METALS AND ALLOYS DICTIONARY

by

M. MERLUB-SOBEL, Ph.D.

Consulting Chemical and Metallurgical Engineer; Director of Research, Virginia-Carolina Chemical Corp., Addresso-graph Multigraph Corp.; Chemical Engineer, Beryllium Corp. of America; Research Engineer, Kemet Labs. Co.

1944

CHEMICAL PUBLISHING CO., INC.

Brooklyn N. Y.

Metals and Alloys Dictionary

© 2011 by Chemical Publishing Co., Inc. All rights reserved. This book is protected by copyright. No part of it may be reproduced, stored in a retrieval system or transmitted in any form or by any means; electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the publisher.

ISBN: 978-0-8206-0031-4

Chemical Publishing Company:
www.chemical-publishing.com
www.chemicalpublishing.net

First Edition:

© **Chemical Publishing Company, Inc.** - New York 1944

Second Impression:

Chemical Publishing Company, Inc. - 2011

Printed in the United States of America

PREFACE

ANY NEW BOOK, certainly one dealing with technical matters, ought to submit something akin to a "certificate of necessity." While "necessity" is highly subjective, and capable of many shades of meaning, the plain fact of this case is that no concise dictionary of metallurgical terms, adapted to American needs, has hitherto been available. And so, if the need but be granted, the author may be permitted to hope that this volume, in greater or lesser measure, fills the void.

Not that perfection is expected—the ideal may not even be prayed for in this all-too-imperfect world. Indeed, I realize that this book must inevitably contain at least a normal quota of error—sins of omission and commission both. For such, ignorance and/or carelessness must take full responsibility; in the interest of future editions, I shall be grateful for such corrections as may appear justified to the reader.

No defense can be made, nor is any intended, for positive errors of commission. In a volume of this type, however, omissions may frequently reflect differing opinions as to what ought to be included. Probably no two students of metallurgy would quite agree on the scope of material to be presented. The problem here has been further complicated by a desire to serve, in this volume, lay workers at the bench and behind the torch no less than technologists with university training. As a consequence of this desire, many words and phrases in sciences peripheral to metallurgy have been included; setting a proper course has frequently been most difficult, threatened at once by the Scylla of incompleteness and the Charybdis of undue bulk. In its final form, this dictionary represents one man's effort at intelligent compromise.

By its very nature, a dictionary can present little of new content. So many sources of information have found reflection in this volume that I am prevented from adequately acknowledging them; wherever possible, in fact, I have checked one source against another. Such metallurgical "demi-bibles" as *Metals Handbook, Engineering Alloys* (by Woldman and Dornblatt), and *The Making, Shaping and Treating of Steel* (by Camp and Francis) have served extensively as guides, and the reader is urged to refer to them and their technical congeners for amplification wherever this dictionary proves inadequate. The remarkably inclusive *Engineering Alloys* is particularly recommended for its listing and description of thousands of alloys which have not seemed important enough for description in this dictionary.

There is only one exception to the generalization that nothing new has been presented. In the realm of the rare metals, where some of the published data are fragmentary, and some erroneous, I have drawn directly on my own specialized experience, and have included some amount of data hitherto unblackened by printers' ink.

Generous unselfish help has been my good fortune. In particular, I am deeply in the debt of Mr. Harry B. Pulsifer and Prof. George L. Kehl—neither needs introduction to American workers in metallurgy —for reviewing many of the definitions of this book; many an error has been eliminated by their far-greater-than-mine knowledge. My co-workers of the Virginia-Carolina Chemical Corporation, Dr. James C. Alexander and Mr. Jack J. Press, have similarly been generous with their aid and advice, as well as in reading of proof, and I would like here to express my sincere thanks to them.

The conversion of an outrageously illegible manuscript into neatly typewritten copy, ready for the printer, was the years-long Augean task which Miss Mary Korpita genially undertook; in that highest of heavens reserved for the hewers of wood and the drawers of water, a special seat of glory, please, for a gallant helper. To Miss Gertrude Schutze, a bow for similar assistance. It is a pleasure, also, to acknowledge the clerical help of Mrs. Mildred Maeth.

To the reader, be he professional or novice, I speak the hope that this volume proves of value. If it does, even in small measure, I shall feel amply repaid in the only coin legitimate to the bibliogenetic realm.

M. M.-S.

EXPLANATORY NOTE

DEFINITIONS ARE LISTED on a strictly alphabetical basis. Each entry is treated as a unit, i.e., as though it were one single word. The following sequence is typical:

Air Cooling
Aircraft Metals
Air Drain
Aired Bars
Air Furnace

Connective words, such as "and", "in", etc., are not considered definite parts of an entry and are consequently not treated as part of the alphabetical sequence.

Each entry is in *bold-face* type, and any entry referred to in the course of a definition is similarly in *bold-face* type, frequently followed by "(see)". The latter is to be understood, of course, as indicating that the preceding word or words in *bold-face* type will be found, separately defined, in the proper alphabetical sequence.

Å (or Å.U.). Abbreviation for Angstrom unit, 1/100,000,000 cm, used for submicroscopic measurement (e.g. of wave-length or dimensions of molecules).

Abel's Reagent. Metallographic etching agent, consisting of 10% chromium trioxide (chromic acid) in water, used in the study of steels.

AB Microhardness Test. See **Microhardness.**

Abnormality. See **Abnormal Steel.**

Abnormal Steel. Steel in which the ferrite and cementite form coagulated units instead of normal laminated pearlite. The exact cause of this abnormality, known as "Ferrite Divorcement," is uncertain.

Abnormal Structure. See **Abnormal Steel.**

Abrasion Hardness. Hardness (see) of a material, as judged by resistance to abrasion.

Abrasion Mark. Surface scratch, caused by friction between two sheets of metal, such as will occur when a pile of sheets is improperly bound during shipment.

Abrasion Test. Test, for determining resistance of a metal to abrasive influences, usually conducted so as to duplicate, as nearly as possible, the expected conditions of service.

Abrasive Hardness. See **Abrasion Hardness.**

Absolute Temperature. Any temperature scale, the values of which are based on a zero point at the theoretical absolute minimum temperature, 273.18 degrees below zero Centigrade, or 459.72 degrees below zero Fahrenheit. The absolute Centigrade scale is also known as the Kelvin scale.

Absorption. Ability of a porous solid material to hold relatively large quantities of gases or liquids.

Absorption Spectrum. Spectrum of radiation coming through a selectively absorbing medium.

Abyssinian Gold. Copper-base alloy, with 8–10% zinc, fractional percentages of other elements, and approximately 1% gold, plated or rolled on the surface.

Ac. Chemical symbol for **Actinium** (see).

Accumulator. See **Storage Battery.**

Acheson Graphite. Artificial graphite, made from coke by electric furnace heating.

Acicular. Spine or needle-shaped; crystal whose length is three or more times its width.

Acid. Compound which yields hydrogen ions when dissolved in water or other solvents. Most metals are soluble in stronger acids (those containing a high concentration of hydrogen ions). Noble metals, such as gold or platinum, are soluble only in "aqua regia", a mixture of nitric and hydrochloric acids. In metallurgical technology, materials are considered acidic if they are susceptible to union with basic substances, such as lime and magnesia. Silica, SiO_2, is the most common acidic material of this type.

Acid Bessemer Steel. See **Bessemer Steel.**

Acid Bottom. Bottom of furnace, made of acid-reacting materials such as silica.

Acid Brittleness. Brittleness resulting from pickling steel in acid; hydrogen, formed by the interaction between iron and acid, is partially absorbed by the metal, causing acid brittleness.

Acid Bronze. Copper-base alloy, containing 74–78% copper, 8–10% tin, 2–17% lead, and 0–2% zinc; resistant to mildly acid conditions; used for chemical equipment.

Acid Electric Process. Process of steel manufacture or melting, in which the metal is melted in an electric arc furnace, using an acid hearth and slag.

Acid Flux. Metallurgically acid material (usually some form of silica) used as a **Flux** (see).

Acid-Forming Element. Element, compounds of which tend, in greater or lesser degree, to yield **Anions** (see) in water solution; non-metals are distinctly acid-forming, metalloids less so, and metals are base-forming.

Acid Hearth. See **Open-Hearth Process.**

Acid Lining. Lining of furnace made of acid-reacting materials such as silica.

Acid Open-Hearth Process. See **Open-Hearth Process.**

Acid Open-Hearth Steel. Steel made by the acid **Open-Hearth Process** (see).

Acid Pig (Iron). See **Bessemer Pig (Iron).**

Acid Process. (a) See **Open-Hearth Process.** (b) See **Flux Process.**

Acid Refractory. See **Refractory.**

Acid Slag. Slag in which the ratio of acidic materials (silica and alumina) exceeds that of the basic materials (lime and magnesia).

Acid Steel. Steel made or melted in contact with an acid-reacting furnace lining.

Acieral. Aluminum-base casting alloy, with about 6% copper and fractional percentages of nickel, zinc, and silicon.

Acker Process. Process of electrolyzing sodium metal from fused sodium chloride, using molten lead as cathode; the resulting sodium-lead alloy is decomposed by water to yield pure sodium hydroxide and lead which is recirculated.

Acme (Stainless) Steel. Series of **Stainless Steels** (see) (Acme Steel Co.).

Acorn (Babbitt). Series of tin-base bearing metals, with about 8% antimony and 4% copper (A. W. Cadman Mfg. Co.).

Actinic Rays. Rays affecting photographic film.

Actinium (chemical symbol Ac). Radioactive element, No. 89 of the periodic system; not yet isolated. Theoretically, its metallic properties are similar to those of **Yttrium** (see) and **Lanthanum** (see), and its theoretical valence is likewise three. Radioactivity renders all actinium compounds unstable, causing their constant decomposition into less radioactive substances.

Activated Bath. Cyaniding (see) bath in which alkali cyanide or alkali cyanide-chloride mixtures are used, with activating addition materials present, such as calcium cyanamide, etc.

Active Hydrogen. Hydrogen activated e.g. by adsorption on a metal surface.

AD Aluminum. Copper-base alloy, used in tube form, consisting of approximately 15% zinc, 2% aluminum, and 1% tin (Chase Brass & Copper Co.)

Adamantine. (a) Crystalline **Boron** (see). (b) Low-alloy, heat-treated steel, with about 0.7% chromium and manganese, used for making hard steel balls (Babcock & Wilcox Co.).

Adamite. Low-alloy iron used for wear-resistant objects, such as dies, containing 0.50–1.50% chromium, nickel up to 0.75%, silicon up to 2%, and 1.2–3.0% carbon (Mackintosh-Hemphill Co.).

Adamite Rolls. Rolls made of a mixture of steel, pig iron, and some alloying elements.

Addition Agent. Material added to an electroplating bath to improve operation of the bath, brighten the deposited metal, etc.

Addition Element. Any element added, in relatively small quantity, to an alloy for scavenging or modifying the properties of the alloy.

Admiralty (Alloy). See **Admiralty Brass.**

Admiralty Brass. Copper-base alloy containing approximately 29% zinc and 1% tin, originally developed in Great Britain for condenser tubes; one of the most commonly used non-ferrous tube materials, available in rod, wire, and sheet form, it lends itself well to cold-working, except machining, but is generally unsuitable for hot-working.

Admiralty Bronze. Copper-base alloy, containing approximately 10% tin and 2% zinc; used for castings, valves, gears, etc.

Admiralty Gun Metal. See **Gun Metal.**

Admiralty Metal. See **Admiralty Brass.**

Adnic. Copper-base alloy, containing approximately 29% nickel and 1% tin; because of strength and corrosion resistance, used in condenser tubing and for similar purposes (Scovill Mfg. Co.).

Adsorption. Ability of a solid surface to attach to itself firmly gases or liquids with which it comes in contact. Adsorption power varies widely with different types of surfaces.

Advance Metal. Copper-nickel alloy of relatively high, constant resistance, consisting approximately of 55% copper and 45% nickel (Driver-Harris Co.). See also **Constantan.**

Aerocarb (Carburizing Compounds). Series of salt mixtures used for case-hardening and other steel treatment (American Cyanamide & Chemical Corp.).

Aerocase (Case Hardening Compound). Series of case-hardening salt mixtures containing sodium and calcium chlorides and calcium cyanide (American Cyanamide & Chemical Corp.).

Aerolite. (a) Aluminum-base alloy containing 1–12% copper, fractional percentages of magnesium and silicon, and, optionally, a low percentage of manganese or iron. Used in automotive and aircraft industries. (b) Metallic or mineral material falling to earth out of interplanetary space.

Aero Metal. Aluminum-zinc casting metal containing approximately 67% aluminum, 28% zinc, 4% copper, and fractional percentages of iron and silicon (Garford Engineering Co.).

Aerosiderite. Aerolite [see **Aerolite** (b)] composed principally of iron.

Aerugo. Green coating on old copper or copper-base articles, formed by oxidation.

Aeterna. Modified yellow **Brass** (see) of about 40% zinc content; the modifying elements, present in fractional percentages, are tin, lead, and manganese.

Afterblow. Maintaining the "blow" (see **Bessemer Steel**) in the basic Bessemer process, so as to remove phosphorus, after carbon has been eliminated.

After-Flow. Plastic flow in solids, continuing after external forces have ceased to act.

Ag. Chemical symbol for **Silver** (see).

Agate Ware. Enameled iron or steel, particularly as used for household utensils. See **Vitreous Enamel.**

Agathon (Steel). See **U. M. A. Steel.**

Age-Hardening. Spontaneous hardening of some alloys, such as Duralumin and beryllium-copper, occurring at ordinary or relatively low temperatures; presumably caused by the precipitation, in sub-microscopic form, of a component held in supersaturated solution. The trend of age-hardening is greatly modified by previous heat treatment.

Age Hardness. See **Age-Hardening.**

Age Strengthening Range. See **Blue Brittle Range.**

Aggregate. Mixture of physically separable substances.

Aggregates. See **Crystal Aggregates.**

Aging. Spontaneous change in the physical properties of some metals, which occurs on standing, at relatively low temperatures. Frequently, synonymous with the term **Age-Hardening** (see).

Aging Steel. Steel which shows **Aging** (see) characteristics at room temperature or below 150°F, such as increased hardness, strength, and yield point.

Aging Test. Test of physical properties showing the characteristics of a material during **Aging** (see).

Agitator Pickling. Pickling (see) operation in which either the acid solution or the material being treated is maintained in motion, during the operation.

Agraphitic Carbon. See **Combined Carbon.**

Agricultural Ply Steel. Composite consisting of two or more layers of steel of different composition (hard steel on the outside, most commonly, for wear resistance). Generally made by casting one grade of steel on another.

Aich Metal. Yellow brass (about 40% zinc) containing approximately 1–2% iron.

Air-Acetylene Welding. See **Gas Welding.**

Air Blasting. Cleaning surface of metal by air blast, with sand or finely divided steel used as abrasive.

Air Bridge. Bridge, in furnace, admitting heated air to gases passing over it, for improving combustion efficiency.

Air Condenser. Surface **Condenser** (see) utilizing air as a condensing medium.

Air Cooling. Cooling of heated metal, intermediate in rapidity between slow **Furnace Cooling** (see) and **Quenching** (see) in which the metal is permitted to stand in the open air.

Aircraft Metals. Aluminum-base and magnesium-base alloys; less strictly, also alloy steels used for seamless tubing in the fabrication of aircraft.

Air Drain. Passage in **Mold** (see) permitting escape of gases when metal is being cast into it.

Aired Bars. Blister Steel (see) which has been exposed to air during the cooling process, resulting in decarburization of the surface through oxidation, and subsequent formation of scale.

Air Furnace. (a) Furnace, depending exclusively on natural draft. (b) Reverberatory furnace, used for lead smelting. (c) Reverberatory furnace for melting iron in the manufacture of malleable cast iron.

Air Gap. Insulating film of air formed, under certain conditions, between a solidified ingot and its mold, owing to expansion of the mold and contraction of the ingot.

Air Hardening Steel. Alloy steel which may be hardened by cooling in air from a temperature above the critical point. Such steels attain their martensitic structure without going through the quenching process. Additions of chromium, nickel, molybdenum and manganese are effective toward this end.

Air Line Pipe. Steel pipe suitable for airbrake systems, on railroads.

Air Patenting. Process of **Patenting** (see) steel products in which the cooling is accomplished in air.

Airplane Sheet. Steel sheet, frequently of non-corroding composition, in ductile and weldable form, for use in aeronautic construction.

Air Port. Inlet for air in furnace, particularly of the reverberatory type.

Air Quenching. Quenching (see) in air as the cooling medium (either still air or air in blast or jet form).

Air Reduction Process. See **Roast-Reaction Process.**

Air Separation. Separation of powdered or crushed material into fractions of approximately the same size, effected by air currents.

A.I.S.I. Steels. Steels of the American Iron and Steel Institute. Common and alloy steels have been numbered in a system essentially the same as the **S.A.E.** (see), series, to which the A.I.S.I. has added the NE series, representing **National Emergency Steels** (see). The A.I.S.I. system is more elaborate than the S.A.E. in that all numbers are preceded by letters: A represents basic open-hearth alloy steel, B acid Bessemer carbon steel, C basic open-hearth carbon steel, CB either acid Bessemer or basic open-hearth carbon steel, E electric furnace alloy steel.

Aitch Metal. See **Aich Metal.**

Ajax Bronze. Series of copper-base alloys, manufactured by Ajax Metal Co.

Ajax Bull. Bearing metal containing approximately 17% antimony, 7% tin, and 76% lead (Ajax Metal Co.).

Ajax-Northrup Furnace. Type of coreless **Induction Furnace** (see) in which the metal acts as secondary and a water-cooled coil, carrying high frequency current, as primary.

Ajax-Wyatt Furnace. Core-type **Induction Furnace** (see), operating at low frequencies.

Al. Chemical symbol for **Aluminum** (see).

Alabamine. See **Helvetium.**

Albata. See **Albatra.**

Albatra. Copper-base alloy, containing about 20% nickel and 20% zinc, used for hardware and similar products.

Alberti Furnace. Reverberatory furnace for roastng mercury ores, the mercury being condensed in iron tubes and brick chambers.

Albion Metal. Composite (see **Cladding**) made by coating lead with tin and rolling together.

Alclad. Trade name for composite metal consisting of one or more layers of pure aluminum rolled onto a layer of aluminum alloy. The former adds chemical resistance, the latter mechanical strength. Alclad 17S and Alclad 24S are standard forms, the number indicating the type of alloy used as the basic layer (Aluminum Company of America).

Alcoa. Aluminum-base alloys (Aluminum Co. of America). The more important types are: Alcoa 2S—Commercially pure aluminum; 3S—Same with 1.2% manganese; 4S—Same with 1.2% manganese and 1.0% magnesium; 17S—Same with 4% copper, 0.5% manganese, and 0.5% magnesium (see **Duralumin**); 24S—Same, with 4.4% copper, 0.5% manganese, and 1.5% magnesium (see **Duralumin**); 25S—Same with 4.5% copper, 0.8% silicon, and 0.8% manganese; 47S—Same with 12.5% silicon (see **Alpax**); 52S—Same with 2.5% magnesium and 0.25% chromium.

Alcrosil (Steel). Series of low-alloy steels, with 4–6% chromium and normally less than 0.15% carbon (Timken Roller Bearing Co.).

Alcumite. Corrosion-resistant **Aluminum Bronze** (see) with about 8% aluminum, 2% iron, and 1% nickel (Duriron Co.).

Alcunic. Copper-base alloy, with approximately 16–27% zinc, 2% aluminum, 1% nickel and, optionally, 1% tin (Scovill Mfg. Co.).

Alfenide. Modified **Nickel Silver** (see) with about 30% zinc, 10% nickel and 1% iron.

Alfol. Crumpled aluminum foil, used for heat insulation.

Alger Metal. Tin-base bearing metal, with up to 25% antimony, and optionally up to 5% copper.

Algier Metal. See **Alger Metal.**

A_3 Line. The A_3 Point (see **Critical Point**) varies from 1670°F at 0.00% carbon to 1333°F at the eutectoid value (about 0.83% carbon).

A_{cm} Line. Line on temperature-composition diagrams for iron-carbon, delineating decomposition temperatures of austenite into proeutectoid cementite.

Alkali (Alkaline). See **Base.**

Alkali Metals. Metals of group IA of the periodic system, including lithium, sodium, potassium, rubidium, cesium, and virginium (eka-cesium). They react vigorously, sometimes violently, with water, forming highly alkaline hydroxides. They are all very reactive, burning readily in air. See individual elements.

Alkaline-Earth Metals. Reactive metals of group II of the periodic system, including calcium, strontium, barium, and radium. So called because their oxides, alkaline in reaction, were known as "earths" in early chemical terminology. See individual elements.

Alkaline Storage Battery. Electric storage battery in which the positive plates consist of nickel and nickel peroxide, and the negative plates of finely divided iron. A strong solution of potassium hydroxide acts as electrolyte. The normal voltage varies between 1.0 and 1.5 volts per cell.

Allan (Red) Metal. Mechanical mixture (not a true alloy) containing approximately equal parts of copper and lead. Used primarily for bearings (A. Allan & Son).

Allegheny-Ludlum Steel. Series of alloy steels, most commonly of the high-chromium and stainless types, manufactured by Allegheny Steel Co.

Allegheny Metal. Series of corrosion and heat-resistant stainless steels, varying in chromium content between 11% and 30% and containing up to 21% nickel and small optional percentages of manganese, molybdenum, columbium and titanium (Allegheny-Ludlum Steel Corp.).

Allen-O'Hara Furnace. Horizontal double-hearth furnace, used for calcining sulfide ores.

Alligator. See **Squeezer.**

Alligator Shears. Metal shears, with one jaw movable and pinned to the other at the end, commonly used on light gage metal.

All-Mine Pig. Pig iron made entirely by the smelting of ore, without addition of scrap metal.

Allotrimorphic Crystal. See **Idiomorphic Crystal.**

Allotrope. See **Allotropy.**

Allotropy. Appearance of certain elements such as phosphorus, carbon, and iron, in varying forms called allotropes. Evidence of allotropy may be seen in such changes as occur in the atomic lattice arrangements. Allotropic forms of an element differ in practically all physical, as well as many chemical properties. The allotropy of iron, particularly the changes between the alpha body-centered cubic form and the gamma face-centered cubic form, is of fundamental importance in the hardening of steel.

Alloy. Mixture of two or more elements, at least one of which is a metal, forming an apparently homogeneous mass possessing metallic characteristics. Alloying may result in (1) a mere solution of one metal in another, or (2) a chemical combination of the elements present dissolved in the excess of one of the elements. Limited solubility of one metal in another will result in limited alloying, and metals practically insoluble in each other will tend to separate into two layers. Generally, alloying lowers the melting point, decreases electrical conductivity, and increases hardness. The latter is especially true if metal-compound formation takes place.

Alloyage. Alloying precious metals with base metals, for coin manufacture.

Alloy Cast Iron. Cast Iron (see), containing substantial proportions of alloying elements, such as nickel, chromium, molybdenum, etc.

Alloyed Casting. See **Alloy Cast Iron.**

Alloyed Chilled Rolls. Chilled Rolls (see) composed of cast iron, containing appreciable quantities of alloying elements.

Alloyed Grain Rolls. Rolls, for rolling metal, composed of sand-cast iron, containing appreciable quantities of alloying elements.

Alloyed Iron Casting. See **Alloy Cast Iron.**

Alloyed Iron Rolls. Rolls, for rolling metal, composed of cast iron, containing appreciable quantities of alloying elements. See **Rolling Mill.**

Alloyed Rolls. Cast iron, or cast steel rolls, containing appreciable amounts of alloying elements. See **Rolling Mill.**

Alloying. Addition of a metal or **Alloy** (see) to another metal or alloy, the latter usually being in the molten form.

Alloying Element. Element added to a basic metal in order to change its properties. In steel, the term covers elements, other than carbon, which are present in quantities greater than in the standard steels.

Alloy Iron. See **Semi-Steel.**

Alloy Pig Iron. Pig Iron (see), containing one or more alloying elements in appreciable quantity.

Alloy Steel. Steel containing substantial quantities of elements other than carbon and the commonly-accepted quotas of manganese, sulfur, silicon, and phosphorus. Addition of such alloying elements is usually for the purpose of increased hardness, strength, or chemical resistance. The metals most commonly used for forming alloy steels are: nickel, chromium, silicon, manganese, tungsten, molybdenum and vanadium. "Low alloy" steels are usually viewed as those totalling less than 5% of such added constituents.

Alloy Steel Strip. Strip Steel (see) containing one or more alloying elements in appreciable quantity. Typical are stainless steel strip and electric sheet steel.

Alloy System. See **Constitution Diagram.**

Alloy-Treated Steel. Simple steel to which one or more alloying elements have been added in small amounts, to improve general quality, without any significant effect on physical characteristics.

Alloy Wrought Iron. Wrought Iron (see), containing one or more alloying elements in appreciable quantity (most commonly, nickel, up to 3%, and copper up to 1.25%).

Alluvial Gold. Gold found native, in association with water-worn material.

Alluvial Tin. See **Stream Tin.**

Almond Furnace. Furnace in which litharge, from silver refining, is reduced to lead by means of charcoal.

Alnico. Alloy series containing approximately 20% nickel, 12% aluminum, 5% cobalt, 0.4% manganese and silicon combined, 62% iron, and not more than 0.15% carbon. Valuable in making permanent magnets of high coercive force. Normally subjected to heat treatment and stabilization by aging (General Electric Co.).

Alpaca. Nickel-Silver (see), containing approximately 64% copper, 20% zinc, 14% nickel, and 2% silver.

Alpakka. See **Alpaca.**

Alpax. Corrosion-resistant, aluminum-base alloy, containing 10–13.5% silicon; used as a casting alloy. Modifications of this alloy may contain approximately 1.2% of magnesium and manganese.

Alpha Antimony. See **Yellow Antimony.**

Alpha Arsenic. See **Yellow Arsenic.**

Alpha-Beta Brass. Brass containing between 39.0 and 45.5% zinc; a mixture of **Alpha** and **Beta Brasses** (see).

Alpha Brass. Face-centered cubic form of brass, found in all brasses, containing 39% zinc or less, which are solid solutions of zinc in copper.

Alpha-Forming Element. Element which, alloyed with iron, tends to suppress the **Gamma** form of **Iron** (see) by raising the A_3 temperature (see **Critical Point)** and lowering the A_4 temperature, to form the "gamma loop," outside of which the alloy exists in the alpha form. Aluminum, molybdenum, tungsten, silicon, and vanadium are typical among the alpha-forming elements.

Alpha Iron. Allotropic form of iron, stable at 1670°F and below, composed of body-centered cubic crystal structure.

Alpha Particle. Nucleus of helium atom, having a positive charge; emitted by radioactive materials.

Alpha Ray. Stream of alpha particles emitted by a radioactive element.

Alpha Tin. See **Tin Pest.**

Alplate. Aluminum-clad steel made by passing hydrogen-heated steel through molten aluminum (Reynolds Metal Co.). See **Cladding.**

Alpro. Series of aluminum-base alloys, most commonly with copper and nickel, manufactured by Alloys & Products, Inc.

Alrok Process. Process of forming a corrosion-resistant oxide film on the surface of aluminum-base metals by immersion in a hot solution of alkali carbonate and chromate.

Alsifer. Trade name for an alloy, containing approximately 40% iron, 40% silicon, and 20% aluminum. Carbon is absent. Used as a deoxidizer in steel, both the aluminum and silicon being effective reactants (Vanadium Corp. of America).

Alternate Stress. See **Fatigue.**

Alternating Current Arc Welding. **Arc Welding** (see), utilizing alternating current at the arc.

Aludur. Age-hardening aluminum alloy, containing approximately 0.7% silicon, 0.5% magnesium, and 0.5% iron.

Alumac. Series of aluminum-base alloys, with 5–13% silicon and, optionally, up to 4% copper (United States Aluminum Co.).

Alumalun. **Antislip Metal** (see) with aluminum as matrix (American Abrasive Metals Co.).

Alumel. Nickel-base alloy, containing approximately 2.5% manganese, 2% aluminum, and 1% silicon. Stable at temperatures up to 2200°F. Used as electrical resistance alloy and as a component of pyrometric thermocouples of the chromel-alumel type (Hoskins Mfg. Co.).

Alumetized Steel. Aluminum-coated steel, made by spraying the aluminum onto the steel and heating to cause surface alloying.

Alumiliting. See **Anodizing.**

Aluminium. British spelling of **Aluminum** (see). Justified by the fact that the chemical names for most metals end in "ium."

Aluminized Steel. Aluminum-clad mild steel. See **Cladding.**

Aluminothermic Process. See **Thermit.**

Aluminothermic Reduction. See **Thermit.**

Aluminum (chemical symbol Al). Element No. 13 of the periodic system; atomic weight 26.97; silvery white metal of valence 3; melting point 1220°F; boiling point approximately 4118°F; specific gravity 2.70; ductile and malleable; stable against normal atmospheric corrosion, but attacked by both acids and alkalies; cannot be electro-deposited. Although present in many minerals and an important constituent of all clays, aluminum can be prepared today economically only from bauxite, which is first converted into pure aluminum oxide, then dissolved in molten cryolite and electro-