International Standard 197/1

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Copper and copper alloys — Terms and definitions — Part 1: Materials

Cuivre et alliages de cuivre — Termes et définitions — Partie 1: Matériaux

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 197/1 was developed by Technical Committee ISO/TC 26, *Copper and copper alloys,* and was circulated to the member bodies in July 1982.

It has been approved by the member bodies of the following countries:

Austria	Iran	Romania
Belgium	Italy	South Africa, Rep. of
Brazil	Japan	Spain
Canada	Korea, Dem. P. Rep. of	Sweden
China	Korea, Rep. of	Switzerland
Egypt, Arab Rep. of	Mexico	Turkey
Finland	Netherlands	United Kingdom
France	Norway	USA
Germany, F.R.	Poland	USSR

No member body expressed disapproval of the document.

This International Standard cancels and replaces ISO Technical Report ISO/TR 197/1-1976.

Copper and copper alloys — Terms and definitions — Part 1: Materials

0 Introduction

Terms and definitions listed in this part of ISO 197 have been approved in principle by the Customs Co-operation Council (CCC) to form the basis of the Harmonized Commodity Description and Coding System (Harmonized System) for the revision of chapter 74 "Copper" of the CCC-Nomenclature.

1 Scope and field of application

This part of ISO 197 gives terms for and definitions of materials in the field of copper and copper alloys.

2 General terms and definitions

2.1 alloy: A metallic substance consisting of a mixture of the basic metallic elements (the element predominating by mass) and other elements such as alloying elements and impurities.

2.2 alloying element: Metallic or non-metallic elements added to or retained by a basic metal for the purpose of giving that metal certain special properties.

2.3 impurity: Metallic or non-metallic elements present but which are not intentionally added to or retained by a metal.

2.4 wrought alloy: An alloy primarily intended for the production of wrought products by hot and/or cold plastic deformation.

2.5 casting alloy: An alloy primarily intended for the production of castings.

2.6 master alloy: An alloy intended only for addition to a melt to adjust composition or to control impurities.

2.7 heat-treatable alloy: An alloy capable of being strengthened by suitable thermal treatment.

2.8 non-heat-treatable alloy: An alloy strengthened by cold working only and incapable of being substantially strengthened by thermal treatment.

3 Classification of copper and copper alloys

Copper and copper alloys are classified as follows: (see the annex for further details).

3.1 Unrefined copper

(For specific terms, see 4.1.)

3.2 Refined copper

(For specific terms, see 4.2.)

a) Metal with a minimum content of 99,85 % (m/m) of copper or

b) Metal with a minimum content of 97,5 % (m/m) of copper, provided that the content by mass of any other element does not exceed the limits specified in the following table:

Table — Other elements

Element		Limiting content % (m/m)
Ag	Silver	0,25
As	Arsenic	0,5
Cd	Cadmium	1,3
Cr	Chromium	1,4
Mg	Magnesium	0,8
Pb	Lead	1,5
S	Sulfur	0,7
Sn	Tin	0,8
Te	Tellurium	0,8
Zn	Zinc	1,0
Zr	Zirconium	0,3
Other elements [1], each		0,3

1) Other elements are, for example Al, Be, Co, Fe, Mn, Ni, Si.

3.3 Copper alloys

Copper alloys are metallic substances other than unrefined copper in which copper predominates by mass over each of the other elements provided that:

a) the content by mass of at least one of such other elements is greater than the limit specified in the table or

b) the total content by mass of such other elements exceeds 2,5 %.

(For specific terms see 4.3.)

4 Specific terms and definitions

4.1 Unrefined copper

4.1.1 copper matte: An intermediate product consisting mainly of ferrous and cuprous sulfides, which is oxidized in converters to produce metallic copper, usually termed blister copper.

4.1.2 black copper: An impure form of copper produced by smelting impure copper scrap and/or oxidized copper ores, usually in a blast furnace. The copper content varies widely, usually in a range of approximately 60 to 85 % (m/m).

4.1.3 blister copper: An impure form of copper produced by blowing air through molten copper matte. During the conversion process, sulfur, iron and other impurities are oxidized. The copper content is normally about 98 % (m/m).

4.1.4 cement copper: An impure, finely divided mixture of copper and copper oxide obtained by precipitation of copper usually by iron (cementation) from aqueous solution of copper compounds.

The copper content, dry basis, varies widely, usually in a range of approximately 50 to 85 % (m/m).

4.2 Refined copper

The definitions listed below refer to those coppers the minimum copper content of which shall be 99,85 % (m/m).

4.2.1 Types of copper

4.2.1.1 oxygen-free copper: Copper containing neither copper(I) oxide nor any residue of deoxidizers.

4.2.1.2 tough pitch copper: Copper containing a controlled amount of oxygen in the form of copper(I) oxide.

4.2.1.3 deoxidized copper: Copper free from copper(I) oxide and containing controlled amounts of metallic or metalloidal deoxidizers, such as phosphorus, lithium, boron, calcium. The phosphorus-deoxidized copper is most commonly used.

4.2.2 Method of refining

The types of copper listed under 4.2.1 originate from one or more of the following refining methods:

4.2.2.1 chemical refining: A process to recover copper from an aqueous solution by other means than electrolytic deposition.

4.2.2.2 electrolytic refining: A process to purify copper by electrolytic deposition using soluble anodes.

4.2.2.3 electro-winning: A process to produce copper by electrolytic deposition from an electrolyte using insoluble anodes.

4.2.2.4 fire refining: A process to produce copper by oxidation and subsequent reduction in the molten state.

4.3 Copper alloys

4.3.1 copper-zinc alloys (brasses): Alloys of copper and zinc, with or without other elements. When other elements are present:

— zinc predominates by mass over each of such other elements;

— any nickel content by mass is less than 5 % [see 4.3.3, copper-nickel-zinc alloys (nickel-silver)];

— any tin content by mass is less than 3 % [see 4.3.2, copper-tin alloys (bronzes)].

4.3.2 copper-tin alloys (bronzes): Alloys with copper and tin, with or without other element. When other elements are present:

— tin predominates by mass over each of such other elements, except that

— when the tin content is 3 % or more by mass, the zinc content by mass may exceed that of tin but shall be less than 10 %.

4.3.3 copper-nickel-zinc alloys (nickel-silvers): Alloys of copper, nickel and zinc, with or without other elements. The nickel content is 5 % (m/m) or more [see 4.3.1, copper-zinc alloys (brasses)].

4.3.4 copper-nickel alloys: Alloys of copper and nickel, with or without other elements, but in any case not more than 1 % (m/m) of zinc.

When other elements are present, nickel predominates by mass over each of the other elements.

4.3.5 copper-aluminium alloys: Alloys of copper and aluminium, with or without other elements. When other elements are present, aluminium predominates by mass over each of the other elements.

4.3.6 special copper alloys: Alloys of copper and other elements not covered by the above-mentioned definitions, for example CuBe, CuSiMn, CuNiSi.

Annex

Dividing line between copper and copper alloys

(This annex forms an integral part of the body of this International Standard.)

Owing to the fact that, in the whole field of non-ferrous metals materials now exist having alloying elements in contents lower than 1 % (*m/m*), which would cause difficulties in fixing the dividing line between an unalloyed metal and an alloy at a certain percentage, for example 99,00 % (*m/m*), this principal question was carefully studied by a joint meeting of representatives of the CCC and ISO/TC 18, *Zinc and zinc alloys,* ISO/TC 26, *Copper and copper alloys,* and ISO/TC 79, *Light metals and their alloys,* in Brussels in February 1974. It was shown that the previous dividing line of 99,0 % (*m/m*) could no longer be maintained as the classification principle in the CCCN because, in view of technical developments, some exceptions, for example for CuCd, CuCr, have to be made. On the other hand, a purely scientific definition of an alloy could not be accepted because in many cases the specification of the material in question is unknown. In any case, it is necessary to avoid the possibility of a material — whether standardized or not — being classified as copper as well as a copper alloy, depending on its actual content of alloying elements.

It was therefore suggested that the classification should be based on a table indicating the limiting values for elements so that the material could be classified on the basis of the specification to which it is supplied or, in case of doubt, on the result of an analysis of the material in question. It was generally agreed that such a table is technically and economically correct and that it represents a modern concept of a classification principle, being based on the actual requirement of both metallurgical and commercial practice.

Concerning the dividing line between copper and copper alloys, it should be recalled that the table showing limiting values is a classification principle to be applied in case of doubt only. It is not considered as a specification according to which products can be ordered, supplied or tested.

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