Technical Bulletin

HYDE™
Industrial Blade Solutions

Glossary of Metal Terminology

A.S.M.: American Society for Metals

A.S.M.E.: American Society of Mechanical Engineers

A.S.T.E.: American Society of Tool Engineers

Air-Hardening Steel: An alloy steel that is hardened by cooling in air from a temperature higher than transformation range. Also called self-hardening steel.

Alloy: A substance that has metallic properties and is composed of two or more chemical elements of which at least one is a metal.

Alloying Elements: Chemical elements constituting an alloy; in steels, usually limited to the metallic elements added to modify the properties of the steel.

Annealing: A process involving heating and cooling, usually applied to induce softening. The term also refers to treatments intended to alter mechanical or physical properties, produce a definite micro-structure, or remove gases. Any process of annealing will usually reduce stresses, but if the treatment is applied for the sole purpose of such relief, it should be designated as "stress relieving."

Billet: A section of ingot, hot worked by forging, rolling, or extrusion.

Bloom (slab, billet - Ferrous Metal): Semi-finished products hot rolled from ingots and rectangular in cross-section, with rounded corners. The principal differences are in cross-sectional area, in ratio of width to thickness, and in the intended uses.

Brasses: Copper-base alloys in which zinc is the principal added element.

Brazing: Joining metals by fusion of non-ferrous alloys that have melting points above 800˚F, but lower than those of the metals being joined.

Broaching: A process of "shaving" metal, accomplished by pushing a tool with stepped cutting edges along the work, particularly through holes.

Cake: A copper ingot rectangular in cross-section.

Carbide: A compound of carbon with one or more metallic elements.

Carbon Steel: Steel that owes its properties chiefly to the presence of carbon, without substantial amounts of other alloying elements (also "ordinary steel" or "straight carbon steel").

Carburizing: A process that introduces carbon into a solid ferrous alloy by heating the metal in contact with carbonaceous material - solid, liquid, or gas - to a temperature above the transformation range and holding at that temperature. Carburizing is usually followed by quenching to produce a hardened case.

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Case: In a ferrous alloy, the surface layer that has been made substantially harder than the interior or core by a process of case hardening.

Case Hardening: A process of hardening a ferrous alloy so that the surface layer or case is made substantially harder than the interior or core. Typical case hardening processes are carburizing and quenching, cyaniding, carbonitriding, nitriding, induction hardening and flame hardening.

Centrifugal Casting: A casting technique in which a mold is rotated during solidification of a casting. Unusually sound castings are produced by the action of centrifugal force pressing toward the periphery.

Cold Working: Deforming a metal plastically at such temperature and rate that strain hardening occurs.

Continuous Casting: A casting technique in which the ingot is continuously solidified while it is being poured, and the length is not determined by mold dimensions.

Critical Temperature: "Transformation temperature" is the preferred term.

Decarburization: The loss of carbon from the surface of a ferrous alloy as the result of heating in a medium that reacts with the carbon.

Die Casting: Casing metals into final shapes in metal molds; usually alloys that have relatively low melting points, such as zinc, lead, tin, aluminum or magnesium base alloys.

Drop Forging: Forming metal, usually under impact, by compression within dies designed to produce the required shape.

Elastic Limit: The maximum stress that a material will withstand without permanent deformation.

Etching: In metallography, the process or revealing structural details by the preferential attack of reagents on a metal surface.

Fatigue: The tendency for a metal to break under conditions of repeated cyclic stressing considerably below the ultimate tensile strength.

Fatigue Crack or Failure: A fracture starting from a point where there is an abnormally high concentration of stress. The crack propagates through the metal a small amount with each cycle of loading. The surface is smooth and frequently shows concentric (sea shell) markings with a nucleus as a center.

Ferrous Metals: Those pertaining to, or derived from iron.

Flash: A thin fin of metal formed at the sides of a forging or weld when a small portion of metal is forced out between the edges of the forging or welding dies.

Free Machining: The property that makes machining easy because of the forming of small chips, a characteristic imparted to steel by sulphur, to brass by lead, to aluminum alloys by lead and bismuth, to nickel alloys by sulphur or carbon, and so on.

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Full Annealing: A softening process in which a ferrous alloy is heated to a temperature above the transformation range and, after being held for a sufficient time at this temperature, is cooled slowly to a temperature below the transformation range. The alloy is ordinarily allowed to cool slowly in the furnace, although it may be removed and cooled in some medium that ensures a slow rate of cooling.

Galling: The damaging of one or both metallic surfaces by removal of particles from localized areas during sliding friction.

German Silver: An alloy of copper, zinc and nickel, containing no silver and probably not originating in Germany.

Grain Refiner: Any material added to a liquid metal for the purpose of producing a finer grain size in the subsequent casting or of retaining fine grains during the heat treatment of wrought structures.

Gum: To enlarge or deepen the spaces between the teeth of a worn saw.

Hardenability: In a ferrous alloy, the property that determines the depth and distribution of hardness induced by quenching.

Hardening: Any process for increasing the hardness of metal by suitable treatment, usually involving heating and cooling.

Hardness: Defined in terms of the method of measurement. (1) Usually the resistance to indentation. (2) Stiffness or temper of wrought products. (3) Machinability characteristics.

Heat Treatment: A combination of heating and cooling operations, timed and applied to a metal or alloy in the solid state in a way that will produce desired properties.

Hot Working: Plastic deformation of metal at such temperature and rate that strain hardening does not occur.

Impact Extrusion: A cold forming process in which the metal is forces by impact to flow around the punch, forming a tube with a solid bottom.

Induction Hardening: A process of hardening a ferrous alloy by heating it above the transformation range by means of electrical induction, and then cooling as required.

Induction Heating: A process of heating by electrical induction.

Ingot: A casting intended for subsequent rolling or forging.

Kerf: The slit made in cutting, as by a blade or knife.

Laminations: Defects resulting from the presence of blisters, seams or foreign inclusions aligned parallel to the worked surface of a metal.

Lap: A surface defect appearing as a seam, caused by folding over hot metal, fins or sharp corners and then rolling or forging them into the surface, but not welding them.

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Light Metals: Metals and alloys that have a low specific gravity, such as beryllium, magnesium and aluminum.

Machinability: A term often encountered in metal working, can be considered as the relative ease in forming a material by metal removal; this term being evaluated by such factors as : (a) productivity in pieces per unit time; (b) power requirements of a given machine in performing the cutting operations; (c) surface finish of the completed part; (d) accuracy to specified dimensions; and (e) tool life in terms of pieces per grind.

Malleability: The property that determines the ease of deforming a metal when the metal is subjected to rolling or hammering. The more malleable metals can be hammered or rolled into thin sheet more easily than others.

Mechanical Properties: Those properties of a material that reveal the elastic and inelastic reaction when force is applied, or that involve relationship between stress and strain; for example, the modulus of elasticity, tensile strength and fatigue limit. These properties have often been designated as "physical properties," but the term "mechanical properties" is preferred.

Melting Range: The range of temperature in which an alloy melts; that is, the range between solid and liquid temperatures.

Metallography: The science concerning the constitution and structure of metals and alloys as revealed by the microscope.

Microstructure: The structure of polished and etched metal and alloy specimens as revealed by the microscope.

Nickel Silver: A copper-base alloy that contains 17 to 32% Zinc and 10 to 30% Nickel.

Nitriding: A process of case hardening in which a ferrous alloy, usually of special composition, is heated in an atmosphere of ammonia or in contact with nitrogenous material to produce surface hardening by the absorption of nitrogen without quenching.

Normalizing: A process in which a ferrous alloy is heated to a suitable temperature above the transformation range and is subsequently cooled in still air at room temperature.

Non-Ferrous Metals: Those not containing, including, or pertaining to iron.

Open Hearth Furnace: A furnace for melting metal, in which the bath is heated by the convection of hot gases over the surface of the metal and by radiation of the roof.

Ore: A mineral from which the metal can be extracted profitably.

Photomicrograph: A photographic reproduction of any object magnified more than 10 diameter. The term micrograph may be used.

Physical Metallurgy: The science concerned with the physical and mechanical characteristics of metals and alloys.

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Physical Properties: Those properties discussed in physics, exclusive of those known as mechanical properties; i.e. density, electrical conductivity, coefficient of thermal expansion.

Pickel: Chemical or electrochemical removal of surface oxides.

Pig: An ingot of virgin or secondary metal to be remelted for use.

Pipe: A cavity formed by contraction in metal (especially ingots) during solidification of the last portion of liquid metal.

Powder Metallurgy: The are to producing metal powders and of utilizing metal powders for the production of massive materials and shaped objects.

Precious Metals: Scarce and costly metals that do not form stable oxides at atmospheric pressures; specifically gold, silver, and metals of the platinum group.

Preheating: A general term used to describe heating applied as a preliminary to some further thermal or mechanical treatment.

Preheating (Non-Ferrous Metals): Heating a metal to a relatively high temperature for a relatively long time in order to change the structure before working.

Quench Hardening: A process of hardening a ferrous alloy of suitable composition by heating within or above the transformation range and cooling at a rate sufficient to increase the hardness substantially.

Quenching: A process of rapid cooling from an elevated temperature by contact with liquids, gases or solids.

R.C.: Rockwell Hardness scale used for testing most hard metals.

Reheating: A thermal operation designed solely to heat the work back to hot forming temperatures. In general, no structural changes are intended.

Riser: A reservoir of excess molten metal at the top of the heaviest section or sections of a casting, designed to supply metal in compensation for shrinkage that cannot be fed properly from the gate.

Roll Forming: (1) An operation used in forming sheets. Strips of sheet are passed between rolls of definite settings that bend the sheet progressively into structural members of various contours, sometimes called "molded sections." (2) A process of coiling sheet into open cylinders.

Rotary Shear: A cutting machine with sharpened circular blades or disk-like cutters used for trimming edges and slitting sheet and foil.

S.A.E.: Society of Automotive Engineers.

Seam: On the surface of metal, a crack that has been closed but not welded; usually produced by some defect either in casting or in working, such as blowholes that have become oxidized or folds and laps that have been formed during working.

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Self-Hardening Steel: See air-hardening steel.

Silver Solders: Alloys of silver, copper, zinc and other metals, melting between 650˚ and 875˚C, used for making strong joints that resist corrosion.

Sintering (Powdered Metals): Bonding adjacent surfaces of particles in a mass of powder or compact by heating.

Soaking: Prolonged heating of a metal at a selected temperature.

Spalling: The cracking and flaking of metal particles from a surface.

Sprue: In casting practice, the vertical channel connecting the pouring basin with the skimming gate, if any, and the runner, to the mold cavity, all of which together may be called the "gate".

Sterling Silver: An alloy of 925 parts of silver and 75 parts copper.

Stress Relieving: A process of reducing residual stresses in a metal object by heating the object to a suitable temperature and holding for a sufficient time. This treatment may be applied to relieve stresses induced by casting, quenching, normalizing, machining, cold working, or welding.

Tempering: A process of reheating quench-hardened or normalized steel to a temperature below the transformation range, and then cooling at any rate desired.

Tensile Strength: The value obtained by dividing the maximum load observed during tensile straining by the specimen cross-sectional area before straining. Also called "ultimate strength."

Transformation Range: The temperature interval within which austenite forms while ferrous alloys are being heated. Also the temperature interval within which austenite disappears while ferrous alloys are being cooled. The two ranges are distinct, sometimes overlapping but never coinciding.

Work Hardness: Hardness developed in metal as a result of cold working. See: Cold Working.

Workability: The characteristic, or group of characteristics, that determines the ease of forming a metal into desired shapes.

Yield Point: In mild or medium carbon steel, the stress at which a marked increase in deformation occurs without increase in load (not observed in other steels or non-ferrous metals).