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Corrosion of metals and alloys — Vocabulary

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Foreword

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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 document 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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This document was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 262, *Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This sixth edition cancels and replaces the fifth edition (ISO 8044:2020) which has been technically revised.

The main changes are as follows:

- ~~—~~ ~~Several~~ several definitions have been changed, including the definition of corrosion. ~~Several;~~
- several editorial changes were made, including the addition of cross-references to other terms within the ~~definitions.~~ definitions.

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.

Introduction

The definitions in this document have been drawn up with the objective of achieving a proper balance between precision and simplicity. The main objective of this document is to provide definitions that can be understood to have the same meaning by all concerned. Some corrosion terms in present use have developed through common usage and are not always logical. It has not, therefore, been possible to define certain terms in the form they are used in some countries. Because of the occasional conflicts between tradition and logic, some definitions inevitably represent a compromise.

An example of this kind of conflict is the term “corrosion”. This has been used to mean the process, the results of the process and the damage caused by the process. In this document, corrosion is understood to mean the process. Any detectable result of corrosion in any part of a corrosion system is termed “corrosion effect”. The term “corrosion damage” covers any impairment of the function of the technical system of which the metal and the environment form a part. Consequently, the term “corrosion protection” implies that the important thing is to avoid corrosion damage rather than to prevent corrosion, which in many cases is impossible and sometimes not necessary.

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Corrosion of metals and alloys — Vocabulary

1 Scope

This document defines terms relating to corrosion that are widely used in modern science and technology. In addition, some definitions are supplemented with short explanations.

NOTE 1 — Throughout the document, International Union of Pure and Applied Chemistry rules for electrode potential signs are applied. The term “metal” is also used to include alloys and other metallic materials.

NOTE 2 — Terms and definitions related to the inorganic surface treatment of metals are given in ISO 2080.

2 Normative references

There are no normative references in this document.

3 Terms related to corrosion in general

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 corrosion

chemical or electrochemical interaction between a material, usually a metal, and its environment

Note 1 to entry: This can lead to deterioration of material properties, the environment, or the function of the system containing that material.

3.2 corrosive agent

substance that ~~will initiate~~ initiates or ~~promote~~ promotes *corrosion* (3.1) (3.1) when in contact with a given metal

3.3 corrosive environment

environment that contains one or more *corrosive agents* (3.2) (3.2)

3.4 corrosion system

system consisting of one or more metals and those parts of the environment that influence *corrosion* (3.1) (3.1)

Note 1-to-entry:- Parts of the environment can be, for example, coatings, surface layers or additional *electrodes* (7.1.2):(7.1.2).

3.5

corrosion effect

change in any part of the *corrosion system* (3.4)(3.4) caused by *corrosion* (3.1)(3.1)

3.6

corrosion damage

corrosion effect (3.5)(3.5) that causes impairment of the function of the metal, the environment or the technical system, of which these form a part

3.7

corrosion failure

corrosion damage (3.6)(3.6) characterized by the total loss of function of the technical system

3.8

corrosion product

substance formed as a result of *corrosion* (3.1)(3.1)

3.9

scale

solid layer of *corrosion products* (3.8)(3.8) formed on a metal at high temperature

Note 1-to-entry:- The term “scale” is also used in some countries for deposits from supersaturated water.

3.10

rust

visible *corrosion products* (3.8)(3.8) consisting mainly of hydrated iron oxides

3.11

corrosion depth

distance between a point on the surface of a metal affected by *corrosion* (3.1)(3.1) and the original surface of the metal

3.12

corrosion rate

corrosion effect (3.5)(3.5) on a metal per unit time

Note 1-to-entry:- The unit used to express the corrosion rate depends on the technical system and on the type of corrosion effect. Thus, corrosion rate is typically expressed as an increase in *corrosion depth* (3.11)(3.11) per unit time, or the mass of metal turned into *corrosion products* (3.8)(3.8) per area of surface and per unit time, etc. The corrosion effect can vary with time and will not be the same at all points of the corroding surface. Therefore, reports of corrosion rates are typically accompanied by information on the type, time dependency and location of the corrosion effect.

3.13

corrosion resistance

ability of a metal to maintain *serviceability* (3.16)(3.16) in a given *corrosion system* (3.4)(3.4)

3.14**corrosivity**

ability of an environment to cause *corrosion* (3.1)(3.1) of a metal in a given *corrosion system* (3.4)(3.4)

3.15**corrosion likelihood**

qualitative and/or quantitative expression of the expected *corrosion effects* (3.5)(3.5) in a defined *corrosion system* (3.4)(3.4)

3.16**serviceability**

~~<corrosion>~~ ability of a *corrosion system* (3.4)(3.4) to perform its specified functions without impairment due to *corrosion* (3.1)(3.1)

3.17**durability**

~~<corrosion>~~ ability of a *corrosion system* (3.4)(3.4) to maintain *serviceability* (3.16)(3.16) over a specified time when the specified requirements for use and maintenance have been fulfilled

3.18**service life**

~~<corrosion>~~ time during which a *corrosion system* (3.4)(3.4) meets the requirements for *serviceability* (3.16)(3.16)

3.19**critical humidity**

value of the relative humidity of an atmosphere above which there is a sharp increase in the *corrosion rate* (3.12)(3.12) of a given metal

3.20**corrosion attack**

corrosion effect (3.5)(3.5) that is detrimental but has not progressed to the point of impairment of the function of the metal, the environment or the technical system, of which these form a part

3.21**pickling**

removal of oxides or other compounds from a metal surface by chemical or electrochemical action

3.22**pitting resistance equivalent number****PREN**

indication of the resistance of stainless steels and nickel-based alloys to pitting in the presence of chloride-containing water

Note 1- to entry:- An example formula for PREN is given by:

$$\text{PREN} = \% \text{Cr} + 3,3 [(\% \text{Mo}) + 0,5 (\% \text{W})] + 16 (\% \text{N})$$

$$\text{PREN} = \% \text{Cr} + 3,3 [(\% \text{Mo}) + 0,5 (\% \text{W})] + 16 (\% \text{N})$$

Note 2-to entry:- In general, the higher the PREN, the higher ~~is~~ the resistance to *pitting corrosion* ~~(4.15)~~(4.15).

3.23

trap

micro structural site at which the residence time for a hydrogen atom is long compared to the residence time in an interstitial lattice site

3.24

time of wetness

period when a metallic surface is covered by adsorptive and/or liquid films of *electrolyte* ~~(7.1.1)~~(7.1.1) to be capable of causing *atmospheric corrosion* ~~(4.4)~~(4.4)

3.25

threshold stress

~~<stress corrosion cracking>~~ tensile stress above which stress corrosion cracks initiate and grow for specified test conditions

3.26

threshold stress intensity factor for stress corrosion cracking

K_{ISCC}

~~<stress corrosion cracking>~~

stress intensity factor above which stress corrosion crack propagation is sustained

Note 1-to entry:- The threshold stress intensity factor is a concept of linear elastic fracture mechanics (LEFM) and is applicable when the plastic zone size is large compared with the microstructure, the crack is sufficiently long, and a high constraint to plastic deformation prevails, i.e. under plane strain predominant conditions. For growing stress corrosion cracks, LEFM is not necessarily applicable in all detail but is adopted as a pragmatic tool that is commonly used.

Note 2-to entry:- Stress corrosion cracks can initiate at a surface or a surface defect and grow in the “small crack” regime at stress intensity factor levels below the apparent threshold stress intensity factor. Therefore, LEFM is not applicable in the “small crack” regime.

4 Terms related to types of corrosion

4.1

electrochemical corrosion

corrosion ~~(3.1)~~(3.1) involving at least one *anodic reaction* ~~(7.1.9)~~(7.1.9) and one *cathodic reaction* ~~(7.1.6)~~(7.1.6)

4.2

chemical corrosion

corrosion ~~(3.1)~~(3.1) not involving an electrochemical reaction

4.3

gaseous corrosion

corrosion ~~(3.1)~~(3.1) with dry gas as the *corrosive environment* ~~(3.3)~~(3.3) and without any liquid phase on the surface of the metal

4.4**atmospheric corrosion**

corrosion (3.1)(3.1) with the earth's atmosphere at ambient temperature as the *corrosive environment* (3.3)(3.3)

4.5**marine corrosion**

corrosion (3.1)(3.1) with sea water as the main agent of the *corrosive environment* (3.3)(3.3)

Note 1-to-entry:- This definition includes both immersed and splash zone conditions.

4.6**underground corrosion**

corrosion (3.1)(3.1) of buried metals, soil being the *corrosive environment* (3.3)(3.3)

Note 1-to-entry:- The term "soil" includes not only the naturally occurring material but also any other material, such as ballast and backfill, used to cover a structure.

4.7**bacterial corrosion**

microbiologically *influenced corrosion* (4.37)(4.37) due to the action of bacteria

4.8**general corrosion**

corrosion (3.1)(3.1) proceeding over the whole surface of the metal exposed to the *corrosive environment* (3.3)(3.3)

4.9**uniform corrosion**

general corrosion (4.8)(4.8) proceeding at almost the same rate over the whole surface

4.10**localized corrosion**

corrosion (3.1)(3.1) preferentially concentrated on discrete sites of the metal surface exposed to the *corrosive environment* (3.3)(3.3)

Note-1-to-entry:- Localized corrosion can result in, for example, pits, cracks or grooves.

4.11**galvanic corrosion**

corrosion (3.1)(3.1) due to the action of a *corrosion cell* (7.1.13)(7.1.13)

Note-1-to-entry:- The term has often been restricted to the action of bimetallic corrosion cells, i.e. to *bimetallic corrosion* (4.12)(4.12).

4.12**bimetallic corrosion**

DEPRECATED: contact corrosion

galvanic corrosion (4.11)(4.11) where the *electrodes* (7.1.2)(7.1.2) are formed by dissimilar metals

4.13

impressed current corrosion

electrochemical corrosion ~~(4.1)~~(4.1) due to the action of an external source of electric current

4.14

stray-current corrosion

impressed current corrosion ~~(4.13)~~(4.13) caused by current flowing through paths other than the intended circuits

4.15

pitting corrosion

localized corrosion ~~(4.10)~~(4.10) resulting in ~~pits, i.e.~~ cavities extending from the surface into the metal

4.16

crevice corrosion

localized corrosion ~~(4.10)~~(4.10) associated with, and taking place in or immediately around, a narrow aperture or clearance formed between the metal surface and another surface (metallic or non-metallic)

4.17

deposit corrosion

localized corrosion ~~(4.10)~~(4.10) associated with, and taking place under or immediately around, a deposit of *corrosion products* ~~(3.8)~~(3.8) or other substance

4.18

water-line corrosion

corrosion ~~(3.1)~~(3.1) along, and as a consequence of the presence of, a gas/liquid boundary

4.19

selective corrosion

dealloying

corrosion ~~(3.1)~~(3.1) of an alloy whereby the components react in proportions that differ from their proportions in the alloy

4.20

dezincification of brass

selective corrosion ~~(4.19)~~(4.19) of brass resulting in the preferential removal of zinc

4.21

graphitic corrosion

selective corrosion ~~(4.19)~~(4.19) of grey cast iron resulting in the partial removal of metallic constituents and leaving graphite

4.22

intergranular corrosion

corrosion ~~(3.1)~~(3.1) in or adjacent to the grain boundaries of a metal

4.23

weld corrosion

corrosion ~~(3.1)~~(3.1) associated with the presence of a welded joint and taking place in the weld or its vicinity