



BSI Standards Publication

# Microstructure of cast irons

Part 3: Matrix structures

**National foreword**

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REPORT

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**Microstructure of cast iron —**

**Part 3:**  
**Matrix structures**

*Microstructure des fontes —*  
*Partie 3: Structures de matrice*



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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](http://www.iso.org/directives)).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 25, *Cast irons and pig irons*.

ISO 945 consists of the following parts, under the general title *Microstructure of cast irons*:

- *Part 1: Graphite classification by visual analysis*
- *Part 2: Graphite classification by image analysis* [Technical Report]
- *Part 3: Matrix structures* [Technical Report]

The following parts are under preparation:

- *Part 4: Determination of nodularity in spheroidal graphite cast irons*

## Introduction

The designation of cast iron matrix structures as given in this part of ISO 945 is in conformity with the designations published by several national foundry organisations<sup>[1][2][3]</sup> or other publishers<sup>[4]</sup>.

This Technical Report aims to

- give the designations, precise descriptions and reference micrographs of the matrix structures of cast irons, and
- facilitate the discussion and to avoid misunderstanding between manufacturer and purchaser regarding the identification of matrix structures.

# Microstructure of cast irons —

## Part 3: Matrix structures

### 1 Scope

This Technical Report gives the designations, descriptions and reference micrographs of the matrix structures of cast irons.

It applies to the following types of cast irons:

- grey cast irons ([Table 4.1](#));
- spheroidal graphite cast irons ([Table 4.2](#));
- austenitic cast irons ([Table 4.3](#));
- malleable cast irons ([Table 4.4](#));
- compacted (vermicular) graphite cast irons ([Table 4.5](#));
- ausferritic spheroidal graphite cast irons ([Table 4.6](#));
- abrasion-resistant cast irons ([Table 4.7](#)).

Each matrix structure is defined with explanations and micrographs.

Unless otherwise stated in [Clause 4](#), the micrographs shown correspond to samples etched with a solution of 2 % nitric acid in ethanol (Nital).

### 2 Designations and descriptions of cast iron microstructures

#### 2.1 Ferrite

Ferrite also known as  $\alpha$ -ferrite ( $\alpha$ -Fe) or alpha iron is a materials science term for iron, or for a solid solution with iron as the main constituent, with a body-centred cubic crystal structure. It is this crystalline structure which gives to steels and cast irons their magnetic properties, and is the classic example of a ferromagnetic material.

Since pearlite has ferrite as a component, any iron-carbon alloy will contain some amount of ferrite if it is allowed to reach equilibrium at room temperature. The exact amount of ferrite will depend on the cooling processes the iron-carbon alloy undergoes when it cools from liquid state.

#### 2.2 Pearlite

Pearlite is a two-phased, lamellar (or layered) structure composed of alternating layers of alpha-ferrite (according thermal dynamical condition 88 % by mass) and cementite (12 % by mass). The lamellar appearance is misleading since the individual lamellae within a colony are connected in three dimensions; a single colony is therefore an interpenetrating bicrystal of ferrite and cementite. Pearlite is a common microstructure occurring in many grades of cast irons.

If cast iron is cooled very slowly or as a result of heat treatment, the cementite can occur in globules instead of in layers. This structure is designated as globular pearlite.