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Founding — Ausferritic spheroidal graphite cast irons — Classification

Fonderie — Fontes ausferritiques à graphite sphéroïdal — Classification

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 25, *Cast irons and pig irons*.

This second edition cancels and replaces the first edition (ISO 17804:2005), which has been technically revised. The main changes compared with the previous edition are as follows:

a) the normative references have been updated;

b) the terms and definitions have been improved and supplemented;

c) a side-by-side cast sample has been included;

d) the method of manufacturing has been made more detailed (including pouring/heat treatment);

e) a subclause (9.4) for graphite structure examination has been added;

f) in Annex C (formerly Annex B), a new conversion table for tensile test results has been added;

g) in Annex H (formerly Annex G), new fatigue data have been added for five different test methods from an international survey;

h) in Annex I (formerly Annex H), nodularity has been made more detailed, in accordance with ISO 945-4[2];

i) the previous Annex I on machinability has been deleted as it is no longer necessary;

j) in Annex J, Chinese GB/T grades have been added and several other international grade changes have been made;

k) the Bibliography has been revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Ausferritic spheroidal graphite cast iron is a cast alloy, iron, carbon and silicon based, carbon primarily in the form of spheroidal graphite particles.

Compared to the spheroidal graphite cast iron grades (see ISO 1083[3]), four material grades combine high strength, ductility and toughness properties while two grades combine higher strength with wear resistance as a result of ausferrite matrix structures.

This document deals with the classification of ausferritic spheroidal graphite cast irons in accordance with the mechanical properties of the material.

The mechanical properties of these ausferritic spheroidal graphite cast irons depend on their structure, e.g. the form of the graphite and the structure of the matrix.

The required structure is developed by selecting the appropriate composition and subsequent processing.

The mechanical properties of the material can be evaluated on machined test pieces prepared from:

— separately cast samples with an appropriate gating system, able to provide metallurgical conditions similar to those of the castings they represent;

— samples cast in the mould alongside the casting, with a joint running system, hereafter called “side-by-side cast samples”;

— samples cast onto either the casting or the running system, hereafter referred to as “cast-on samples”;

— samples cut from a casting (only by agreement between the manufacturer and the purchaser, the agreement specifying, in particular, the conditions of sampling and the values to be obtained).

Two grades of ausferritic spheroidal graphite cast iron are specified in Annex A, in accordance with their hardness. These cast irons are used in applications where high abrasion resistance is required (e.g. mining, earth moving and manufacturing industries).

Five grades of ausferritic spheroidal graphite cast iron are specified by their mechanical properties. When, for these grades, hardness is a requirement for the application, Annex D provides the means for determining appropriate hardness ranges.

Some ausferritic spheroidal graphite cast iron grades can be used for pressure equipment.

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Founding — Ausferritic spheroidal graphite cast irons — Classification

1 Scope

This document defines the grades and the corresponding requirements for ausferritic spheroidal graphite cast irons.

This document specifies five grades of ausferritic spheroidal graphite cast iron by a classification based on mechanical properties determined on machined test pieces prepared from:

— separately cast samples, side-by-side cast or cast-on samples;

— samples cut from a casting.

This document also specifies two grades by a classification as a function of hardness.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 945-1, *Microstructure of cast irons — Part 1: Graphite classification by visual analysis*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO/TR 15931, *Designation system for cast irons and pig irons*

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
ausferritic spheroidal graphite cast iron
austempered ductile iron
ADI
cast material, iron, carbon and silicon based, carbon being present mainly in the form of spheroidal graphite particles, subjected to an austempering heat treatment in order to produce an ausferritic matrix

3.2
graphite spheroidizing treatment
process that brings the liquid iron into contact with a substance to produce graphite in the spheroidal form (predominantly form VI) during solidification

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3.3
austempering
<of spheroidal graphite cast iron> heat treatment process, consisting of heating the castings to a temperature at which austenite starts to form during heating and holding a sufficient time for carbon diffusion into the austenite, followed by cooling at a rate sufficient to avoid the formation of pearlite, and transforming the matrix structure for a time and a temperature (above the martensite start temperature) sufficient to produce the desired properties

Note 1 to entry: This process produces a microstructure that consists predominantly of ferrite and high carbon austenite. This microstructure is called "ausferrite". Examples of ausferritic microstructures are given in ISO/TR 945-3[1].

3.4
ausferrite
cast iron microstructure, produced by a controlled thermal process, which consists of predominantly acicular ferrite and high carbon austenite

3.5
cast sample
quantity of material cast to represent the cast material, including separately cast samples, side-by-side cast samples and cast-on samples

3.6
separately cast sample
sample cast in a separate sand mould under representative manufacturing conditions and material grade

3.7
side-by-side cast sample
sample cast in the mould alongside the casting, with a joint running system

3.8
cast-on sample
sample attached directly to the casting

3.9
relevant wall thickness
section of the casting, agreed between the manufacturer and the purchaser, to which the determined mechanical properties apply

Note 1 to entry: Relevant wall thickness may be associated with a range of casting sections and/or with a sample type and size according to Table 3. The association is made by considering the cooling conditions during solidification and heat treatment.

3.10
test unit
inspection lot
test batch
number of pieces or the tonnage of castings to be accepted or rejected together, on the basis of the tests carried out on the test pieces in accordance with the requirements of the relevant specification, material standard or order

4 Designation

The material shall be designated in accordance with ISO/TR 15931.

Annex J gives a selection of approximate cross-references of grade designations from this document to standard grades from EN, ASTM, JIS, GB/T and SAE standards.

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