DOWNLOAD PDF METALS AND WELDING

Chapter 1 : welding | Types & Definition | calendrierdelascience.com

Other welding methods that are used include GMAW (gas metal arc welding or Mig). Stick aluminum welding is only used for smaller project. The process tarts by selecting a joint design for the base metals (tee, lap, edge, corner or butt).

One of the most significant changes in the technology of metals fabrication has been the introduction of fusion welding during the 20th century. Before this, the main joining processes were riveting and forge welding. Both had limitations of scale, although they could be usedâ€¦ Basic principles of welding A weld can be defined as a coalescence of metals produced by heating to a suitable temperature with or without the application of pressure , and with or without the use of a filler material. In fusion welding a heat source generates sufficient heat to create and maintain a molten pool of metal of the required size. The heat may be supplied by electricity or by a gas flame. Electric resistance welding can be considered fusion welding because some molten metal is formed. Solid-phase processes produce welds without melting the base material and without the addition of a filler metal. Pressure is always employed, and generally some heat is provided. Frictional heat is developed in ultrasonic and friction joining, and furnace heating is usually employed in diffusion bonding. The electric arc used in welding is a high-current, low-voltage discharge generally in the range 10â€”2, amperes at 10â€”50 volts. An arc column is complex but, broadly speaking, consists of a cathode that emits electrons, a gas plasma for current conduction, and an anode region that becomes comparatively hotter than the cathode due to electron bombardment. A direct current DC arc is usually used, but alternating current AC arcs can be employed. Total energy input in all welding processes exceeds that which is required to produce a joint, because not all the heat generated can be effectively utilized. Efficiencies vary from 60 to 90 percent, depending on the process; some special processes deviate widely from this figure. Heat is lost by conduction through the base metal and by radiation to the surroundings. Most metals, when heated, react with the atmosphere or other nearby metals. These reactions can be extremely detrimental to the properties of a welded joint. Most metals, for example, rapidly oxidize when molten. A layer of oxide can prevent proper bonding of the metal. Molten-metal droplets coated with oxide become entrapped in the weld and make the joint brittle. Some valuable materials added for specific properties react so quickly on exposure to the air that the metal deposited does not have the same composition as it had initially. These problems have led to the use of fluxes and inert atmospheres. In fusion welding the flux has a protective role in facilitating a controlled reaction of the metal and then preventing oxidation by forming a blanket over the molten material. Fluxes can be active and help in the process or inactive and simply protect the surfaces during joining. Inert atmospheres play a protective role similar to that of fluxes. In gas-shielded metal-arc and gas-shielded tungsten-arc welding an inert gasâ€”usually argon â€”flows from an annulus surrounding the torch in a continuous stream, displacing the air from around the arc. The gas does not chemically react with the metal but simply protects it from contact with the oxygen in the air. The metallurgy of metal joining is important to the functional capabilities of the joint. The arc weld illustrates all the basic features of a joint. Three zones result from the passage of a welding arc: The weld metal is that portion of the joint that has been melted during welding. The heat-affected zone is a region adjacent to the weld metal that has not been welded but has undergone a change in microstructure or mechanical properties due to the heat of welding. The unaffected material is that which was not heated sufficiently to alter its properties. Weld-metal composition and the conditions under which it freezes solidifies significantly affect the ability of the joint to meet service requirements. In arc welding, the weld metal comprises filler material plus the base metal that has melted. After the arc passes, rapid cooling of the weld metal occurs. A one-pass weld has a cast structure with columnar grains extending from the edge of the molten pool to the centre of the weld. In a multipass weld, this cast structure may be modified, depending on the particular metal that is being welded. The base metal adjacent to the weld, or the heat-affected zone, is subjected to a range of temperature cycles, and its change in structure is directly related to the peak temperature at any given point, the time of exposure, and the cooling rates. The types of base metal are too numerous to discuss here, but they can be grouped in three classes: Welding produces stresses in materials. These forces are induced by contraction of the weld metal and by expansion and then contraction of the heat-affected zone. The unheated metal imposes a restraint on the above, and as contraction predominates, the weld metal cannot contract freely, and a stress is built up in the joint. This is generally known as residual stress, and for some critical applications must be removed by heat treatment of the whole fabrication. Residual stress is unavoidable in all welded structures, and if it is not controlled bowing or distortion of the weldment will take place. Control is exercised by welding technique, jigs and fixtures , fabrication procedures, and final heat treatment. There are a wide variety of welding processes. Several of the most important are discussed below. Forge welding This original fusion technique dates from the earliest uses of iron. The process was first employed to make small pieces of iron into larger useful pieces by joining them. The parts to be joined were first shaped, then heated to welding temperature in a forge and finally hammered or pressed together. The Damascus sword, for example, consisted of wrought-iron bars hammered until thin, doubled back on themselves, and then rehammered to produce a forged weld. The larger the number of times this process was repeated, the tougher the sword that was obtained. In the Middle Ages cannons were made by welding together several iron bands, and bolts tipped with steel fired from crossbows were fabricated by forge welding. Arc welding Shielded metal-arc welding accounts for the largest total volume of welding today. In this process an electric arc is struck between the metallic electrode and the workpiece. Tiny globules of molten metal are transferred from the metal electrode to the weld joint. Since arc welding can be done with either alternating or direct current, some welding units accommodate both for wider application. A holder or clamping device with an insulated handle is used to conduct the welding current to the electrode. A return circuit to the power source is made by means of a clamp to the workpiece. Gas-shielded arc welding, in which the arc is shielded from the air by an inert gas such as argon or helium , has become increasingly important because it can deposit more material at a higher efficiency and can be readily automated. The tungsten electrode version finds its major applications in highly alloyed sheet materials. Either direct or alternating current is used, and filler metal is added either hot or cold into the arc. Consumable electrode gas-metal arc welding with a carbon dioxide shielding gas is widely used for steel welding. Two processes known as spray arc and short-circuiting arc are utilized. Metal transfer is rapid, and the gas protection ensures a tough weld deposit. Submerged arc welding is similar to the above except that the gas shield is replaced with a granulated mineral material as a flux, which is mounded around the electrode so that no arc is visible. Plasma welding is an arc process in which a hot plasma is the source of heat. It has some similarity to gas-shielded tungsten-arc welding, the main advantages being greater energy concentration, improved arc stability, and easier operator control. Better arc stability means less sensitivity to joint alignment and arc length variation. In most plasma welding equipment, a secondary arc must first be struck to create an ionized gas stream and permit the main arc to be started. This secondary arc may utilize either a high-frequency or a direct contact start. Water cooling is used because of the high energies forced through a small orifice. The process is amenable to mechanization, and rapid production rates are possible. Thermochemical processes One such process is gas welding. It once ranked as equal in importance to the metal-arc welding processes but is now confined to a specialized area of sheet fabrication and is probably used as much by artists as in industry. Gas welding is a fusion process with heat supplied by burning acetylene in oxygen to provide an intense, closely controlled flame. Metal is added to the joint in the form of a cold filler wire. A neutral or reducing flame is generally desirable to prevent base-metal oxidation. By deft craftsmanship very good welds can be produced, but welding speeds are very low. Fluxes aid in preventing oxide contamination of the joint. Another thermochemical process is aluminothermic thermite joining. It has been successfully used for both ferrous and nonferrous metals but is more frequently used for the former. The reaction is completed in 30 seconds to 2 minutes regardless of the size of the charge. The process is suited to joining sections with large, compact cross sections, such as rectangles and rounds. A mold is used to contain the liquid metal. Resistance welding Spot, seam, and projection welding are resistance welding processes in which the required heat for joining is generated at the interface by the electrical resistance of the joint. Welds are made in a relatively short time typically 0. Spot welds are made at regular intervals on sheet metal that has an overlap. Joint strength depends on the number and size of the welds. Seam welding is a continuous process wherein the electric current is successively pulsed into the joint to form a series of overlapping spots or a continuous seam. This process is used to weld containers or structures where spot welding is insufficient. A projection weld is formed when one of the parts to be welded in the resistance machine has been dimpled or pressed to form a protuberance that is melted down during the weld cycle. The process allows a number of predetermined spots to be welded at one time. All of these processes are capable of very high rates of production with continuous quality control. The most modern equipment in resistance welding includes complete feedback control systems to self-correct any weld that does not meet the desired specifications. Flash welding is a resistance welding process where parts to be joined are clamped, the ends brought together slowly and then drawn apart to cause an arc or flash. Flashing or arcing is continued until the entire area of the joint is heated; the parts are then forced together and pressure maintained until the joint is formed and cooled. Low- and high-frequency resistance welding is used for the manufacture of tubing.

Chapter 2 : Oxy-fuel welding and cutting - Wikipedia

Start studying Metals and Welding. Learn vocabulary, terms, and more with flashcards, games, and other study tools.

Solidified Slag Gas metal arc welding GMAW , also known as metal inert gas or MIG welding, is a semi-automatic or automatic process that uses a continuous wire feed as an electrode and an inert or semi-inert gas mixture to protect the weld from contamination. It is often used when quality welds are extremely important, such as in bicycle , aircraft and naval applications. The arc is more concentrated than the GTAW arc, making transverse control more critical and thus generally restricting the technique to a mechanized process. Because of its stable current, the method can be used on a wider range of material thicknesses than can the GTAW process and it is much faster. It can be applied to all of the same materials as GTAW except magnesium, and automated welding of stainless steel is one important application of the process. A variation of the process is plasma cutting , an efficient steel cutting process. This increases arc quality, since contaminants in the atmosphere are blocked by the flux. The slag that forms on the weld generally comes off by itself, and combined with the use of a continuous wire feed, the weld deposition rate is high. Working conditions are much improved over other arc welding processes, since the flux hides the arc and almost no smoke is produced. The process is commonly used in industry, especially for large products and in the manufacture of welded pressure vessels. Oxy-fuel welding and cutting The most common gas welding process is oxyfuel welding, [17] also known as oxyacetylene welding. It is one of the oldest and most versatile welding processes, but in recent years it has become less popular in industrial applications. It is still widely used for welding pipes and tubes, as well as repair work. A similar process, generally called oxyfuel cutting, is used to cut metals. Resistance welding Resistance welding involves the generation of heat by passing current through the resistance caused by the contact between two or more metal surfaces. Small pools of molten metal are formed at the weld area as high current â€", A is passed through the metal. The advantages of the method include efficient energy use , limited workpiece deformation, high production rates, easy automation, and no required filler materials. Weld strength is significantly lower than with other welding methods, making the process suitable for only certain applications. It is used extensively in the automotive industryâ€"ordinary cars can have several thousand spot welds made by industrial robots. A specialized process, called shot welding , can be used to spot weld stainless steel. However, instead of pointed electrodes, wheel-shaped electrodes roll along and often feed the workpiece, making it possible to make long continuous welds. In the past, this process was used in the manufacture of beverage cans, but now its uses are more limited. The two processes are quite similar, differing most notably in their source of power. Laser beam welding employs a highly focused laser beam, while electron beam welding is done in a vacuum and uses an electron beam. Both have a very high energy density, making deep weld penetration possible and minimizing the size of the weld area. Both processes are extremely fast, and are easily automated, making them highly productive. The primary disadvantages are their very high equipment costs though these are decreasing and a susceptibility to thermal cracking. Developments in this area include laser-hybrid welding , which uses principles from both laser beam welding and arc welding for even better weld properties, laser cladding , and x-ray welding. One of the most popular, ultrasonic welding , is used to connect thin sheets or wires made of metal or thermoplastic by vibrating them at high frequency and under high pressure. Welding metals with this process does not involve melting the materials; instead, the weld is formed by introducing mechanical vibrations horizontally under pressure. When welding plastics, the materials should have similar melting temperatures, and the vibrations are introduced vertically. Ultrasonic welding is commonly used for making electrical connections out of aluminum or copper, and it is also a very common polymer welding process. The energy from the impact plasticizes the materials, forming a weld, even though only a limited amount of heat is generated. The process is commonly used for welding dissimilar materials, such as the welding of aluminum with steel in ship hulls or compound plates. Welding joint Common welding joint types â€" 1 Square butt joint, 2 V butt joint, 3 Lap joint, 4 T-joint Welds can be geometrically prepared in many different ways. The five basic types of weld joints are the butt joint, lap joint, corner joint, edge joint, and T-joint a variant of this last is the cruciform joint. Other variations exist as wellâ€”for example, double-V preparation joints are characterized by the two pieces of material each tapering to a single center point at one-half their height. Single-U and double-U preparation joints are also fairly commonâ€”instead of having straight edges like the single-V and double-V preparation joints, they are curved, forming the shape of a U. Lap joints are also commonly more than two pieces thickâ€”depending on the process used and the thickness of the material, many pieces can be welded together in a lap joint geometry. Other welding methods, like shielded metal arc welding, are extremely versatile and can weld virtually any type of joint. Some processes can also be used to make multipass welds, in which one weld is allowed to cool, and then another weld is performed on top of it. This allows for the welding of thick sections arranged in a single-V preparation joint, for example. After welding, a number of distinct regions can be identified in the weld area. The weld itself is called the fusion zoneâ€”more specifically, it is where the filler metal was laid during the welding process. The properties of the fusion zone depend primarily on the filler metal used, and its compatibility with the base materials. It is surrounded by the heat-affected zone , the area that had its microstructure and properties altered by the weld. The metal in this area is often weaker than both the base material and the fusion zone, and is also where residual stresses are found. This is an accurate way to identify temperature, but does not represent the HAZ width. The HAZ is the narrow area that immediately surrounds the welded base metal. Many distinct factors influence the strength of welds and the material around them, including the welding method, the amount and concentration of energy input, the weldability of the base material, filler material, and flux material, the design of the joint, and the interactions between all these factors. Types of welding defects include cracks, distortion, gas inclusions porosity , non-metallic inclusions, lack of fusion, incomplete penetration, lamellar tearing, and undercutting. The metalworking industry has instituted specifications and codes to guide welders , weld inspectors , engineers , managers, and property owners in proper welding technique, design of welds, how to judge the quality of Welding Procedure Specification , how to judge the skill of the person performing the weld, and how to ensure the quality of a welding job. Heat-affected zone[edit] The heat-affected zone HAZ is a ring surrounding the weld in which the temperature of the welding process, combined with the stresses of uneven heating and cooling, alter the heat-treatment properties of the alloy. The effects of welding on the material surrounding the weld can be detrimentalâ€”depending on the materials used and the heat input of the welding process used, the HAZ can be of varying size and strength. The thermal diffusivity of the base material plays a large roleâ€”if the diffusivity is high, the material cooling rate is high and the HAZ is relatively small. Conversely, a low diffusivity leads to slower cooling and a larger HAZ. The amount of heat injected by the welding process plays an important role as well, as processes like oxyacetylene welding have an unconcentrated heat input and increase the size of the HAZ. Processes like laser beam welding give a highly concentrated, limited amount of heat, resulting in a small HAZ. Arc welding falls between these two extremes, with the individual processes varying somewhat in heat input.

Chapter 3 : Seattle Welding, Metal Fabrication, Machining, Starman Metal Fabrication, Renton WA

Welding is the process of permanently joining two or more metal parts, by melting both materials. The molten materials quickly cool, and the two metals are permanently bonded. Spot welding and seam welding are two very popular methods used for bonding sheet metal parts.

Oxy-fuel torches are or have been used for: Depositing metal to build up a surface, as in hardfacing. Also, oxy-hydrogen flames are used: A steel circular brush is attached to an angle grinder and used to remove the first layer leaving behind a bumpy surface similar to hammered bronze. In short, oxy-fuel equipment is quite versatile, not only because it is preferred for some sorts of iron or steel welding but also because it lends itself to brazing, braze-welding, metal heating for annealing or tempering, bending or forming , rust or scale removal, the loosening of corroded nuts and bolts, and is a ubiquitous means of cutting ferrous metals. Apparatus[edit] The apparatus used in gas welding consists basically of an oxygen source and a fuel gas source usually contained in cylinders , two pressure regulators and two flexible hoses one for each cylinder , and a torch. This sort of torch can also be used for soldering and brazing. The cylinders are often carried in a special wheeled trolley. There are also examples of pressurized liquid fuel cutting torches, usually using gasoline. These are used for their increased portability. Pressure regulator The regulator ensures that pressure of the gas from the tanks matches the required pressure in the hose. The flow rate is then adjusted by the operator using needle valves on the torch. Accurate flow control with a needle valve relies on a constant inlet pressure. Most regulators have two stages. The first stage is a fixed-pressure regulator, which releases gas from the cylinder at a constant intermediate pressure, despite the pressure in the cylinder falling as the gas in it is consumed. This is similar to the first stage of a scuba-diving regulator. The adjustable second stage of the regulator controls the pressure reduction from the intermediate pressure to the low outlet pressure. The regulator has two pressure gauges, one indicating cylinder pressure, the other indicating hose pressure. The adjustment knob of the regulator is sometimes roughly calibrated for pressure, but an accurate setting requires observation of the gauge. Some simpler or cheaper oxygen-fuel regulators have only a single stage regulator, or only a single gauge. A single-stage regulator will tend to allow a reduction in outlet pressure as the cylinder is emptied, requiring manual readjustment. For low-volume users, this is an acceptable simplification. Welding regulators, unlike simpler LPG heating regulators, retain their outlet hose pressure gauge and do not rely on the calibration of the adjustment knob. The cheaper single-stage regulators may sometimes omit the cylinder contents gauge, or replace the accurate dial gauge with a cheaper and less precise "rising button" gauge. Gas hoses[edit] The hoses are designed for use in welding and cutting metal. A double-hose or twinned design can be used, meaning that the oxygen and fuel hoses are joined together. The hoses are color-coded for visual identification. The color of the hoses varies between countries. In the United States , the oxygen hose is green, and the fuel hose is red. LPG will damage an incompatible hose, including most acetylene hoses. The threaded connectors on the hoses are handed to avoid accidental mis-connection: The use of worm-drive hose clips or Jubilee clips is specifically forbidden in the UK and other countries. If a detonation wave enters the acetylene tank, the tank will be blown apart by the decomposition. Ordinary check valves that normally prevent back flow cannot stop a detonation wave because they are not capable of closing before the wave passes around the gate. For that reason a flashback arrestor is needed. It is designed to operate before the detonation wave makes it from the hose side to the supply side. European practice is to fit flashback arrestors at the regulator and check valves at the torch. US practice is to fit both at the regulator. In case the pressure wave has created a leak downstream of the flashback arrestor, it will remain switched off until someone resets it. Check valve[edit] A check valve lets gas flow in one direction only. It is usually a chamber containing a ball that is pressed against one end by a spring. Gas flow one way pushes the ball out of the way, and a lack of flow or a reverse flow allows the spring to push the ball into the inlet, blocking it. Not to be confused with a flashback arrestor, a check valve is not designed to block a shock wave. The shock wave could occur while the ball is so far from the inlet that the wave will get past the ball before it can reach its off position. Torch[edit] The torch is the tool that the welder holds and manipulates to make the weld. It has a connection and valve for the fuel gas and a connection and valve for the oxygen, a handle for the welder to grasp, and a mixing chamber set at an angle where the fuel gas and oxygen mix, with a tip where the flame forms. Two basic types of torches are positive pressure type and low pressure or injector type. The top torch is a welding torch and the bottom is a cutting torch Welding torch[edit] A welding torch head is used to weld metals. It can be identified by having only one or two pipes running to the nozzle, no oxygen-blast trigger, and two valve knobs at the bottom of the handle letting the operator adjust the oxygen and fuel flow respectively. Cutting torch[edit] A cutting torch head is used to cut materials. It is similar to a welding torch, but can be identified by the oxygen blast trigger or lever. When cutting, the metal is first heated by the flame until it is cherry red. Once this temperature is attained, oxygen is supplied to the heated parts by pressing the oxygen-blast trigger. This oxygen reacts with the metal, forming iron oxide and producing heat. It is the heat that continues the cutting process. The cutting torch only heats the metal to start the process; further heat is provided by the burning metal. The melting point of the iron oxide is around half that of the metal being cut. As the metal burns, it immediately turns to liquid iron oxide and flows away from the cutting zone. Rose bud torch[edit] A rose bud torch is used to heat metals for bending, straightening, etc. It is so-called because the flame at the end looks like a rose bud. A welding torch can also be used to heat small areas such as rusted nuts and bolts. Injector torch[edit] A typical oxy-fuel torch, called an equal-pressure torch, merely mixes the two gases. In an injector torch, high-pressure oxygen comes out of a small nozzle inside the torch head which drags the fuel gas along with it, using the venturi effect. Fuels[edit] Oxy-fuel processes may use a variety of fuel gases, the most common being acetylene. Many brands use different kinds of gases in their mixes. Acetylene[edit] Acetylene generator as used in Bali by a reaction of calcium carbide with water. This is used where acetylene cylinders are not available. Acetylene Acetylene is the primary fuel for oxy-fuel welding and is the fuel of choice for repair work and general cutting and welding. Acetylene gas is shipped in special cylinders designed to keep the gas dissolved. The cylinders are packed with porous materials e. There is about kPa psi pressure in the tank when full. Compressed gas cylinders containing oxygen and MAPP gas. Gasoline[edit] Oxy- gasoline , also known as oxy-petrol, torches have been found to perform very well, especially where bottled gas fuel is not available or difficult to transport to the worksite. Tests showed that an oxy-gasoline torch can cut steel plate up to 0. In plate thicknesses greater than 0. Another low cost approach commonly used by jewelry makers in Asia is using air bubbled through a gasoline container by a foot-operated air pump, and burning the fuel-air mixture in a specialized welding torch. Oxyhydrogen Hydrogen has a clean flame and is good for use on aluminium. It can be used at a higher pressure than acetylene and is therefore useful for underwater welding and cutting. It is a good type of flame to use when heating large amounts of material. Hydrogen is not used for welding steels and other ferrous materials, because it causes hydrogen embrittlement. For some oxyhydrogen torches the oxygen and hydrogen are produced by electrolysis of water in an apparatus which is connected directly to the torch. Types of this sort of torch: The oxygen and the hydrogen are led off the electrolysis cell separately and are fed into the two gas connections of an ordinary oxy-gas torch. This happens in the water torch, which is sometimes used in small torches used in making jewelry and electronics. The mixed oxygen and hydrogen are drawn from the electrolysis cell and are led into a special torch designed to prevent flashback. It has the storage and shipping characteristics of LPG and has a heat value a little less than acetylene. Further, more of it can be stored in a single place at one time, as the increased compressibility allows for more gas to be put into a tank. Other welding gases that develop comparable temperatures need special procedures for safe shipping and handling. As they were the only North American plant making MAPP gas, many substitutes were introduced by the companies who had repackaged the Dow and Varennes product s - most of these substitutes are propylene, see below. Propylene and Fuel Gas[edit] Propylene is used in production welding and cutting. It cuts similarly to propane. When propylene is used, the torch rarely needs tip cleaning. There is often a substantial advantage to cutting with an injector torch see the propane section rather than an equal-pressure torch when using propylene. Quite a few North American suppliers have begun selling propylene under proprietary trademarks such as FG2 and Fuel-Max. Butane and propane do not react with each other and are regularly mixed. Butane boils at 0. Vaporization is rapid at temperatures above the boiling points. The calorific heat values of both are almost equal. Both are thus mixed to attain the vapor pressure that is required by the end user and depending on the ambient conditions.

Chapter 4 : Metal Supply â€“ Copper Supply - Aluminum Supply | calendrierdelascience.com

If you don't have it yet, I would strongly recommend getting the book "Metals and How to Weld Them" (Second Edition) Written by by T.B. JEFFERSON and GORHAM WOODS The Lincoln Welding foundation is a best kept secret, and I thought you would like to know about it.

It is hot short, i. The molten metal is very fluid. It has high electrical conductivity. It owes much of its strength to cold working. Copper has the highest thermal conductivity of all commercial metals and the comments made concerning thermal conductivity of aluminum apply to copper, to an even greater degree. This creates problems when making generalized statements about the different copper-based alloys. The melting point of the different copper alloys varies over a relatively wide range, but is at least oC lower than carbon steel. Some of the copper alloys are hot short. This means that they become brittle at high temperatures. This is because some of the alloying elements form oxides and other compounds at the grain boundaries, embrittling the material. Copper does not exhibit heat colors like steel and when it melts it is relatively fluid. This is essentially the result of the high preheat normally used for heavier sections. Copper has the highest electrical conductivity of any of the commercial metals and this is a definite problem in the resistance welding processes. All of the copper alloys derive their strength from cold working. The heat of welding will anneal the copper in the heat-affected area adjacent to the weld and reduce the strength provided by cold working. This must be considered when welding high-strength joints. There is one other problem associated with the copper alloys that contain zinc. Zinc has a relatively low boiling temperature, and under the heat of an arc will tend to vaporize and escape from the weld. For this reason the arc processes are not recommended for the alloys containing zinc. Welding Magnesium - Base Alloys Magnesium is the lightest structural metal. It is approximately two-thirds as heavy as aluminum and one-fourth as heavy as steel. Magnesium alloys containing small amounts of aluminum, manganese, zinc, zirconium, etc. They can be rolled into plate, shapes, and strip. Magnesium can be cast, forged, fabricated, and machined. As a structural metal it is used in aircraft. It is used by the materials-moving industry for parts of machinery and for hand-power tools due to its strength to weight ratio. Magnesium can be welded by many of the arc and resistance welding processes, as well as by the oxy-fuel gas welding process, and it can be brazed. Magnesium possesses properties that make welding it different than the welding of steels. Many of these are the same as for aluminum. Magnesium oxide surface coating Relatively high thermal expansion coefficient Relatively low melting temperature The absence of color change as temperature approaches the melting point. The normal metallurgical factors that apply to other metals apply to magnesium as well. Magnesium is a very active metal and the rate of oxidation increases as the temperature is increased. The melting point of magnesium is very close to that of aluminum, but the melting point of the oxide is very high. In view of this, the oxide coating must be removed. Magnesium has high thermal heat conductivity and a high coefficient of thermal expansion. The thermal conductivity is not as high as aluminum but the coefficient of thermal expansion is very nearly the same. The absence of color change is not too important with respect to the arc welding processes. Welding Nickel - Base Alloys Nickel and the high-nickel alloys are commonly used when corrosion resistance is required. They are used in the chemical industry and the food industry. Nickel and nickel alloys are also widely used as filler metals for joining dissimilar materials and cast iron. When welding, the nickel alloys can be treated much in the same manner as austenitic stainless steels with a few exceptions. The nickel alloys will acquire a surface oxide coating which melts at a temperature approximately oC above the meting point of the base metal. The nickel alloys are susceptible to emrittlement at welding temperatures by lead, sulphur, phosphorus, and some low temperature metals and alloys. Weld penetration is less then expected with other metals. When compensation is made for these three factors the welding procedures used for the nickel alloys can be the same as those used for stainless steel. This is because the melting point, the coefficient of thermal expansion, and the thermal conductivity are similar to austenitic stainless steel. It is necessary that each of these precautions be considered. The surface oxide should be completely removed from the joint area by grinding, abrasive blasting, machining, or by chemical means. When chemical etches are used they must be completely removed by rinsing prior to welding. The oxide which melts at temperatures above the melting point of the base metal may enter the weld as a foreign material, or impurity, and will greatly reduce the strength and ductility of the weld. The problem of embrittlement at welding temperatures also means that the welding surface must be absolutely clean. Paints, marking crayons, grease, oil, machining lubricants, cutting oils may all contain the ingredients which will cause embrittlement. They must be completely removed from the weld area to avoid embrittlement. Finally, with respect to the minimum penetration, it is necessary to increase the opening of groove angles and to provide adequate root openings when full-penetration welds are used. Almost all the welding processes can be used for welding the nickel alloys. In addition, they can be joined by brazing and soldering. Where available, full property information can be viewed for materials including chemical composition, mechanical properties, physical properties and carbon equivalent data as well as advice on welding application. It maybe that you need to further narrow the search criteria by using the other fields in the Advanced Search page e. A list of materials will then be generated for you to choose from. After clicking a material from the resulting list, a list of subgroups derived from standard specifications appears. From here it is possible to view specific property data for the selected material and also to view similar and equivalent materials in our powerful cross reference tables. Click on the property data link of interest to you to view specific property data.

Chapter 5 : Welding - Wikipedia

Welding is a complicated process which means there are many complications that can arise. One way to reduce the risk is by selecting a metal that is easily weldable and does not require many extra pre-weld and post-weld operatins to prevent weld failure.

Chapter 6 : Metals and How to Weld Them

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion.

Chapter 7 : Welding - Metals, Inc.

Welders are responsible not only for knowing a variety of welding techniques, but for how to weld a variety of metals. Different metals possess different properties, and a technique that works well on one metal may produce a very poor weld on another.

Chapter 8 : Welding Techniques for Different Types of Metals - Tulsa Welding School

Metal Magicians Welding & Fabrication, LLC is a full service, insured and bonded welding and fabrication, female-owned company based in Jacksonville, FL. Our services include a wide array of structural and miscellaneous metal projects and metal products for commercial customers.

Chapter 9 : Welding the Nonferrous Metals: General Overview

Williams Metals Fulfills Your Metal Supply Needs. WMWA is a multi-location processing and distribution service center supplying copper, brass, bronze, and aluminum in strip, sheet, rod, bar, plate, tubing, and pipe forms.