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Standard Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys¹

This standard is issued under the fixed designation A941; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This standard is a compilation of definitions of terms related to steel, stainless steel, related alloys, and ferroalloys.

1.2 When a term is used in an ASTM document for which Committee A01 is responsible, it is included herein only when judged, after review by Subcommittee A01.92, to be a generally usable term.

1.3 Some definitions include a discussion section, which is a mandatory part of the definition and contains additional information that is relevant to the meaning of the defined term.

1.4 Definitions of terms specific to a particular standard will appear in that standard and will supersede any definitions of identical terms in this standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E112 Test Methods for Determining Average Grain Size

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

Ac_{cm} , Ac_1 , Ac_3 , Ac_4 —See **transformation temperature**.

Ae_{cm} , Ae_1 , Ae_3 , Ae_4 —See **transformation temperature**.

age hardening, n —hardening by **aging**, usually after rapid cooling or **cold working**.

age hardening, n —see **precipitation hardening**.

¹ This terminology is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.92 on Terminology.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

aging, n —a change in the properties of certain **steels** that occurs at ambient or moderately elevated temperatures after hot working or a heat treatment (**quench aging**, **natural aging**, or **artificial aging**) or after a cold-working operation (**strain aging**).

DISCUSSION—The change in properties is often, but not always, due to **precipitation hardening**, but never involves a change in the chemical composition of the **steel**.

alloy steel, n —a **steel**, other than a **stainless steel**, that conforms to a specification that requires one or more of the following elements, by mass percent, to have a minimum content equal to or greater than: 0.30 for aluminum; 0.0008 for boron; 0.30 for chromium; 0.30 for cobalt; 0.40 for copper; 0.40 for lead; 1.65 for manganese; 0.08 for molybdenum; 0.30 for nickel; 0.06 for niobium (columbium); 0.60 for silicon; 0.05 for titanium; 0.30 for tungsten (wolfram); 0.10 for vanadium; 0.05 for zirconium; or 0.10 for any other alloying element, except sulphur, phosphorus, carbon, and nitrogen.

annealing, n —a generic term covering any of several **heat treatments**.

DISCUSSION—This treatment is used for purposes such as reducing hardness, improving machinability, facilitating **cold working**, producing a desired microstructure, or obtaining desired mechanical, physical, or other properties. Where applicable, it is preferred that the following more specific terms be used: **box annealing**, **bright annealing**, **full annealing**, **intermediate annealing**, **isothermal annealing**, **process annealing**, **spheroidizing**, and **subcritical annealing**. The term “**annealing**,” without qualification, implies **full annealing**. Any process of **annealing** will usually reduce stresses; however, if the treatment is applied for the sole purpose of stress reduction, it should be designated **stress relieving**.

Ar_{cm} , Ar_1 , Ar_3 , Ar_4 —See **transformation temperature**.

artificial aging, n —aging above room temperature.

atmospheric corrosion resistance, n —the ability to resist degradation or alteration of material through chemical reaction with the surrounding atmosphere.

DISCUSSION—This term generally pertains to carbon steel, low alloy steel, or micro-alloyed steel.

austempering, n —heat treatment involving **quenching** a steel object from a temperature above the **transformation range** in a medium maintained at a temperature above the **martensite range** sufficiently fast to avoid the formation of

*A Summary of Changes section appears at the end of this standard

high temperature transformation products, and then holding it at that temperature until transformation is complete.

austenitizing, *n*—forming austenite by heating a steel object above the **transformation range**.

baking, *n*—heating to a low temperature in order to remove gases.

batch furnace, *n*—a heating device within which steel objects are held stationary or oscillated during the thermal processing cycle.

blank carburizing, *n*—simulating the **carburizing** operation without introducing carbon.

DISCUSSION—This is usually accomplished by using an inert material in place of the carburizing agent, or by applying a suitable protective coating on the object being heat treated.

blank nitriding, *n*—simulating the nitriding operation without introducing nitrogen.

DISCUSSION—This is usually accomplished by using an inert material in place of the nitriding agent, or by applying a suitable protective coating on the object being heat treated.

bluing, *n*—subjecting the scale-free surface of a steel object to the action of air, steam, or other agents at a suitable temperature, thereby forming a thin blue film of oxide and improving the object's appearance and corrosion resistance.

DISCUSSION—This term is ordinarily applied to sheet, strip, or finished parts. It is used also to denote the heating of springs after fabrication in order to improve their properties.

box annealing, *n*—**annealing** in a sealed container under conditions that minimize oxidation.

DISCUSSION—The charge is usually heated slowly to a temperature below the **transformation range**, but sometimes above or within it, and is then cooled slowly.

bright annealing, *n*—**annealing** in a protective medium to prevent discoloration of the bright surface.

capped steel, *n*—a **rimmed steel** in which, during ingot solidification, the rimming action was limited by mechanical or chemical means.

carbon potential, *n*—the carbon content at the surface of a specimen of pure iron in equilibrium with the carburizing medium considered, and under the conditions specified.

carbon restoration, *n*—replacing the carbon lost from the surface layer in previous processing by carburizing this layer to substantially the original carbon level.

carbon steel, *n*—a **steel** that conforms to a specification that prescribes a maximum limit, by **heat analysis** in mass percent, of not more than: 2.00 for carbon and 1.65 for manganese, but does not prescribe a minimum limit for chromium, cobalt, molybdenum, nickel, niobium (columbium), tungsten (wolfram), vanadium, or zirconium.

DISCUSSION—Except as required above, it is permissible for carbon steel specifications to prescribe limits (minimum or maximum, or both) for each specified alloying element, subject to the following restrictions for the heat analysis limits in mass percent:

(a) for wrought carbon steel products, the specified maximum limit is not to exceed: 0.10 for aluminum, 0.60 for silicon, and 0.050 for titanium;

(b) for carbon steel castings, the specified maximum limit is not to exceed: 0.10 for aluminum, 1.00 for silicon, and 0.050 for titanium.

(c) for **carbon steels** that are required to be rephosphorized, the specified minimum limit for phosphorus is not to be less than 0.040;

(d) for **carbon steels** that are required to be resulfurized, the specified minimum limit for sulfur is not to be less than 0.060;

(e) for **carbon steels** that are not required to be rephosphorized or resulfurized, the specified maximum limit is not to exceed: 0.60 for copper, 0.050 for phosphorus, and 0.060 for sulfur; and

(f) for **carbon steels** that are required to contain boron, copper, or lead, the specified minimum limit is not to exceed: 0.0005 for boron, 0.35 for copper, and 0.25 for lead.

carbonitriding, *n*—**case hardening** in which a suitable steel object is heated above A_{c1} in a gaseous atmosphere of such composition as to cause simultaneous absorption of carbon and nitrogen by the surface and, by diffusion, to create a concentration gradient.

carburizing, *n*—a process in which an austenitized steel object is brought into contact with a carbonaceous environment of sufficient carbon potential to cause absorption of carbon at the surface and, by diffusion, to create a concentration gradient.

case, *n*—in *case hardening*, the outer portion that has been made harder than the **core** as a result of altered composition or microstructure, or both, from treatments such as **carburizing**, **nitriding**, and **induction hardening**.

case hardening, *n*—a generic term covering any of several processes applicable to **steel** that change the chemical composition or microstructure, or both, of the surface layer.

DISCUSSION—The processes commonly used are: **carburizing** and **quench hardening**; **nitriding**; and **carbonitriding**. It is preferred that the applicable specific process name be used.

cast analysis—Deprecated term. Use the preferred term **heat analysis**.

cementation, *n*—the introduction of one or more elements into the outer portion of a steel object by means of diffusion at high temperature.

certificate of compliance, *n*—in *manufactured products*, a document that states that the product was manufactured, sampled, tested, and inspected in accordance with the requirements of the specification (including year of issue) and any other requirements specified in the purchase order or contract, and has been found to meet such requirements.

DISCUSSION—A single document, containing test report information and certificate of compliance information, may be used.

certifying organization, *n*—in *product specifications*, the entity responsible for the conformance and certification of the product to the specification requirements.

check analysis—Deprecated term. Use the preferred term **product analysis**.

coarse grain practice, *n*—a steelmaking practice for other than **stainless steel** that is intended to produce a **killed steel** in which aluminum, niobium (columbium), titanium, and vanadium are **residual elements**.