

THE LANGUAGE OF THE PERMANENT MAGNET INDUSTRY ©

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A

Area of the Air Gap (A_g) - The cross sectional area of the air gap perpendicular to the flux path, or the average cross sectional area of that portion of the air gap within which the application interaction occurs. This area is measured in the plane perpendicular to the central flux line of the air gap.

Area of a Magnet (A_m) - The cross sectional area of the magnet perpendicular to the central flux line, usually measured in sq. cm. at any point along its length. In magnet design, A_m is usually considered the area at the neutral section of the magnet.

Air Gap Volume (V_g) - The useful volume of air or nonmagnetic material between magnetic poles; often measured in cubic centimeters.

Absolute Permeability – Absolute Permeability is a ratio of the magnetic induction caused by an applied magnetic field. Permeability of magnetic materials is rarely expressed as an absolute permeability. Typically it is reported in terms of relative permeability

Air Gap - A region in the flux path of a magnetic circuit where the flux is available for use, as in a motor. Often the air gap is just air, but may also include other materials such as paint, aluminum, epoxy etc.

Alnico Magnets - Developed in the 1930s. Alnico magnets are an iron-based alloy system and named from their main alloying elements – aluminum, nickel and cobalt. Alnico magnets have the widest range of temperature stability of any standard permanent magnet material. Alnico must be carefully stored since it is prone to demagnetization. Manufacture is by sintering or casting.

Alloy - A metallic compound containing two or more elemental metals.

Amorphous - Any material that is metallurgically non-crystalline in nature, i.e. the atoms are not arranged in a regular crystalline pattern.

Anisotropic Magnet - A magnet having a preferred direction of magnetic orientation, the magnetic characteristics are optimum in that direction.

Anisotropic Materials - Materials having different characteristics in different directions are called anisotropic materials.

Anisotropy - Means having different properties depending on the measured direction. Magnets which are anisotropic, or have an easy axis of magnetization, have their anisotropy developed by either shape or magneto crystalline differences.

Anneal - The high-temperature conditioning treatment of a material to relieve the stresses introduced when the material was originally formed. To prevent oxidation, annealing is often performed in a vacuum or inert gas atmosphere.

ARPA-E REACT - Short for "Rare Earth Alternatives in Critical Technologies", a US government program initially funded in 2011 that supported initiatives to develop new low-cost permanent magnet materials that would not rely on rare earth raw materials. Initial funding phase - \$27 million.

Axial Pressing - In axial pressing, pressure is applied parallel to the direction of alignment. Most rings are axially pressed.

Axis of Easy Magnetization - For an anisotropic magnetic body, this is the crystal direction in which magnetization is easiest to achieve.

Axis of Hard Magnetization - For an anisotropic magnetic body, this is the crystal direction in which magnetization is difficult.

B

B_d/H_d - Slope of the operating line determined by the magnetic circuit, or the ratio of the remnant induction, B_d , to a demagnetizing force, H_d . It is also referred to as the permeance coefficient, shear line, load line and unit permeance.

Bastnasite - A yellowish to reddish-brown fluorocarbonate mineral that is a common source of rare earth elements.

Bending Strength - A characteristic value showing the resistance to bending and is also called bend strength. Bending strength shows the maximum strength at which a test piece is broken by the bend load. This value is often used to characterize the mechanical strength of a magnet.

Bonded Magnets - Magnetic powder is blended in a rubberized or plastic compound material. The magnetic compound is then either compression or injection molded, extruded or calendared. A bonded magnet is always less powerful than a traditional sintered magnet of any formulation. (See Flexible Magnets, Injection Molded or Compression Bonded Magnets)

C

Calendaring – A calendar is a series of hard pressure rollers used to form or smooth a sheet of material. Although calendaring is most commonly used to manufacture paper products, it is also utilized in the manufacture of flexible bonded ferrite magnets.

Capture - The act of magnetically extracting ferrous tramp from a product stream.

CGS System – A system of units based on the Centimeter-Gram-Second and the one commonly used for presenting magnetic data.

Center Flow Magnets – Center-Flow Magnets are in-line magnet separators designed to remove ferrous fines as well as larger pieces of tramp iron from dry particulates as they travel through pneumatic or gravity-flow conveying lines. To achieve optimum contact with the product flow, a bullet-shaped magnet is suspended in the centerline of the housing. The tapered, exposed-pole cartridge has a stainless steel “nose cone” to direct the flow of materials around the magnet. This design allows ferrous fines to collect out of the direct air stream, and tramp metal will collect there.

Ceramic Magnets (see Ferrite Magnets)

Closed Magnetic Circuit - Exists when the flux path external to a permanent magnet is confined within high permeability materials that compose the magnet circuit. No magnetic flux is available outside the flux path.

CMMDA – The China Magnetic Materials Device Association. CMMDA is associated with the Southwest institute of Applied Magnetism of China. Membership represents a relatively small percentage of the total Chinese magnet industry.

Coating – A thin layer of material applied to the outside of a magnet to prevent corrosion. Neodymium magnets are the most prone to corrosion and the most likely to require a coating. Various coatings applied to permanent magnets, including Zn, Ni, Epoxy, CR3+Zn or Ni+Ag.

Cobalt – A metallic element that is usually obtained as a by-product of nickel mining. Cobalt pricing can occasionally be volatile. It is a key ingredient in Samarium Cobalt and Alnico magnets. It is also a critical additive to NdFeB magnets, to improve the high-temperature performance of the magnet.

Coercive Force (H_c) - The demagnetizing force necessary to reduce the induction, B, to zero, in a previously saturated magnet.

Collection Area - Locations on the magnetic face where tramp metal collects due to high concentrations of magnetic flux. These locations may be above internal magnetic poles or at external pole extensions.

Columnar Alnico – The magnetic properties of certain Alnico grades can be improved applying a magnetic field to the magnet during heat treatment to create long columnar grains parallel to the applied magnetic field.

Compression Bonded Magnets – These magnets are made by mixing magnet powder with a polymer such as epoxy or plastic to form a matrix of magnetic and bonding materials. The magnets are then compression molded to final shape and final solidification occurs by curing instead of sintering.

Core Loss – The power expended in a magnetic material subjected to a varying magnetic force.

Cow Magnets – Alnico or ceramic magnets that are fed to cows to collect the various ferrous contaminants and tramp iron from their stomach which they consume during grazing. These magnets remain in the cow for life.

Corrosion Resistance – The ability to resist oxidation. Corrosion resistance can sometimes be an issue with NdFeB magnets, particularly in high-humidity applications. Optimization of the magnet’s chemistry and carefully controlled processing and coating of the finished part can significantly reduce a magnet’s tendency to corrode in most applications.

Cunife – An alloy primarily composed of copper, nickel and iron. The alloy has a linear coefficient of expansion similar to certain compositions of glass, and thus makes an ideal material for the lead wires in light bulbs. Cunife is ferromagnetic and can occasionally be utilized as a weak permanent magnet.

Curie Temperature (T_c) - This is the temperature where thermal vibrations initially overtake the parallel alignment of magnetic moments, and the material has no magnetization.

Cyclically Magnetized – A magnetic material is considered in a cyclically magnetized state when, under the influence of a magnetizing force which varies cyclically, its successive hysteresis loops are identical.

D

Demagnetization - A process through which induction is reduced to or approaches zero. This can be done by applying an adverse field or by heating a magnet above its Curie temperature.

Demagnetization Curve - The second quadrant of the hysteresis loop, generally describing the behavior of the magnet in actual use. Also known as the B-H Curve.

Demagnetization Force - A magnetizing force, typically applied in the direction opposite to the force used to magnetize a magnet in the first place. Temperature and radiation can also be demagnetizing forces.

Demagnetized – A magnetic material with no magnetization. A magnet can be either thermally or field demagnetized. Thermal demagnetization can be achieved by heating the magnets above the Curie temperature. Field demagnetization can be achieved by exposure to a continually decreasing AC field.

Diamagnetism - A magnetic characteristic in which the individual magnetic moments in a material are oriented randomly in the absence of an external magnetic field, such that the body as a whole is not magnetized. When an external magnetic field is applied, the body becomes weakly magnetized in the opposite direction to the applied field, with intensity proportional to the magnetic field. Diamagnetism is normally seen in inert gases, metals such as copper, gold, silver, and zinc, and many organic compounds

Dimension Ratio (l_m/D) - Is the ratio of the length of a magnet to its diameter, or alternately, the diameter of a circle of equivalent cross-sectional area. For simple geometries, such as bars and rods, the dimension ratio is related to the slope of the operating line of the magnet, B_d/H_a .

Dimensional Tolerance - An allowance, given as a permissible range, for the nominal dimensions of a finished magnet. The purpose of a tolerance is to specify the allowed leeway for dimensional variations in manufacturing.

Dimensions - The physical size of a magnet, occasionally including any plating or coating.

Dipole Ring Magnets - A magnetic circuit that generates a uniform magnetic field in a specific direction. This is an extraordinarily efficient magnetic circuit, considering the magnetic field generated for the weight of magnets. Dipole ring magnets are cylindrically shaped, with magnets placed along the circumference of the cylinder cross sections. The segment magnets are pasted into place in such a way that the magnetic orientation direction is continuous.

Direction of Magnetization – This refers to the "easy axis" or the axis of choice for the direction of alignment, which exists for anisotropic magnets. For example, most rings are aligned axially so the direction of magnetization is through the axis (or thickness). Other possibilities for rings include "across the diameter" or "radial" magnetization.

Domains - Regions in a magnetic alloy which have the same orientation. Domains may be rotated and manipulated by an external magnetizing field to create a useful magnet with a net magnetic moment. In the case of unmagnetized material, the domains cancel each other out. Thus, in this condition there is no net external field.

Drum Magnets - Magnetic Drums and Drum Separators are self-cleaning devices which provide continuous removal of ferrous contaminants from a wide range of free-flowing bulk and granular materials in high-volume applications.

Dysprosium – A widely used rare earth element, which is often added to NdFeB magnets to increase resistance to demagnetization at elevated temperatures.

Dyne – The force producing an acceleration of one centimeter per second per second when applied to a one gram mass.

Dysprosium – A widely used rare earth element, which is often added to NdFeB magnets to increase resistance to demagnetization at elevated temperatures.

E

Eddy Currents – These are circulating electrical currents that are induced in electrically conductive elements when exposed to a varying magnetic field. The currents flow in a direction which creates an opposing force to the change. Eddy currents can be harnessed to perform useful work (such as damping of movement), or may be unwanted consequences in certain designs such as transformers, which should be accounted for or minimized.

Eddy Current Loss – That portion of core loss due to circulating currents in a magnetic material as a result of electromotive forces induced by varying induction.

Eddy Current Separator – An eddy current separator uses a powerful magnetic field to separate metals from non-metals (usually in garbage). When a magnetic field is applied to a conveyor belt carrying a thin layer of mixed waste, electrically conductive materials, such as metals are thrown off the belt, and nonmetals simply fall off the end of the belt.

EDM –Electric discharge machining (EDM) is a process called spark machining, spark eroding, burning, die sinking or wire erosion. A common process for cutting permanent magnet materials. Material is removed from the magnet by rapidly recurring current discharges between two electrodes, separated by a dielectric liquid and subject to an electric voltage.

Electric Bicycles – A bicycle with a motor and battery to propel it. This is a major application of NdFeB magnets, especially in China.

Electromagnet - A magnet, consisting of a solenoid which creates a magnetic field only while current flows through the coil.

EMERF – The Electric Motor Education and Research Foundation. A group devoted to the promotion of educational and research activities associated with small electric motors and their components, affiliated with the SMMA.

Energy Product – Is related to the energy that a permanent magnet can supply to a magnetic circuit, when operating in a device. It is calculated by $B_p \times H_d$.

Erg – The work done by the force of one dyne whose point of application is moved one centimeter in the direction of the force.

Exchange Spring Magnets - A composite magnet comprised of fine sub-micron hard and soft magnetic phases. In spite of the two components, this magnet behaves like a homogenous and uniform magnet, with a magnetic exchange coupling between the two phases. Because its magnetization behavior is as though the hard and soft magnetic phases are linked with a magnetic spring, this type of magnet is called an exchange spring magnet. In hysteresis loops, these magnets show the best qualities of the two materials used to make them, with improved magnetization and resistance to demagnetization.

Extrusion – The process pushing a material through a mold to form it. Extrusion is used to produce flexible ferrite magnets for applications such as refrigerator door seals and similar holding applications.

F

Ferrimagnetic Materials – These are materials in which the magnetic moments of the atoms on different sub lattices are opposed. It is similar to antiferromagnetism, except the magnetic moments of the two sub lattices do not cancel out completely and a spontaneous magnetization is observed.

Ferrimagnetism - Is exhibited by ferrites and magnetic garnets. The oldest-known magnetic substance, magnetite (Lodestone), is a ferrimagnet. It was originally classified as a ferromagnet before Neel's discovery of ferrimagnetism and antiferromagnetism.

Ferrite Magnets - A hard or soft magnet made from combining magnetic oxides whose primary component is Fe_2O_3 . In addition, hard ferrite magnets use barium or strontium oxides. These magnets are relatively inexpensive, have high corrosion resistance and exhibit high electrical resistivity. However, their magnetic characteristics are normally lower than those of rare earth magnets and their maximum energy product is about 1/10 of that for a rare earth magnet.

Ferromagnetic Material - A material which is easily magnetized with a small magnetic field, i.e. its permeability is very much larger than 1 (from 60 to several thousand times), and which exhibits hysteresis phenomena. A material that either is a source of magnetic flux or a conductor of magnetic flux.

Flexible Magnets – A magnet material that is easily bent. It is normally produced with a mixture of magnetic powder (usually hard ferrite) and organic binding materials. The resulting compound is then either extruded or

calendared. The resulting flexible magnetic sheet is then commonly printed and presented to the market as the traditional “Refrigerator Magnet”.

Flux Meter - An instrument that measures the change of flux linkage with a search coil. This signal can be converted to B, induction.

Fringing Fields – A leakage flux particularly associated with edge effects in a magnetic circuit.

Fully Dense Magnet – A magnet produced through a metallurgical casting or sintering method. Fully dense magnets exhibit the highest magnetic performance for their material type (as opposed to Bonded Magnets).

G

Gauss Meter - An instrument that measures the instantaneous value of magnetic field, H. Its principle of operation is usually based on one of the following: the Hall effect, nuclear magnetic resonance (NMR), or the rotating coil principle.

GHz - 1,000,000,000 Hz (giga Hertz).

Gradient - Indicates a change in magnetic strength between two points measured at different distances perpendicular to the magnetic field of a magnet.

Grate Magnets – Magnet assemblies which normally incorporate hard ferrite or rare earth tube magnets into an array, to remove ferrous contamination from free flowing liquids or solids as they pass through the grate.

H

Hall Effect Transducer - A semiconductor device that produces a voltage dependent on an applied DC voltage and an incident magnetic field. The magnitude of the output is proportional to the field strength and the angle of incidence with the Hall device. This type of sensor is often used to provide an output signal for use in a Gauss meter to measure the incident magnetic force, H.

Hard Magnetic Material - A magnetic material with a large coercive force, meaning that it is not easily demagnetized by external magnetic fields. This generally describes a magnet or permanent magnet but also includes magnetic recording materials. Ferrite magnets, NdFeB magnets, SmCo magnets, platinum iron, and FeCoCr alloys are common hard magnetic materials.

Holding Magnets – Constructed of a magnet embedded in a steel channel, or a magnet sandwiched between two steel plates. These magnet assemblies provide strong pull for their sizes. Most holding magnets come with mounting holes for easy installation and use.

Hysteresis and Hysteresis Loss - Hysteresis is the tendency of a magnetic material to retain its magnetization. This tendency is strong in permanent magnets and weak in soft magnetic materials. Hysteresis causes the graph of magnetic flux density versus magnetizing force to form a closed loop rather than a line. The area enclosed by the loop represents the difference between energy stored and energy released per unit volume of material per cycle.

Hysteresis Loop - A plot of magnetizing force versus resultant magnetization or induction (also called a B-H curve) of a material as it is successively magnetized to saturation, demagnetized, magnetized in the opposite direction and finally remagnetized. This plot is a closed loop which completely describes the characteristics of the magnetic material at a given temperature. The size and shape of this loop is important for both hard and soft materials. With hard materials the "fatter" the loop, the magnet has more resistance to demagnetization. The first quadrant of the loop (that is +X and +Y) is called the magnetization curve. It is of interest because it shows how much magnetizing force must be applied to saturate a magnet. The second quadrant (+X and -Y) is called the Demagnetization Curve.

Hysteresisgraph - An instrument that draws hysteresis loops. Also called a permeameter.

Hz - Frequency in units of Hertz (cycles per second).

I

IEEE Magnetics Society – One of 38 divisions within the IEEE. This organization works to characterize basic permanent magnet materials and work on standardization of definitions, symbols, and operating characteristics of permanent magnet materials.

Induction - The magnetic flux per unit area of a section normal to the direction of flux.

Induction Curve - A graph depicting the relationship between induction, B, and the applied field (magnetizing force), H.

Injection Molded Magnets – A mixture of either ferrite or NdFeB powder is thoroughly mixed with a plastic material and a finished magnet is molded to final shape in an injection molding machine. Although injection molded magnets sacrifice significant magnetic strength (compared to a fully dense magnet), the injection molding process offers the ability to produce magnets with complex shapes and magnetization patterns not achievable by other processes. See Bonded Magnets.

Intrinsic Coercive Force, H_{ci} - Is a measure of the material's inherent ability to resist demagnetization. It is the demagnetization force corresponding to zero magnetization in the magnetic material after saturation. Practical consequences of high H_{ci} values are seen in greater temperature stability for a given class of material, and greater stability in dynamic operating conditions.

Intrinsic Demagnetization Curve - The hysteresis loop of M versus H, where M is the magnetization resulting from only the magnetic material.

Iron Nitride Magnets – A theoretically strong permanent magnet that does not require any rare earth materials. The theoretical magnetic energy product for iron nitride magnets is reported to be 130 MGOe, which is more than twice

the maximum reported magnet energy product for rare-earth magnets. This material is still in research and is not yet commercially proven.

Iron Oxide – Iron oxide is used in the production of both bonded and sintered ferrite magnets. A level of high purity is necessary to achieve optimum magnetic properties. Most iron oxide used in magnet production is produced with the Ruthner process, which reclaims iron oxide from steel industry pickle liquor.

Irreversible Flux Loss - A partial demagnetization of the magnet, caused by exposure to elevated temperatures, external demagnetizing fields, radiation or other factors. These losses can be recovered by re-magnetization. Magnets can be stabilized to remove irreversible losses, either by partial demagnetization induced by temperature cycles or by external magnetic fields. This loss can be recovered by remagnetization.

Isotropic Magnet - A material whose magnetic properties are the same in any direction. Isotropic materials can be magnetized in any direction without loss of magnetic characteristics or performance.

Isostatic Pressing – A pressing method where the pressure is applied equally in all directions, it usually provides a higher degree of alignment and higher magnetic properties, compared to axial pressing.

Isotropic (Non-oriented) – A material that has no preferred direction of magnetic orientation, allowing for magnetization in any direction.

J

JABM – The Japan Association of Bonded Magnetic Materials. A consortium of Japanese bonded magnet producers and related companies.

Joule - SI unit for energy.

K

kHz - 1,000 Hz (Kilo Hertz).

Keeper - A keeper is a high permeability material, typically mild steel, which is installed on an alnico magnet or magnetic assembly to reduce the risk of demagnetization. This reduces the overall leakage fields generated by the magnet or magnetic assembly.

Kilogauss - One Kilogauss = 1,000 Gauss = Maxwells per square centimeter.

Knee of the Demagnetization Curve - The point at which the B-H curve ceases to be linear. All magnet materials, even if their second quadrant curves are straight line at room temperature, develop a knee at some temperature. If the operating point of a magnet falls below the knee, small changes in H produce large changes in B, and the magnet will not be able to recover its original flux output without remagnetization.

L

Lanthanides – Also known as rare earth elements. The lanthanide series is the row of elements in which the 4f sublevel is being filled.

Lanthanum Ferrites – An improved-performance ferrite magnet introduced to the market by Hitachi Metals in 1998. A premium-priced magnet that has achieved commercial success.

Lattam Magnets – Lattam magnets consist of ferrite or Neodymium magnets bonded onto a steel plate. The magnetic side has several poles (North and South) while the opposite side has no magnetic attraction. Lattam magnets are used for any type of attachment or positioning devices such as catches.

Leakage Factor – Characterizes the flux leakage from the magnetic circuit. It is the ratio between the magnetic flux at the magnet neutral section and the average flux present in the air gap.

Leakage Flux - That portion of the magnetic flux that is lost through leakage in the magnetic circuit due to saturation or air-gaps, and is therefore unable to be used. Measured in Maxwells.

Length of Air Gap (L_g) - The length of the path of the central flux line in the air-gap.

Licensed Producer – Normally refers to those manufacturers of sintered NdFeB magnets who have been licensed by Hitachi Metals Ltd. (Neomax Co. Ltd.) to produce sintered NdFeB magnets. Magnets produced by Neomax licensees are commonly referred to as “Licensed Product”.

Lifting Magnet - A circular, rectangular, or specially-shaped magnet used for handling pig iron, scrap iron, castings, billets, rails, and other magnetic materials.

Load Line - A line drawn from the origin of the Demagnetization Curve with a slope of $-B/H$, the intersection of which with the B-H curve represents the operating point of the magnet. See Permeance Coefficient.

Lodestone – A naturally occurring mineral (magnetite) that was discovered as early as 1000 BC to be naturally magnetized. Individual pieces of lodestone were used as crude compass devices to assist in early navigation.

Loudspeaker Magnet – The loudspeaker magnet (normally ferrite or NdFeB) provides a uniform magnetic field to create a force on a wire wrapped around the speaker cone.

M

Maglev - (derived from “ Magnetic Levitation”), is a system of transportation that suspends, guides and propels vehicles, predominantly trains, using magnetic levitation from a very large number of magnets for lift and propulsion. The magnetic field can be supplied by either electromagnets or permanent magnets.

Magnet - A magnet is an object made of certain materials which create a magnetic field. Every magnet has at least one north pole and one south pole. By convention, we say that the magnetic field lines leave the North end of a magnet and enter the South end of a magnet.

Magnetic Assembly - A combination of materials, magnetic and non-magnetic, which accomplish a particular solution. Usually incorporates a permanent magnet as the flux generator and normally relies on mild steel to conduct the flux to the workface.

Magnetic Braking Systems – Utilize ferrite or NdFeB magnets. These are advanced braking systems for roller coasters and other equipment requiring automatic and smooth braking of sensitive equipment.

Magnetic Cartridges – Tubes of a durable stainless steel are filled with hard ferrite or NdFeB permanent magnets and then assembled in a grate construction. Used in a wide variety of magnetic separation equipment.

Magnetic Catches – A wide variety of magnetic catch assemblies are utilized in the furniture industry to assure secure closure of doors.

Magnetic Chuck - Magnetic chucks are primarily designed for holding ferro-metallic work pieces. They consist of an accurately centered permanent magnet face. Fixed ferrous plates, or pole pieces, contained within a housing are brought into contact with electromagnets or permanent magnets.

Magnetic Circuit - An assembly consisting of some or all of the following: permanent magnets, ferromagnetic conduction elements, air gaps, and electrical currents.

Magnetic Dipole - Magnetic charge dipole. Unlike electricity, it is not possible to take out an independent magnetic pole (magnetic monopole), so the minimum unit for magnetism is not the magnetic pole, but rather the magnetic dipole.

Magnetic Domain - This is a small area in which the magnetic moment of a collection of magnetic dipoles is aligned. The aligned magnetic domains create a structure in which the mutual magnetic moments cancel each other out or magnetic moments link with each other. As a result, the spontaneous magnetization of the overall magnetic body is reduced, giving the magnetic potential a more stable state.

Magnetic Drive Rollers – Magnetic rollers are used to facilitate the handling of sheet stock ranging from .010” to over ¼” thick. Mild steel poles and a recessed center provide a highly scratch and nick resistant drive surface for moving, driving and controlling ferrous sheet stock.

Magnetic Face - The surface of a magnetic separator through which magnetism emanates and on which ferrous tramp is held at collection areas.

Magnetic Field - A magnetic field is the region in space where a magnetic force can be detected. The magnetic field strength and direction can be measured both in terms of strength and direction.

Magnetic Field Strength (H) - Magnetizing or demagnetizing force, is the measure of the vector magnetic quantity that determines the ability of an electric current, or a magnetic body, to induce a magnetic field at a given point. Measured in Oersted.

Magnetic Flux - The total magnetic induction over a given area. When the magnetic induction, B, is uniformly distributed over an area A, Magnetic Flux = BA.

Magnetic Flux Density - Lines of flux per unit area, usually measured in Gauss (CGS). One line of flux per square centimeter is one Maxwell.

Magnetic Induction (B) - The magnetic field induced by a field strength, H, at a given point. It is the vector sum, at each point within the substance, of the magnetic field strength and the resultant intrinsic induction. Magnetic induction is the flux per unit area normal to the direction of the magnetic path.

Magnetic Induction in the Air Gap (B_g) - The average value of magnetic induction over the area of the air gap, A; or it is the magnetic induction measured at a specific point within the air gap. Measured in Gauss.

Magnetician - An individual who has demonstrated expertise in the development, design or application of permanent magnets or magnetic assemblies.

Magnetic Length - The physical length of the magnet dimension which corresponds to the direction the magnet is magnetized. This may or may not be the magnet's orientation direction.

Magnetic Lines of Force - A series of invisible lines passing from one pole to another of a magnet, which, combined, form the magnetic field.

Magnetic Liquid Traps - Liquid Trap Magnets are designed to remove ferrous tramp from liquid processing and conveying lines. They are usually designed with high-energy NdFeB magnets to capture even weakly magnetic debris of the smallest particle size.

Magnetic Pole - An area where the lines of flux are concentrated.

Magnetic Printing Cylinder - A metallic cylinder with embedded magnets used in printing and die cutting applications. The magnetic cylinder holds a flexible steel die used for a variety of printing and die cutting applications.

Magnetic Pulleys - Used at the end of conveyors to turn ferrous parts over or on the top corner of an elevator conveyor to change product flow direction. Magnetic Pulleys are usually used in conjunction with plate rail assemblies to insure smooth continuous flow of parts or materials. They can be designed and built in a single lane configuration for a single lane, dual lane configurations or in a wide magnetic field for mass flow.

Magnetic Rollers - Magnetic rollers are engineering device to remove the metallic contamination from the materials on the belt. They are normally positioned at the head of a belt conveyor.

Magnetic Separator - Equipment designed to magnetically remove ferrous tramp from product streams. The magnetic energy source may be either permanent or electro magnets and the configurations and magnetic circuitry may vary widely.

Magnetic Sheet Fanners – Sheet fanners are magnetic separators that induce a magnetic field to a ferrous steel sheet stack. The induced magnetic field creates like magnetic polarity between the top and second sheet. Like magnetic polarity repels one another resulting in the top sheet pushing away from the lower sheet and providing for safer and more productive handling of steel sheet products.

Magnetic Sweepers – Magnet assemblies that are utilized to remove metal contaminants from factory floors. Some sweepers function like a traditional broom that picks up metal debris, while others can easily be attached to lift truck forks to accomplish the same function.

Magnetizing Force, H - The magnetomotive force per unit length at any point in a magnetic circuit. Measured in Oersteds in the CGS system.

Magnetic Force - The force exerted between magnetic poles, producing magnetization.

Magnetic Orientation - Determines the magnetic polarity and position of one magnet pole relative to the other.

Magnetic Refrigeration – A relatively new technology based on the “Magnetocaloric Effect”. Rare earth magnets are being considered for this novel application.

Magnetic Saturation - The maximum amount of magnetic energy that can be absorbed by a magnetic material.

Magnetic Therapy – The application of permanent magnets on the surface of the human body. The theory is that the moderate magnetic field promotes blood flow and offers healing powers. Unproven science.

Magnetization Curve - The first quadrant portion of the hysteresis loop (B/H) Curve for a magnetic material.

Magnetization Patterns – Magnets with a conventional magnetization pattern have a single, equal strength pole on each opposite face. Magnets with multipole magnetization pattern on both sides have multiple poles along both faces. In this case, magnetic force is of equal strength on both sides. Magnets with a two-pole or multi-pole magnetization pattern have two or more poles on one face of the magnet.

Magnetizing Force, H - The magnetomotive force per unit length at any point in a magnetic circuit. Measured in Oersteds in the CGS system.

Magnetohydrodynamics (MHD) - Also known as *hydromagnetics* or *magnetofluidynamics*, this is the academic discipline which studies the dynamics of electrically-conducting fluids and their interactions with magnetic fields.

Magnetomotive Force (MMF) - Most commonly produced by a current flowing through a coil of wire where its magnitude is proportional to the current and the number of turns. Analogous to voltage in electrical circuits, MMF is the magnetic potential difference between any two points.

Magnetostriction - The property of a ferromagnetic material the results in a shape or dimensional change when subjected to a magnetic field. The expansion and contraction of a magnet with changing magnetic flux density. It is the change of length divided by original length (a dimensionless number) and is measured at the saturation flux density.

Magnet Wire - Copper or aluminum wire with electrical insulating material applied to the surface to prevent continuity between adjacent turns in a motor or generator winding. Magnet wire is also used to fabricate coils in electromagnets.

Major Hysteresis Loop - The major hysteresis loop of a material is the closed loop obtained when the material is cycled between positive and negative saturation.

Material Grade – Magnets are graded by the magnetic material from which they are manufactured. Generally speaking, the higher the grade of material, the stronger the magnet. Neodymium magnets, for example, typically range in grade from N27 to N52.

Maximum Energy Product, BHMax - The point on the Demagnetization Curve where the product of B and H is a maximum and the required volume of magnet material required to project a given energy into its surroundings is a minimum. Measured in Mega Gauss Oersteds (MGOe).

Maximum Operating Temperature - The maximum temperature of exposure that a magnet can experience without significant long-range instability or structural changes. Also referred to as Maximum Service Temperature.

Maxwell's Equations - The set of four equations, attributed to James Maxwell, that describes the behavior of both the electric and magnetic fields, as well as their interactions with matter. They express, respectively, how electric charges produce electric fields (Gauss's law), the experimental absence of magnetic charges and how currents produce magnetic fields (Ampère's law), and how changing magnetic fields produce electric fields (Faraday's law of induction).

Maxwell - Unit of magnetic flux in the CGS system. One Maxwell is one line of magnetic flux.

Megagauss-oersteds (MGOe) - The stored energy in a magnet, usually considered a measure of magnet performance.

Micro-motors – Miniature motors used in a wide range of consumer products (cameras, toys, etc.) The magnet of choice for these applications is a compression bonded NdFeB magnet.

Mil - 0.001 inch or one thousandths of an inch.

Minor Loop - The working point of a magnet moves according to the usage conditions, but this movement generally is not along the demagnetization curve, but rather is a small loop within the hysteresis curves with the working point at the starting point. This curve is called a minor loop of the hysteresis curves and is a curve unique to any material.

Mischmetal – An alloy of unseparated rare earth metals, often used as flint in lighters.

MMPA – The Magnetic Materials Producers Association. (See PMD)

Motor Arc – A curved permanent magnet, usually utilizing hard ferrite or NdFeB magnet material. Commonly used for the production of permanent magnet motors and generators. The curved magnet segment is normally held in place by clips or glue construct rotor or stator assemblies.

Mu-Metal - A nickel-iron alloy typically containing more than 65% nickel used for shielding magnetic flux. The name of the material refers to the Greek letter, μ (mu), which is the symbol for magnetic permeability. Mu-metal has a high value of magnetic permeability.

N

Nano Coatings – A coating on the nano-scale.

Nanocomposite Magnets - Magnets that have fine hard magnetic phases and soft magnetic phases, in which exchange bonding operation works between the phases and which behaves like one single-phase magnet. These magnets are called Nano composite magnets because the size of the structure is on the nanometer (10^{-9} m) order. (See Exchange Spring Magnets).

Neodymium - A rare earth element that is a critical component of strong permanent magnets. Cell phones, portable CD players, computers and most modern sound systems would not exist in their current form without using neodymium magnets. Neodymium-Iron-Boron (NdFeB) permanent magnets are essential for miniaturizing a variety of technologies. These magnets maximize the power/cost ratio, and are often used in a wide variety of motors and mechanical systems.

Net Effective Magnetizing Force (H_s) – The magnetizing force required to magnetize a material to saturation.

Net Permeability - The permeability of a magnetic circuit when all materials, air gaps, and applied MMFs are taken into account. The same as effective permeability.

NdFeB (Neodymium-Iron-Boron) - The most powerful 'rare-earth' permanent magnet composition. First became commercially available in 1984. NdFeB magnets have the highest B, Br, and BHmax of any commercially available permanent magnet material.

Normal Demagnetization Curve – See Induction Curve.

North Pole - That pole of a magnet which, when freely suspended, would point to the north magnetic pole of the earth. The definition of polarity can be a confusing issue, and it is often best to clarify by using "north seeking pole" instead of "north pole" in specifications. This north-seeking pole is identified by the letter "N".

Neutral Section - Defined by a plane passing through a magnet perpendicular to its central flux line at the point of maximum flux.

O

Oersted, Oe - A CGS unit of measure used to describe magnetizing force. The English system equivalent is Ampere Turns per Inch, and the SI system's is Ampere Turns per Meter.

Ohm (O) - Unit of electrical resistance.

Open Circuit Condition - Exists when a magnetized magnet is isolated from ferro-magnetic components that are commonly found in the magnetic circuit.

Operating Line - For a given permanent magnet circuit, the straight line passing through the origin of the demagnetization curve with a slope of negative B_d/H_d . (Also known as permeance coefficient line)

Operating Point - That point on a demagnetization curve defined by the coordinates (B_d/H_d) or that point within the demagnetization curve defined by the coordinates (B_m/H_m) .

Orientation - Used to describe the direction of magnetization of a material.

Orientation Direction - The direction in which an anisotropic magnet should be magnetized in order to achieve optimum magnetic properties. Also known as the "axis", "easy axis", or "angle of inclination".

P

Paramagnet – A magnet made of a substance whose magnetization is proportional to the strength of the magnetic field applied to it.

Paramagnetic Materials - Materials that are not attracted to magnetic fields (wood, plastic, aluminum, etc.). A material having a permeability slightly greater than 1.

Paramagnetism - A magnetic characteristic in which the magnetic moment in the material does not generate magnetization of the whole in various random directions in the absence of an external magnetic field, but when an external magnetic field is applied, the magnetic moments align in their own way according to the intensity of the magnetic field and generate magnetization. Paramagnets do not retain any magnetization in the absence of an externally applied magnetic field.

Permalloy - A high permeability alloy of 4% molybdenum, 79% nickel, 17% iron used to make tape wound and laminated cores and other components in a magnetic circuit. (See Mu-Metal).

Permanent Magnets - Permanent magnets are those magnets which are not dependent on external source for their magnetic field. They are found naturally and are also manufactured artificially. Any type of ferro-magnetic material, which once having been magnetized, shows definite resistance to external demagnetizing forces, i.e., requires a high demagnetizing force to remove the residual magnetism.

Permeability of Free Space - The permeability of a volume occupied by a vacuum; sometimes called the magnetic constant.

Permeability, Initial - The limit of incremental permeability as a changing unbiased magnetizing force approaches zero.

Permeability, Normal - The ratio of the normal induction to the corresponding magnetizing force.

Permeability, Recoil - The ratio of change in flux density as a function of incremental change in applied field (H) in the vicinity of $H = 0$. It has no dimensions in either the MKS or CGS system.

Permeability (μ) - The ratio of the magnetic induction of a material to the magnetizing force producing it (B/H). The magnetic permeability of a vacuum (μ_0) is $4\pi \times 10^{-7}$ N/Amp².

Permeameter - An instrument that can measure, and often record, the magnetic characteristics of a specimen.

Permeance (P) - A measure of relative ease with which flux passes through a given material or space. It is calculated by dividing magnetic flux by magnetomotive force. Permeance is the reciprocal of reluctance.

Permeance Coefficient (P_c) - Ratio of the magnetic induction, Bd, to its self-demagnetizing force, Hd. $P_c = Bd / Hd$. This is also known as the "load line", "slope of the operating line", or operating point of the magnet, and is useful in estimating the flux output of the magnet in various conditions. P_c is a function of the geometry of the magnetic circuit. In practical terms, it's a number that defines how hard it is for the field lines to go from the North Pole to the South Pole of a magnet. A tall cylindrical magnet will have a high P_c, while a short, thin disc will have a low P_c.

Pickup Magnets – An electric guitar pickup consists of a permanent magnet wrapped in a coil of wire. Alnico magnets have been used for guitar pickups since the late 1940s. Alnico has remained the popular choice among guitar makers due its long shelf life, but they're also preferred because they produce a warm musical tone.

Plate Rails – Magnetic rails designed with either ceramic and NdFeB magnets are used under stainless steel slider beds (under a conveyor belt) to attract and control ferrous parts and assemblies on belted conveyors. Plate rails are very popular to secure and hold parts in inclined applications.

Plating/Coating - Most neodymium magnets are plated or coated in order to protect the magnet material from corrosion. Neodymium magnets are mostly composed of neodymium, iron, and boron and the iron in the magnet will rust if it is not sealed from the environment by some sort of plating or coating. Many neodymium magnets are plated with nickel-copper-nickel, but some are plated in gold, silver, or black nickel. Others are coated with epoxy, plastic or rubber.

Platinum Cobalt – A material with magnetic properties superior to Alnico magnets, invented in the 1930's. This material has enjoyed limited commercial success, primarily due to cost.

PMD – The Permanent Magnet Division of SMMA. Established in 2007 to increase the understanding, promotion and effective utilization of permanent magnetic materials for all users of permanent magnet products. Originally established in 1959 as the Magnetic Materials Producers Association (MMPA).

Polarity - The characteristic of a particular pole at a particular location of a permanent magnet. Differentiates the North Pole from the South Pole.

Polarity Indicator - A device used to identify the polarity (North or South) of a magnet and may also be used to indicate the center of a magnetic pole or the direction of magnetic flux at a specific location. The indicator may be a simple attraction/repulsion device, a compass type device or an electronic device.

Pole - An area where the lines of magnetic flux are concentrated.

Pole Pieces - Ferromagnetic materials placed on magnetic poles used to shape and alter the effect of lines of flux.

Polymer Bonded Magnets - Magnet powder is mixed with a polymer such as epoxy to form a carrier matrix. The magnets are then molded by compression, extrusion, or injection into a certain shape. Final solidification occurs by curing instead of sintering.

Praseodymium – This rare earth element usually comprises less than 4 percent of the lanthanide content of bastnasite, but is often used as a common coloring pigment. Along with neodymium, praseodymium is used to filter certain wavelengths of light. When used in an alloy, praseodymium is a component of permanent magnet systems designed for a variety of small motors.

Pull Gap - Usually illustrated in graph format, these curves are a representation of the relationship between the attractive force exerted by a magnet on a soft magnetic work piece and the distance between them. Pull Gap curve diagrams are useful when selecting a magnet for a particular tractive or holding application.

Pull Test - A test of holding value or breakaway force and reach out, usually conducted with a flat ferrous plate or ferrous sphere and a spring scale.

Pull Force - The force required to pull a magnet free from a flat steel plate using force perpendicular to the surface. The limit of the holding power of a magnet.

Q

Quenching - A rapid cooling process which follows sintering or solid solutioning.

R

Radial Magnets - Cylinder anisotropic magnets whose easy magnetization axis direction is the radial direction. For radial anisotropy, the number of magnetic poles and the magnetization pattern of the magnet can be adjusted with the way the magnetization is performed. Also, assembly of radial magnets in a motor rotor is generally easy, reducing motor manufacturing costs. However, from the perspective of magnet manufacture, the process of manufacturing radial magnets is complex and the production efficiency and yields tend to be poor, which raises costs.

Rapidly Solidified Magnets – NdFeB magnet materials which, when in the molten state, the liquid alloy is dropped on a rapidly spinning Cu wheel and the alloy solidifies very rapidly in the form of fine (thin) ribbons. These ribbons are broken up into small pieces and held together with a molten plastic binder which then is cooled to room temperature - these are called "Bonded Magnets."

Rare Earths - A family of elements in the periodic table having an atomic number from 57 to 71, and including 21 and 39. They are also known as the lanthanide series, which includes lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, scandium, and yttrium.

RARE – A Washington-based lobbying association with the mission to increase the production of rare earth elements and to remove barriers to access of rare earth elements domestically and internationally. They strive to increase the affordability and trade of rare earth minerals and increase the affordability and availability of technologically and environmentally advanced products made with rare earth minerals.

Rare Earth Magnets - Magnets made up of rare earth elements like cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium etc. Commonly used to describe high energy magnet materials such as NdFeB (Neodymium-Iron-Boron) and SmCo (Samarium-Cobalt).

Rare Earth Oxides - Often referred to as REO. After removal of rare-earth containing ore from the ground, the ore is milled and subjected to a floatation process followed by a chemical separation process that yields individual oxides of rare earth elements. These are then referred to as "REO". Neodymium oxide and Dysprosium oxide are common raw materials utilized for the manufacture of NdFeB permanent magnets.

Reach Out - The distance in which a magnetic field will extend from the magnet source.

Recoil Permeability - Is the magnetic induction that remains in a magnetic material after magnetizing and conditioning for final use; measured in Gauss.

Relative Permeability - The ratio of permeability of a medium to that of a vacuum. In the CGS system, the permeability is equal to 1 in a vacuum by definition. The permeability of air is also for all practical purposes equal to 1 in the CGS system.

Reprographic Magnet Rolls – Critical components in many commercial and consumer printers and copy machines. The magnetic rolls perform the function of transporting toner in these systems. Normally use ferrite or NdFeB magnets.

Retentivity – The property of a magnetic material measured by the maximum value of the residual induction.

Return Path - Conduction elements in a magnetic circuit which provide a low reluctance path for the magnetic flux.

Reluctance, R - Analogous to resistance in an electrical circuit, reluctance is related to the magnetomotive force, F, and the magnetic flux by the equation $R = F/(\text{Magnetic Flux})$, paralleling Ohm's Law where F is the magnetomotive force (in CGS units).

Reluctance Factor (f) - Accounts for the apparent magnetic circuit reluctance. This factor is required due to the treatment of H_m and H_g as constants.

Remanence, B_r - The magnetic induction that remains in a magnetic circuit after the removal of an applied magnetizing force. If there is an air gap in the circuit, the remanence will be less than the residual induction, B_r . Also called Remnant Induction.

REO – See Rare Earth Oxides.

Residual Flux Density ($B_{r_{max}}$) - Also called "Residual Induction". It is the magnetic induction remaining in a saturated magnetic material after the magnetizing field has been removed. This is the point at which the hysteresis loop crosses the B axis at zero magnetizing force, and represents the maximum flux output from the given magnet material. By definition, this point occurs at zero air gap, and therefore cannot be seen in practical use.

Residual Magnetism - Small amounts of magnetism that remain in a material after being exposed to a magnetic force.

Retention - The ability to magnetically hold ferrous tramp to the magnetic face against the force of product flow.

Return Path - Conduction elements in a magnetic circuit which provide a low reluctance path for the magnetic flux.

Reversible Temperature Coefficient (RTC) - The reversible temperature coefficient (RTC) is the measure of the rate at which the field strength of a magnet changes with temperature. The field strength is spontaneously regained when the temperature is returned to its original point.

S

S.I. – Abbreviation for “Système International”. Refers to the International Standard System of units. It is also known as the MKS system.

Samarium - A rare earth element that has properties of spectral absorption, making it useful in filtering glasses that surround neodymium laser rods. Also a critical element in Samarium Cobalt magnets.

Samarium Cobalt 1:5 - An intermetallic compound comprised of two or more elements including Sm and Co. "1:5" is the atomic ratio between rare earth elements (Sm and Gd) and the transition metal, cobalt.

Samarium Cobalt 2:17 - An intermetallic compound comprised of five or more elements including Sm, Fe, Cu, Zr, and Co. "2:17" is the atomic ratio between the rare earth elements (Sm and Gd) and the transition metals including Fe, Cu, Zr, and Co.

Samarium Cobalt Magnets – used for high power and resistance to elevated temperatures and corrosive applications. Developed in the 1970s, these were the first so-called 'rare earth' magnets. They are almost as powerful as NdFeB magnets, however they are usually the most expensive magnet formulation. Hence, they are usually only used where resistance to high temperatures (high Tc) and corrosion resistance is required. Also very brittle and relatively hard to machine.

Samarium Iron Nitride – An alloy of Samarium and iron with a proportion of about 1:4 to about 1:9 of Samarium to iron. The molten alloy is then quenched in a non-oxidizing environment to form a solid crystalline alloy in the form of a thin ribbon. The ribbon is reduced to form a powder which is then nitrated, producing a magnetically hard powder with a relatively high coercivity. Limited temperature capability has resulted in relatively limited commercial success.

Saturation Flux Density - The flux density at which a magnet saturates.

Saturation - The condition under which all elementary magnetic moments have become oriented in one direction. A ferromagnetic material is saturated when an increase in the applied magnetizing force produces no increase in induction.

Saturation Magnetization - The saturation value of magnetization of a ferromagnetic body. The inside of the magnetic body is normally divided into any number of domains, but accompanying increase in the external magnetic field, domain walls may move and magnetization may rotate within domains, so ultimately the magnetic body becomes one domain (single-domain state). If the easy magnetization axis and the external magnetic field direction match, this state is called magnetization saturation and the value of the magnetization at that time is referred to as the saturation magnetization.

Saturation Intrinsic Induction (B_s) - Is the maximum intrinsic induction possible in a material.

Search Coil - A coil conductor, usually of known area and number of turns that is used with a flux meter to measure the change of flux linkage with the coil.

Shipping Magnets - Shipping large magnetized Rare Earth magnets can be difficult and dangerous. Not only can the magnets damage other items in transit, they can be challenging to install in a final assembly. In addition, magnets tend to collect ferromagnetic debris, which can be difficult to remove.

Shunt - A soft iron piece temporarily added between the poles of a magnetic circuit to protect it from demagnetizing influences. Also called a keeper. Not needed for NdFeB or SmCo magnets.

Sintering - The bonding of powder compacts by the application of heat to enable one or more of several mechanisms of atom movement into the particle contact interfaces to occur; the mechanisms are: viscous flow, liquid phase solution precipitation, surface diffusion, bulk diffusion, and evaporation-condensation. Densification is the objective of sintering.

Sintered Magnet - A magnet produced with a powder metallurgical process. After the magnet material is finely pulverized, the easy magnetization axis is aligned in the magnetic field, the material is press molded, and then it is sintered. Since the sintering contraction is large, the dimensional precision is poor and generally, processing (such as grinding) is required after sintering.

Slope of the Operating Line – See B_d/H_d

SmCo – A Samarium Cobalt permanent magnet.

SMMA – The Motor and Motion Association, a North American association with a global focus, for electric motors, drives and their control and application. It serves as the principal voice of the industry and provides a forum to develop, collect and disseminate technical and management knowledge regarding motors, magnets and their application.

Soft Magnetic Material - Magnetic material whose magnetization and permeability are large and in which the magnetization varies with the external magnetic field direction and size. Soft magnetic material is used to strengthen the magnetic field generated by the coil and permanent magnet and used as the path of the magnetic flux generated. Soft magnetic material is used in transformer and motor iron cores etc. Most of the commercial soft materials have an intrinsic coercivity less than 10 Oe.

Solution, or Solid Solution - A homogenization process done at elevated temperatures in order to obtain a single, uniform phase, such as Sm_2TM_{17} phase; homogenization is generally followed by a fast quench to "freeze" the single phase. Solution temperature and a rapid quench after solution are critical to achieve good magnetic properties for SmCo 2:17 magnets.

South Pole - The south pole of a magnet is the one attracted to the south pole of the earth. This south seeking pole is identified by the letter S. By accepted convention, the lines of flux travel from the north pole to the south pole.

Spindle Motor Magnet – The spindle motor spins the platter in the traditional disk drive. The spindle motor uses a bonded NdFe magnet.

Spacer - A shim of non-ferrous material used to create a specific air gap between the magnetic face and the test piece.

Spontaneous Magnetization - Magnetization that occurs in the state in which a magnetic body has its atomic magnetic moments aligned without being affected by an external magnetic field. For a strongly magnetic body, spontaneous magnetization is maximum at absolute zero degrees. As the temperature rises, the magnetic moment of each atom decreases due to heat fluctuation and it disappears at the Curie temperature.

Square Loop - Refers to an intrinsic hysteresis loop with a rectangular shape.

Stability - The ability to resist demagnetizing influences encountered in the operating environment. These demagnetizing influences can be caused by high or low temperatures or by external magnetic fields.

Stabilization - Exposure of a magnet to demagnetizing influences expected to be encountered in use in order to prevent irreversible losses during actual operation. Demagnetizing influences can be caused by high or low temperatures, or by external magnetic fields.

Strontium Carbonate – A key raw material utilized in the manufacture of sintered ferrite magnets.

Surface Coatings - Unlike Samarium Cobalt, Alnico and ceramic materials, which are corrosion resistant, Neodymium Iron Boron magnets are susceptible to corrosion. Based upon the magnets' application, coatings (like nickel plating or epoxy coating) can be chosen to apply on surfaces of Neodymium Iron Boron magnets.

Surface Field (Surface Gauss) - The magnetic field strength at the surface of the magnet as measured by a Gauss meter.

T

Temperature Coefficient - A factor, which describes the change in a magnetic property with changes in temperature. Temperature coefficients are expressed as percent change per unit of temperature.

Temperature Stabilization - After manufacturing, many types of hard and soft magnetic material can be thermally cycled to remove irreversible changes that occur the first time temperature extremes are encountered.

Tesla - The S.I. unit for magnetic induction (flux density). One Tesla equals 10,000 Gauss.

Tesla Coil - An electrical oscillator developed by Nikola Tesla which produces high voltage, radio frequency alternating electric current. The Tesla coil consists of an air core transformer with loose coupling between the primary and secondary. The primary winding is excited by the discharge of a high voltage capacitor through a mechanical switching device known as a "break." Operation is characterized by a series of individual primary pulses, each being followed by a more rapid series of diminishing secondary oscillations.

Tesla Coil Transmitter - A Tesla coil configured specifically for the purpose of wireless transmission of electrical energy using either of two ground-based methods: Ground-Air Conduction and Earth Resonance. In both cases the Tesla coil oscillator is provided with a robust ground connection and a terminal capacitance that is raised slightly above the top turn of the helical resonator.

Test Piece - A standardized ferrous object used to generate attractive force to a magnetic field for measurement in a pull test.

Torpedo Magnet – The torpedo magnet is used in Just-In-Time (JIT) hopper loaders. The Torpedo Magnet consists of a formed stainless steel ring, welded to a rare earth magnetic cartridge, allowing the magnetic cartridge to hang suspended in the center of the JIT loader's glass tube. With the torpedo magnet in this position, tramp metal is captured before it can reach a plastic molding machine. The bottom of the torpedo magnet is a live magnetic pole that allows tramp metal to collect and hide, preventing tramp metal wipe-off back into the product stream.

Tramp - Magnetic ferrous or weakly magnetic non-ferrous debris to be removed from a product stream.

Traveling Wave Tube (TWT) – An electronic device used to amplify radio frequency signals.

U

UK Magnetics Society – A UK-based Magnetics Association with world-wide membership. Primary goal is the collaboration and transfer of knowledge between industry and academia.

USMMA – United States Magnetic Materials Association. Created in 2009 to advocate on behalf specialty materials manufacturers, specifically to influence government policy on behalf of its members.

V

Voice Coil Motor (VCM) – The actuator that moves the read-write head over the platter in a disk drive. Uses a high-energy sintered NdFeB magnet.

W

Weber - The practical unit of magnetic flux. It is the amount of magnetic flux which, when linked at a uniform rate with a single-turn electric circuit during an interval of 1 second, will induce in this circuit an electromotive force of 1 volt.

Wedge Magnets – Wedge Magnets provide protection against tramp metal damage for pellet mills and other equipment used to process particulate or semi-solid materials under gravity flow. Wedge Magnets are ideal for

installation in narrow, vertical, or steeply inclined chutes that are easily accessible and can be opened for inspection and manual cleaning. The wedge shape resists bridging and diverts the product flow across the front and back collection surfaces where Ceramic magnets usually located behind the outer stainless steel skin capture and hold the ferrous contaminants.

Weight - The weight of a single magnet.

Wet Pressing – The process most commonly utilized to manufacture anisotropic hard ferrite magnets. The magnetic powder is prepared as a water-based slurry which is introduced into a die. As the magnet is formed (in a magnetic field), the water is removed with a vacuum system to produce a green magnet compact that is subsequently sintered in a high-temperature furnace.

Working Point - This is a point on the magnet's B-H demagnetization loop and indicates the B and H state of the magnet in the magnetic circuit. By knowing the working point, it is possible to forecast the magnetic flux density B that can be taken out from the magnetic circuit and whether or not the magnet itself demagnetizes. Also, the straight line drawn from the origin to this point is called the permeance line and when the slope of this line is expressed as $B/H = \mu_0 p$, p is called the permeance coefficient.

Z

Zero TC - Refers to the magnet material that is said to be fully temperature-compensated, i.e., the fundamental magnetic properties exhibit very minute (as little as -0.001% per degree C) change over the functional temperature range of the magnet application.

Your suggestions for improvement of this glossary are genuinely welcomed. Please send your comments to wbglossary@aol.com. Thanks very much!

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