metallic powders (see [Clause 6](#)).

**NOTE** The reduction-extraction method is also applicable to nitrogen determination and certain instruments permit simultaneous measurement of oxygen and nitrogen contents. However, the determination of nitrogen is not covered by this International Standard.



# Metallic powders — Determination of oxygen content by reduction methods —

## Part 4: Total oxygen by reduction-extraction

### 1 Scope

This part of ISO 4491 specifies a method for the determination of the total oxygen content of metallic powders by reduction-extraction at high temperature.

By agreement, this method is also applicable to the determination of the total oxygen content of sintered metal materials.

The method is applicable to all powders of metals, alloys, carbides, and mixtures thereof which are non-volatile under the test conditions. The sample may be in powder or compact form.

The analysis is carried out on the powder as supplied, but the method is not applicable if the powder contains a lubricant or binder. If such substances are present, the method may be used only if they can first be completely removed by a method not affecting the oxygen content of the powder.

This part of ISO 4491 is to be read in conjunction with ISO 4491-1.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4491-1, *Metallic powders — Determination of oxygen content by reduction methods — Part 1: General guidelines*

### 3 Principle

A test portion of the sample is heated in a graphite crucible at high temperature, either under vacuum or in a flow of an inert carrier gas. Oxygen in the sample is converted to oxides of carbon. These are extracted and transformed completely to either carbon monoxide or carbon dioxide, which is determined by a suitable gas analysis method.

The methods used in practice to determine the total oxygen content have the following features:

- a) Environment in the reaction chamber:
  - Vacuum or
  - flow of inert gas (nitrogen, argon, helium).
- b) Graphite crucible:
  - Individual, i.e. used only for one test portion, or
  - cumulative, i.e. the same crucible is used for the analysis of several successive test portions.

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