WELDWELL

Quarterly newsletter of Weldwell Speciality Pvt. Ltd.

SERVICE TO THE WELDING COMMUNITY

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SPECTRUM

Prof. (Dr.) S.S.Sundaresan, the first L&T Chairperson of Welding, is being felicitated on completing 50 years of teaching by Prof. (Dr.) S.K.Dutta, Head & Director, ME Welding Tech. Course, M.S University, Vadodara, in a glittering function at Vadodara in Feb. 2016

HIGHLIGHTS

- Common challenges in GMAW welding of Aluminium
- Precipitation hardening martensitic stainless steel and its welding
- Recent developments in Plasma cutting

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INSIDE

Editorial

Dear Reader,

The emphasis on infrastructure in the recent budget presented in February is a welcome step for the welding fraternity. I have often mentioned that our fraternity gets the benefit of any policy announcement at the last nevertheless, we hope that this time the time lag will not be very long.

Industrial usage of aluminium and consequently its welding is increasing rapidly. With increasing amount of welding of aluminium it is important to look deeper into the possible challenges associated with it. GMAW being the most popular process for welding of aluminium the lead article elaborates many of the frequently observed challenges during welding using this process, their cause/s and plausible remedial actions. AWS has just announced a new Standard, AWS A5.36/A5.36M, for flux cored and metal cored electrodes called Specification For Carbon And Low-Alloy Steel Flux Cored Electrodes For Flux Cored Arc Welding And Metal Cored Electrodes For Gas Metal Arc Welding. The scope of this specification prescribes requirements for the classification of carbon and low-alloy steel flux cored electrodes for flux cored arc welding (FCAW), either with or without shielding gas, and carbon and low-alloy steel metal cored electrodes for gas metal arc welding (GMAW). This new specification replaces both AWS A5.20/A5.20M and AWS A5.29/A5.29M. The education section of this edition provides some more details of the changes made. Precipitation hardening (PH) stainless steels are high strength steels having yield strength up to 1795 MPa and are used where very high strength materials are required. The technical section describes its classification, welding procedures, recommended filler wires and any PWHT, if required. Keeping pace with the improvements in technology, Kemppi Oy. Finland, has introduced FASTMIG X power source series designed for high quality welding. It is not a standard welding machine but a multi-purpose welding solution consisting of various components. Details are described as a New Product. It is well known that there is no welding without cutting. Plasma cutting technique has made strident progress during the last two to three decades. The progress path has been travelled in the review section.

We are happy to announce the formation of an Editorial Board consisting of prominent welding technologists to improve the newsletter and to bring more interesting subjects to you.

Event

Workshop on Advances in Welding Technology

A one day workshop on Advances in Welding Technology was organised by Metallurgical & Materials Engg. Dept. and SMES Alumni Association, MS University, Vadodara on 20.02.2016 as part of Golden Jubilee Celebration the Dept. and to commemorate 50 years of teaching and attaining 75 years by their first L&T Chairperson of Welding, Professor Dr. S. Sundaresan.

During the felicitation ceremony Professor Dr. S. Sundaresan delivered a lecture on "Super Stainless Steels - Alloy design & Weldability".

He presented a brief overview of stainless steel classification, problems with standard SS and need for improved properties over super duplex steel for highly specialised applications such as subsea equipment in oil and gas exploration, drilling & processing etc. He then elaborated on the principles of Super SS alloy design and their merits and compared chemical composition and properties of standard SS with super SS. Some of the super SS he elaborated were

- Superaust. SS: Most corrosion resistant, and also the most expensive
- Lean Duplex: Corr. res. on par with 304/316, stronger and cheaper than 304/316
- Hyper Duplex: Corr. res. nearly on par with SASS, but much stronger, slightly cheaper
- Supermart. SS: Corr. res. between C-steel and ASS but much stronger than C-steel, easily weldable. Most promising super-SS
- Superferritic SS: Excellent corr. res, least weldable and least promising super-SS

The presentation covered welding of super SS, welding consumables used and problems associated with it.

Mr. Y.S. Trivedi, Executive Vice President and Member of the Board – Heavy Engineering IC, who is also an alumni of first batch of welding under Prof. Sundaresan, delivered an excellent special lecture on narrow gap welding. There were many practical tips and details provided that may not be found in any publication. Mr. Trivedi added that L&T has come across joints from 0.3 mm to 800 mm thick. The special brazing joint of 0.3mm was not as satisfactory as desired by the end user of defense to say challenges are plenty. Some of the tips to recall are about choice of 4 or 5mm SAW wire to be used for reliable feeding, bent end shape of the long contact tube to ensure positive electrical contact at discharge point, bead placement choice of 1+1 together with parameter settings to ensure side wall fusion and minimal dilution. He also highlighted the new approach in progress about reducing the groove width and angle by half to reduce weld metal deposit that runs into several tons. The present groove angles used is 1Degree and +/- 5mm gap.

There were over 75 registered delegates including 50% of students. This trend is very heartening for welding fraternity.

Challenges in Aluminium welding

There are few challenges which are typical to welding aluminium and its alloys. Finding a solution to mitigate these is key to success of the welding technologist or the engineer.

GMAW is the most common welding process for aluminium. An attempt has been made here to explain cause and probable solution to the common problems in GMAW welding of aluminium.

OBTAIN STABLE ARC AND ELIMINATE ERRATIC FEEDING AND BURN-BACKS

To obtain these conditions the major contributors are mechanical conditions of the filler wire and the welding machine. Some of the most important requirements of the filler wire are controlled diameter, stiffness, cast, pitch (helix), surface finish and low surface sliding friction. Secondly, always use a welding system that is designed specifically for welding aluminum like Kemppi made Kempact or Kemppi FastMig. The following check list will help in eliminating this problem to a large extent:

- Check and tighten electrical connections and grounding
- Ensure that the base metal is not contaminated with water stains, moisture, heavy oxide, or hydrocarbon containing materials.
- Check that feed rolls, guides and contact tips meet specified profile and surface polish recommendations of the suppliers.
- They must be free of burrs and machining marks. Use a push-pull wire feeder or spool gun for optimum feedability.
- Match the contact tip size to the wire size being used (wire diameter + 10%).
- Contact tips must be recessed in the gas cup 1/8 to 1/4 inch for proper gas cooling of the tip and spatter control. Do not use joggled contact tips.
- Prevent overheating of the gun and contact tip by operating at a reduced duty cycle or switching to a water cooled gun.

Purchasing Contact Tips and Maintenance Suggestions:

- Purchase contact tips with bore sizes that are 10% larger than the electrode diameter as suggested
- Purchase contact tips that have polished bores free from burrs on the inlet and exit ends
- Replace all metallic wire guides with non-metallic material

Drive Roll Design and Wire Feedability

All too often the incorrect choice of drive rolls is a major cause of aluminum welding wire feedability problems. Most often these problems are caused by aluminum wire shavings that originate from poor fitting and incorrectly designed drive rolls.

Listed below are suggestions on how to select the correct type and design of drive rolls:

- Polish all groove surfaces, ensure both rolls are aligned. Sharp edges and misalignment of the rolls can shave the wire.
- Select Drive Roll Groove Radius = 0.6 X wire diameter

WELD JOINT POROSITY

Producing a weld with low porosity is the responsibility of both the electrode manufacturer and the welder. The electrode manufacturer must supply an electrode that is contamination free and meet the requirements of AWS standards A5.10. The welder must incorporate the practices and procedures of codes like AWS D1.2 to ensure that porosity is not introduced into the weld pool. All weld porosity results from the absorption of hydrogen during melting and the expulsion of hydrogen during solidification of the weld pool. After the material reaches its liquid stage and at temperatures above its melting point it becomes very susceptible to hydrogen absorption. The hydrogen can then form bubbles in the molten aluminium as it solidifies and these bubbles are then trapped in the metal causing porosity. The cause of porosity in aluminum is hydrogen.

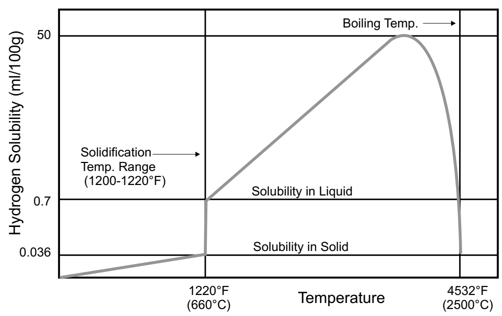

Fig. 1 Hydrogen Solubility in Aluminum

Some of the common sources of hydrogen are Hydrocarbons (in the form of paint, oil & grease), Hydrated aluminium oxide, Moisture in the atmosphere and Contaminated shielding gas. Hydrogen gas from these sources can become trapped within the weld deposit and create porosity. Fig. 2 and 3 shows various types of porosity.

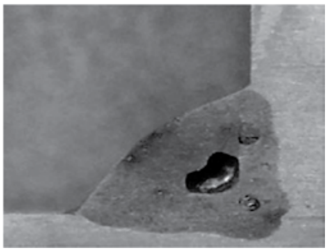

Fig 2. Macroetch of fillet weld showing large irregular shaped porosity.

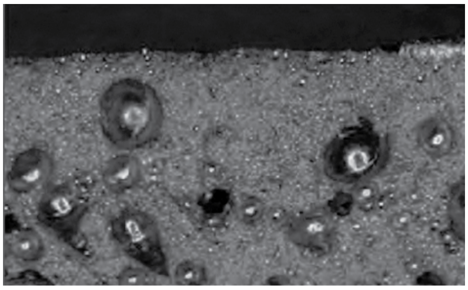

Fig 3. Scattered porosity in internal structure after nick-break testing.

Tips for Reducing Weld Joint Porosity

When experiencing porosity problems the first course of action is to identify the source of hydrogen that is responsible for producing the porosity.

- Purchase electrodes and rods that have been diamond shaved to eliminate harmful oxides
- Purchase low dew point shielding gases
- Clean the base metals by solvent cleaning or etching and then stainless steel wire brushing prior to assembling the weld joint
- Use shielding gas flow rates and purge cycles recommended for the welding procedure and position being used.
- Monitor torch angle to ensure air is not being aspirated into the protective inert gas shield
- Increase gas cup size and gas flow rate, if required.
- Ensure that the base metal and electrode are not wet with condensation
- Put spacers between the base metal members (plates for example) to allow air to circulate.
- Allow the welding material to reach room temperature prior to welding
- Store unpackaged electrode and rods in a heated cabinet or room
- Do not weld in drafty conditions.
- Avoid excessive spatter build-up inside gas nozzle
- Use the correct contact tip to work distance.
- Avoid exhaust contamination from compressed air tools.
- Do not use anti-spatter compounds.
- Check for water leaks in water-cooled welding systems.
- Check for cooling system shut off capability between duty cycles.
- Check for inadequately pure shielding gas (as supplied)
- Argon should be 99.997% pure (-76°F or lower dew point)
- Helium should be 99.995% pure (-71°F or lower dew point)
- Check for imperfections within the gas delivery line such as leaks
- Prevent hydrated aluminum oxide
- Avoid cutting fluids and saw blade lubricants

- Avoid grinding disc debris

CRACKING

The majority of aluminum base metals can be successfully arc welded without cracking related problems, however, using the most appropriate filler alloy and conducting the welding operation with an appropriately developed and tested welding procedure is significant to success.

Cracking Mechanism in Aluminum Welds (Hot Cracking)

Hot cracking is the cause of most cracking in aluminum weldments. Hot cracking is a high-temperature cracking mechanism and is mainly a function of how metal alloy systems solidify. There are three areas that can significantly influence hot cracking in an aluminium welded structure:

- Susceptible base material chemistry
- Selection and use of the appropriate filler metal
- Choosing the most appropriate joint design

Hot Crack Sensitivity Curves

Aluminum crack sensitivity curve diagrams (Fig. 4) are a very helpful tool for understanding why aluminum welds crack and how the choice of filler alloy and joint design can influence crack sensitivity.

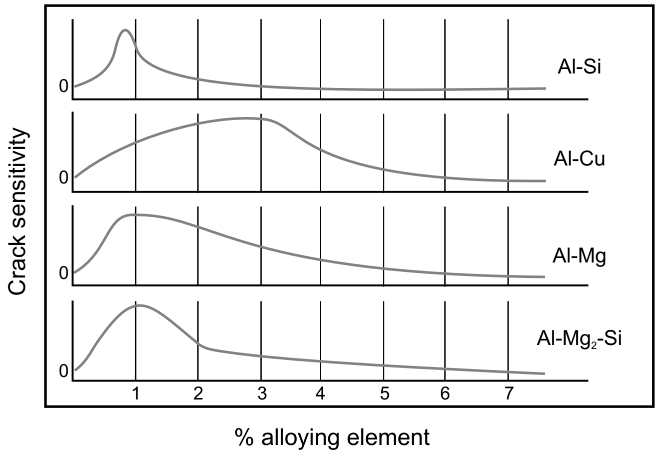

Fig. 4. Crack Sensitivity Curve

The diagram shows the effects of four different alloy additions - Silicon (Si), Copper (Cu), Magnesium (Mg), and Magnesium Silicide (Mg_2Si) – on the crack sensitivity ofaluminum. The crack sensitivity curves reveal that with the addition of small amounts of alloying elements, the cracksensitivity becomes more severe, reaches a maximum, and then falls off to relatively low levels

Controlling Hot Crack Sensitivity

Thus, it is clear that crack sensitivity of an aluminium base alloy is primarily dependent on its chemistry and so it can be inferred that the crack sensitivity of an aluminium weld is also dependent on its chemistry.

With the knowledge of the two principles that can reduce the incidence for hot cracking which are: first, when welding base alloys that have low crack sensitivity, always use a filler alloy of similar chemistry and secondly, when welding base alloys that have high crack sensitivity use a filler alloy with a different chemistry than that of the base alloy to create a weld metal chemistry that has low crack sensitivity. Porosity and cracks are usually formed because of narrow band between solidus and liquidus. Double pulsing is a likely solution wherein a low frequency DC pulse is superimposed. AC GMAW, even though very expensive, provides excellent control for thin sections.

When considering the welding of the more commonly used 5xxx series (Al-Mg) and the 6xxx series (Al-Mg-Si) aluminum base alloys, these principals are clearly illustrated.

The Effect of Weld Joint Design on Hot Crack Sensitivity

The weld joint design also affects the chemistry of the weldment based on the extent of melting of the base metal. The following two figures Fig. 4 A & B shows how the joint design influences cracking.

Stress Cracking

In addition to primary cracking due to chemistry there are many more reasons which lead to cracking in aluminium weldment. Some of the typical problems faced and their plausible solutions are given below:

Problem: Excessive shrinkage rates during weld solidification and further cooling.

Solution: Correct filler metal choice with higher Si content has an effect on reducing stress cracking.

Problem: Excessive base metal melting and increased shrinkage stresses resulting from too slow a travel speed.

Solution: Increase travel speed to narrow the heat affected zone and reduce melting.

Problem: A fillet weld that is too small or concave may not withstand shrinkage stresses, and crack.

Solution: Increase fillet size and/or adjust weld profile.

Problem: A weldment that is highly restrained during the welding process may develop excessive residual stresses which may result in welding cracking.

Solution: Remove excessive restraint and/or apply a compressive force during welding.

Problem: Termination cracking at the end of the weld bead (crater cracks).

Solution: Termination cracks can be reduced by increasing travel speed at the termination of the weld or by doubling back for a short distance at the end of the weld

WELD DISCOLORATION, SPATTER AND BLACK SMUT

Discoloration, spatter, and smut from contamination are other types of problems often faced during welding of aluminium. Presence of Mg is one of the major causes of these problems.

The Magnesium in aluminium alloys vaporizes in the arc and condenses as a black powder next to the weld bead and causes discolouration and black smut.

Small spatter and vaporized Mg are thrown outside of the arc plasma column. Increased black smut and spatter are encountered next to the weld bead with 5xxx filler metal alloys. Introduction of oxygen into the shielding gas envelope via air, moisture, and contaminants will increase the burning (oxidation) of the filler metal producing discoloration, spatter, and smut.

To Minimize Weld Discoloration, Spatter and Black Smut

Some of the simple way to minimize these defects are:

- Use a 4xxx filler alloy vs 5xxx
- Air contains both oxygen and moisture which causes weld discoloration and smut buildup
- Minimize air in the shielding gas.
- Keep electrode covered while on the welding machine or in storage to minimize oxidation, moisture condensation, and other contamination
- Degrease base metal with the correct solvents
- Solvent clean and use stainless steel brush only.

INADEQUATE WELD BEAD ROOT PENETRATION AND FUSION

Penetration and fusion are controlled by the welder, the weld joint design, the weld procedure, the welding equipment,and the shielding gas characteristics.

To increase root penetration and fusion the following actions may help:

- Increase welding amperage and reduce arc travel speed
- Decrease arc length and/or increase amperage to increase penetration.
- For better fusion, solvent clean and then wire brush base metal prior to fit-up to remove
- Hydrocarbonsand oxides. Fusion will not occur across an oxide barrier
- Remove all edges that have been cut with a band saw
- For heat treatable aluminum alloys, remove all edges that have been cut by melting
- Use stringer beads, do not weave
- Redesign the weld joint to improve access to the root, incorporate a 60° bevel to allow better penetration and wider fusion in the weld root.

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AWS Changes Standards for Welding Consumables

AWS has just announced a new Standard, AWS A5.36/A5.36M, for flux cored and metal cored electrodes called Specification For Carbon And Low-Alloy Steel Flux Cored Electrodes For Flux Cored Arc Welding And Metal Cored Electrodes For Gas Metal Arc Welding. The scope of this specification prescribes requirements for the classification of carbon and low-alloy steel flux cored electrodes for flux cored arc welding (FCAW), either with or without shielding gas, and carbon and low-alloy steel metal cored electrodes for gas metal arc welding (GMAW). This new specification replaces both AWS A5.20/A5.20M,Specification for Carbon Steel Electrodes for Flux Cored Arc Welding, and AWS A5.29/A5.29M, Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding. It also includes provisions for the classification of carbon and low-alloy steel metal cored electrodes which previously had been classified according to AWS A5.18/A5.18M,Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding, or AWS A5.28/A5.28M,Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding, as applicable. Iron is the only element of the undiluted weld metal deposited by the electrodes classified under this specification whose content exceeds 10.5%.

This new AWS A5.36/A5.36M specification utilizes two classification systems. The first of these is a "fixed classification system" which has been carried over to this specification from AWS A5.20/A5.20M or AWS A5.18/A5.18M, as applicable, for the classification of those carbon steel flux cored electrodes or carbon steel metal cored electrodes which, with the specific mechanical properties specified for them in AWS A5.20/A5.20M or AWS A5.18/A5.18M, and popular for single and multiple pass applications. The classification designations and requirements for these specific electrodes are unchanged from those previously specified in AWS A5.20/A5.20M or AWS A5.18/A5.18M. A listing of these electrodes with their requirements is given in Table 1 of the new specification.

This AWS A5.36/A5.36M specification also utilizes a new, "open classification system" which is introduced in this document for the classification of carbon and low-alloy steel flux cored and metal cored electrodes. The open classification system uses designators to indicate electrode type (Usability Designator), welding position capability, tensile strength, impact strength, shielding gas (with more options and new designations), condition of heat treatment, if any, and weld deposit composition. The change to an open classification system is being made to allow for the classification of flux cored and metal cored electrodes with classification options which (1) better define the performance capabilities of the advanced electrode designs that have been developed, and (2) reflect the application requirements of today's marketplace. In addition, the provision has been made in this document for the classification of metal cored electrodes (usability Designator T15) and two new electrode types (Usability Designators T16 and T17) for the classification of metal cored and flux cored electrodes designed for use with AC power sources with or without modified waveforms. The EXXT-2X classification has been discontinued. Electrodes previously classified as EXXT-2X can now be classified under the new open classification system without requiring a unique "2" Usability Designator. The EXXT-13 electrode classification has been discontinued due to lack of commercial significance. For a complete listing of the affected existing electrode classifications and the corresponding equivalent classifications using the open classification system under AWS A5.36/A5.36M, refer to A9 in Annex A of he specification. Two additional changes to note are (1) the fillet weld test, previously required under AWS A5.20/A5.20M and AWS A5.29/A5.29M (and also detailed in ISO 15792-3) is not a required test under AWS A5.36/A5.36M, and (2) the preheat viii AWS A5.36/A5.36M:2012 and interpass temperature requirements for the "D" optional, supplemental designator have been modified for better agreement with AWS D1.8/D1.8M, Structural Welding Code—Seismic Supplement."

It is worth noting the followings:

- Standards AWS A5.18 and AWS A5.28 will continue to exist, but will deal only with solid wire products.
- Standards AWS A5.20 and AWS A5.29 will be archived and the contents merged into AWS A5.36.

SOME RAMIFICATIONS

The new standard, which takes effect immediately,

...continued on Page 10

Precipitation hardening martensitic stainless steel and its welding*

Precipitation hardening (PH) stainless steels are iron-chromium-nickel alloys with corrosion resistance superior to that of the hardenable 400 series stainless steels and yield strengths of 585 to 1795 MPa. These high strength are obtained by precipitation hardening a martensitic or austenitic matrix with one or more of the flowing elements: Cu, Al, Ti, Nb, and Mo. Precipitation hardening steels can be grouped into three types – martensitic, semiaustenitic and austenitic – based on their martensite start and finish temperatures and resultant behaviour upon cooling from a suitable solution treatment temperature. 17- 4PH stainless steel is one of the most popular martensitic stainless steels amongst the PH stainless steels.

Weldability

17- 4PH stainless steel is typical of the martensitic PH steels. It weldability is superior to that of the standard austenitic stainless steels because, due to its low carbon content, it does not require preheat to prevent cracking in thicknesses up to 100 mm. The welding conditions used for arc welding 17- 4PH stainless steel are essentially the same as those used for joining the standard austenitic stainless steels. However, neither welds nor base metal have the high ductility of the austenitic stainless steels, so care must be taken to avoid the presence of stress risers. One common form of stress riser is the built-in notch at the root of a partial penetration weld. If design requirements dictate partial penetration welds, the initiation of cracks at the root of the weld can be avoided by making the root pass with a ductile, low-strength filler metal such as type 308L, and then completing the balance of the weld with a matching high-strength heat-treatable filler metal.

Arc Welding-Base Metal Conditions for Welding

Depending on the thickness and level of restraint, 17-4PH stainless steel can be welded in the annealed (A) or an overaged (H1100) conditions. The welding of material in conditions H900 through H1075 is generally not recommended. Material up to 25 mm thick can usually be welded in condition A provided that the weld is not very heavily restrained. Highly retrained welds or welds in heavier sections are best welded in conditions H1100 or H1150.

Filler Metals

Type 630 covered electrodes and filler wires, which deposit weld metal that closely matches 17- 4PH base metal in composition and heat treatment response are used when high-strength welds are required. Austenitic filler metals, such as type 308L, can be used for joining 17- 4PH when high strength is not required in the joint. Welds made with austenitic filler metals are less susceptible to hydrogen embrittlement than those made with martensitic filler metals and may be used in the as-welded condition.

Postweld Heat Treatment

In the as-welded condition, the weld metal and the high-temperature regions of the HAZs of welds in 17- 4PH stainless steel have structures consisting primarily of untempered martensite plus a small amount of ferrite. Weldments exhibit an aging peak in the HAZ and a weld metal hardness that is only slightly less than that of the base metal in condition A. Weldments in 17- 4PH stainless steel are not usually put into service in the as-welded condition except for repair welds where PWHT is impractical. In order to obtain weld properties approximating those of the base metal, PWHT is necessary. For single-pass welds made with the base metal in condition A, a simple aging treatment of 1 to 4 hours at 480 to 620°C is usually sufficient. It simultaneously hardens the weld metal, HAZ, and base metal and lowers the residual stresses associated with the weld. Because only slight overaging occurs in the portion of the HAZ that is heated into the aging temperature range during welding, joint efficiencies of 97 to 100% are obtained. In multipass welds, the repeated heating from the deposition of successive beads may leave a variation in structure from bead to bead that will result in non-uniform response to the aging treatment. Consequently, in the aged condition, weld yield and ultimate tensile strengths are only about 65% and 80 to 90%, respectively, of the base-metal values. Solution treating the weld before hardening reduces the weld metal and HAZ ferrite contents and improves weld metal uniformity and response to heat treatment. As a result, weld strength increases to 80 to 90% and 90 to 95%, respectively, of the base-metal yield and ultimate tensile strengths. For welds made with the base metal in the overaged conditions, solution treatment is required if it is desired to heat treat the weldment to a higher strength level. In general, if the weld deposit is less that 13 mm in thickness, fairly good tensile properties can be obtained even if the solution treatment is omitted prior to aging. However, the toughness of the weld metal decreases with aging temperature above 540°C probably due to and unfavourable carbide morphology. Therefore, if weld deposits are 13 mm or greater in thickness and a postweld solution treatment is not feasible, an age-hardening temperature of 550°C or lower is suggested.

**Adapted from ASM Handbook, Vol 6, Edition 2007, Welding, Brazing and Soldering*

FastMig X - A New Standard of Professional Excellence

If you want to be on top of your game, want to be the best in what you do, you need to have technological edge that guarantees your professional excellence. With FastMig X, Kemppi presents you a new black series of highest-class pulse welding solutions for demanding industrial applications.

INTRODUCTION

The world's leading arc welding equipment manufacturer Kemppi Oy. Finland, has introduced FastMig X power source series designed for high quality welding and professional use. FastMig X is the next generation welding excellence where FAST indicates 'Formula Arc System Technology'.

FastMig X is not a standard machine but a multi-purpose welding solution. It is a flexible setup of high-quality components, selected to precisely match with customer welding needs. It is assembled for the perfect setup for high-quality pulse welding that saves energy, time and money. The key components are:

- Special processes
- Welding management software
- Welding programs and functions
- Special tools

The power sources

The FastMig X 450 and FastMig X 350MV are multi-process CC/CV power sources, representing the most efficient and high-quality power source technology available in the market.

The wire feeders

One can choose wire feeder model optimized for sheet welding or other specialised fabrication job.

The software

For FastMig X systems there are Wise™ and Match™ software solutions that further increase welding performance in specific applications.

Welding quality

Kemppi's FastMig X features three alternative high-end configuration recommendations for three different purposes: FastMig X Regular for robust workshop use – a MIG/MAG pulse welding, mainly for welding thick plates, FastMig X Pipe for pipe and root welding and FastMig X Intelligent for demanding welding applications, for all metals and processes, including welding of thin sheets.

FastMig X offers the best alternative overcoming the drawbacks of TIG welding and Plasma transferred arc welding with powder due to slow deposition rate.

BENEFITS

There are certain distinct benefits while using FastMig X. They are

- FastMig X is five times faster than TIG process
- Outstanding durability. FastMig X is built to last
- Welding quality control is achieved through arc quality.

CONCLUSIONS

In the field of high-quality multi-process welding, whatever your needs may be, FastMig X is what you are looking for. FastMig X is not one standard machine. It's a flexible setup of high-quality components, always selected to precisely match your welding needs.

Contact: Nivek Agencies. Email: nivek@vsnl.net

...Lead Article continued from Page 6

WELD BEAD CONTOUR AND PENETRATION

The Aluminum Association state that the welder learns to set the correct arc length mostly by sight and sound, which is true. This part provides a better understanding of the science involved and to give more guidance on what are the effects of changing the voltage and amperage in the welding process.

Proper voltage, amperage, and travel speed are selected to make a MIG weld determines the shape, size, and penetration of the weldbead. The shape, size, and penetration of the weld bead required for a specific welded component varies based on the weldjoint design, section sizes of the components being welded and on the mechanical strength requirements of the finished weldment. Other considerations such as visual requirements are also to be considered.

Voltage controls the length of the arc. As the voltage is increased, the arc length increases. As the arc length is increased, the weld bead penetration is decreased, and the weld bead profile becomes lower and wider.

CONCLUSION

Welding of aluminium is not difficult but like any other metal it also has its own specific needs which requires to be met or else weld defects will appear. The above article is an attempt to give glimpse of some of the major and common defects one encounters while welding aluminium and their plausible cause and remedies. If the precautions as mentioned above are taken the possibility of getting the defects becomes low.

...Education continued from Page 7

pulls together all tubular products (both metal core and flux core) from four existing standards and combines them in one standard that harmonizes labeling. From now until the end of 2015, manufacturers may list both the old and new AWS classifications on their packaging. As of Jan 1, 2016, classification to AWS A5.36/A5.36M will be required.

ASME has not yet recognized the new standard. However, in most cases, ASME adopts AWS filler specifications in ASME Section II Part C. If ASME does adopt the new AWS standard, all ASME-compliant welding procedure specifications that refer to the old AWS specifications will become technically incorrect. Anyone using these welding procedures will need to revise their procedures to use the new consumable classifications.

This specification makes use of both U.S. Customary Units and the International System of Units (SI). The measurements are not exact equivalents; therefore, each system must be used independently of the other without combining in any way when referring to weld metal properties. The specification with the designation A5.36 uses U.S. Customary Units. The specification A5.36M uses the International System of Units (SI). The latter are shown within brackets ([ ]) or in appropriate columns in tables and figures. Standard dimensions based on either system may be used for the sizing of electrodes or packaging or both under the A5.36 and A5.36M specifications.

Safety issues and concerns are addressed in this standard, although health issues and concerns are beyond the scope of this standard. Some safety and health information can be found in nonmandatory Annex A, Clauses A5 and A10. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1 and applicable federal and state regulations.

This transition will affect mechanized and semiautomatic welding processes in the industry quite dramatically. However, the timelines for the transition are not yet clear.

Recent Developments in Plasma Cutting

An electrically neutral state is produced when a gas is heated to a very high temperature (5 to 7 thousand degrees or higher) and called plasma state or thermal equilibrium plasma.

The plasma cutting system (Fig.1) utilizes heat generated by arc discharge. Arc discharge heat forms working gas into the plasma state of high temperature; the plasma jet of high temperature and high-speed is blown out from the nozzle; and the cutting object material is melted to be cut.

Recent Developments

Plasma cutting has undergone significant developments in the recent past since 80s and it gained popularity. Some of the major developments are describe below:

In 1980, plasma arc cutting equipment manufacturers introduced equipment using air as the plasma gas, particularly for low-amp plasma systems. This opened a new era for plasma arc cutting which increased the world market size about 50 times.

With the new thrust given to the plasma arc cutting industry through increased competition, many new improvements were introduced which made the process easy to use. Power supply designs using solid state primary and secondary converter technology improved arc characteristics and reduced the size and weight of the systems. Hypertherm made other contributions on contact start torch which eliminated high frequency arc starting, and the air-injected shield nozzle, which protected front end parts during metal piercing.

In early 1970, it was found that hafnium and zirconium did resist the rapid deterioration which occurred with oxygen plasma arc cutting. Air and oxygen as plasma gases thus became gases of extreme interest.

In 1983, Hypertherm succeeded with an improved torch design that made it possible to use oxygen as the plasma gas and oxygen plasma cutting became the major development in plasma arc technology. Oxygen plasma cutting offered a wide range of dross-free cutting speed conditions, increased cutting speed by up to 30%, while operating at lower current levels, and produced smooth, square, and softer edges. Oxygen injection plasma cutting circumvented the electrode life problem by using nitrogen as the plasma gas and injecting oxygen downstream at the exit of the nozzle.

In the 1990s, the atomic power industry was faced with two major challenges viz. how to extend the life of existing nuclear plants and how to dismantle non-operational plants. Since a major part of the components are made of stainless steel and under water cutting was required, plasma cutting was a desired method. In 1990 Hypertherm's PAC500 1000 amp plasma system was successfully used to cut up 4 1/2" (114 mm) stainless steel heat shields under 15 feet (4.56 m) of water. Also in 1990, the MAX100 and MAX200 were used underwater in several locations at a depth of 25 feet (7.62 m).

To further improve the cut quality, in the early 1990s the first high quality plasma installation of 40 to 90 amps, which produced a squarer cut and reduced kerf width with increased cutting speed was carried out. The expectations are that a plasma cut will soon be of the same quality as a laser cut. Since plasma equipment is much lower in capital cost than a laser unit, it is expected that this type of plasma cutting will become a major competitor in today's laser cutting market.

Since air and oxygen plasma cutting have become more popular, the major issue has become the short life cycle of their consumable parts. The major manufacturers of plasma cutting systems are working on this issue.

In one of the recent developments Hypertherm has introduced in the market a plasma cutting machine which has inbuilt high pressure air supply unit. This has eliminated the requirement of a high pressure air connections or a compressor.

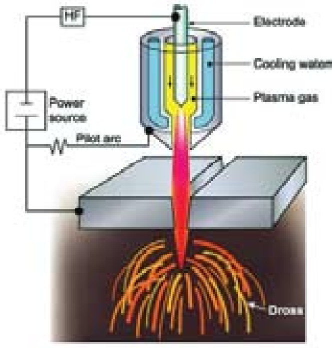

Fig. 1 Schematic diagram of plasma cutting arrangement

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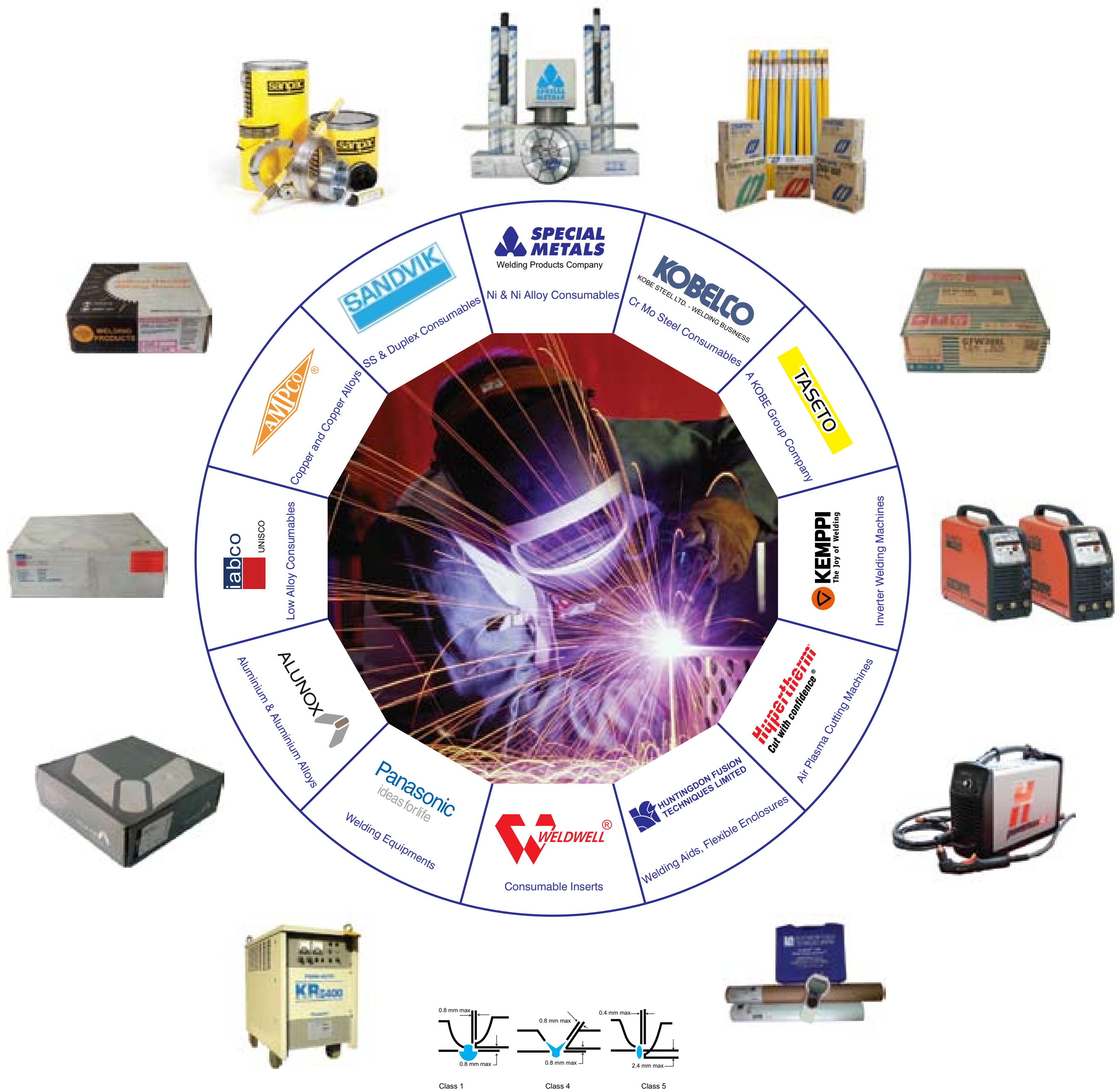

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