WELDWELL

Quarterly newsletter of Weldwell Speciality Pvt. Ltd.

SERVICE TO THE WELDING COMMUNITY

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SPECTRUM

Nivek Agencies stall at the National Welding Seminar (NWS) organized by The Indian Institute of Welding at CIDCO Exhibition and Convention Centre, Vashi, Navi Mumbai, from 9th to 11th December, 2015.

HIGHLIGHTS

- Welding and Applications - High-temperature Creep-resistant Steels for Power Plants
- Importance of Stick-out and gun (torch) angle in GMAW
- Tips for Gas Tungsten Arc Welding of Titanium

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INSIDE

11th Kobelco ASEAN Meet, Bangkok

Kobe Steel, Ltd., Welding Business (KOBELCO) organised their 11th ASEAN Meet at Hotel Millennium Hilton, Bangkok on 19th November, 2015.

Mr. Koshiishi (Managing Director & Head of Welding Business, Kobe Steel Ltd.) opened the meet. He informed that welding division of Kobe was doing best business amongst all other divisions of Kobe Steel though welding has not improved its business over the last year. The presentation was then started by Mr. Koichi Sugiyama, G.M. International Sales. He gave global outlook for total Kobelco business for the next 3 years. It was followed by a presentation given by Mr. Hama (Head of ASEAN Sales & Marketing). He gave details of the business in ASEAN countries and specified that in last 3 years the business has grown in ASEAN countries and India. Mr. Yamazakin (Technical General Manager of KWAP) gave an introduction of new products for ASEAN market (E6013, E7018 & E71T-1). These products will be manufactured at their new factory in Malaysia.

There were total 100 delegates including Kobelco representatives and the ASEAN Distributors who attended the meet. All invitees and distributors were welcomed on the stage with name flashing on the stage screen to say a few words about themselves. Mr. C.C.Girotra, M.D of Weldwell, India, was given an opportunity to speak. He welcomed all the members and Kobe representatives and thanked the organisers for inviting Kobe India distributors for the first time at the ASEAN meet. He spoke about the high quality of Kobe products and stated that 'Weldwell' has been stocking and selling all Kobe welding consumables in India since the last 20 years (1995). It was also stated that there is considerable potential for Kobe business in India and Kobe should seriously think about putting up a manufacturing facility here in India.

Mementos were distributed to all invitees and distributors after the meeting.

Editorial

Dear Readers,

Welding, being an enabling industry, gets benefited from the Government policies late. The last year has not been particularly a good year. With some incentives for power industry and improvements in coal supply situation let us hope welding industry will see a better new year.

Environmental pollution is of very high concern today. To mitigate pollution Improving fuel efficiency by increasing the operating temperature and pressure is seen as a possible solution. As a result the attention was given to develop materials which can withstand these harsher operating conditions. The lead article covers High-temperature Creep-resistant Steels for Power Plants – Welding and Applications. The education section has elaborated this aspect of GMAW. GMAW is a common technique though we often ignore the importance of stick-out and gun (torch) angle in GMAW. Usage of titanium welding is significantly increasing. But unfortunately not many can do it properly. We have tried to provide some Tips for Gas Tungsten Arc Welding of Titanium in this edition in the technical section. There were a number of interesting activities that took place in the last quarter. Weldwell participated in two important events viz. 11th Kobelco ASEAN Meet, Bangkok and National Welding Seminar (NWS) and Weld India 2015. India was invited for the Kobelco ASEAN Meet for the first time. Mr. C.C.Girotra and Mr. NavinBadlani represented India in the meet.

The Editorial Board of Weldwell Spectrum wishes all our readers a HAPPY AND PROSPEROUS NEW YEAR 2016

Dr. S. Bhattacharya
Editor

Event

National Welding Seminar (NWS) and Weld India 2015

The Indian Institute of Welding organized the National Welding Seminar (NWS) at CIDCO Exhibition and Convention Centre, Vashi, Navi Mumbai, from 9th to 11th December, 2015.

The seminar was inaugurated by Mr. B.Narayan, Group President, RIL. In his inaugural speech he emphasized on skill development particularly for the unemployed youths. He requested IIW-I to take up training of welders who are ready for welding IBR coded jobs. There is an acute shortage of such qualified welders. He lamented that in India, qualified welders do not get the respect they deserve. This image needs to be improved to attract more youth to the welding profession. Dr. S.Guruprasad, Director, Research & Development Establishment, Pune was the Guest of Honour. The inauguration addresses were followed by award distribution including Weldwell Speciality Award to Dr. Hrishikesh Daas for best thesis in the field of welding. Keith Memorial lecture by Dr. Madhusudan Reddy of DMRL and Dr. Placid Rodriguez Memorial lecture by Mr.Krishnan Sivaraman of L&T Ltd. concluded the session.

There were seventy three technical papers presented in eighteen sessions held in parallel in three different auditoriums. The papers covered wide range of subjects which were academic in nature to one of industrial use. More than 200 delegates attended the seminar. The seminar concluded with a lively valedictory session.

Concurrently an international exhibition - Weld India 2015, was also organized at the same venue from 10th to 12th December, 2015. There were 65 exhibitors from US, European Union, Japan and China in addition to Indian exhibitors. Nivek Agencies also displayed their products very impressively. AWPM organized a welder's skill competition using weld simulator which attracted good response. Over four thousand visited the exhibition.

High-temperature Creep-resistant Steels for Power Plants - Welding and Applications *

One of the major polluting sectors is fossil fuel power generation. Improving fuel efficiency by increasing the operating temperature and pressure is a possible solution. Materials withstanding these harsher operating conditions are Molybdenum containing steels. Welding of such steels is covered in this write-up.

Introduction

To cut down the emission of polluting CO_2 from power plants it was considered necessary to operate them at higher temperature and pressure. This improved the fuel efficiency resulting in emitting lower amount of pollutants. The materials of construction too had to meet these harsher operating requirements. The creep resistant property of these materials played an important role. Molybdenum has been the key alloying element used to develop creep-resistant ferritic steels for service temperatures up to 530°C. Figure 1 shows that future ultra-super-critical (USC) plant efficiency. Creep-resistant ferritic steels continue to be the materials of choice for power plants, oil refineries and petrochemical plants worldwide. Improvements, especially of the creep strength, have been achieved by alloying with vanadium, niobium, tungsten and boron. Ferritic steel grades appear to reach their limit at live steam temperatures around 620°C. Future USC power plants will need to use austenitic steels and, more likely, superalloys like Inconel 617 in areas of the highest temperatures. Such alloys contain up to 10% Mo.

Applications

The main application areas of creep-resistant steels are power generation and petrochemical plants, which use all product forms. Steam turbines require large forgings and castings, whereas pressure vessels, boilers and piping systems require tubes, pipes, plates and fittings. In addition to high creep strength, other material properties like hardenability, corrosion resistance, and weldability are also important. The relative importance of these properties depends on the specific application. Creep-resistant ferritic steels are classified into C-Mn steels, Mo steels, low-alloy Cr-Mo steels, and 9-12%Cr steels. Because of the large number of different steel grades, Table 1 includes only a few representatives typical of each group.

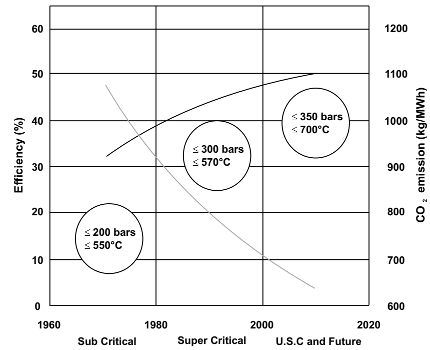

Fig. 1. *Effect of operating conditions on efficiency and emissions of steam power plants.*

Mechanism

In Mo steels, the solution hardening provided by 0.3% molybdenum is the main reason for the increase of creep rupture strength shown in Figure 2(a). 9NiCuMoNb5-6-4, widely known as WB 36, shows a dramatic increase of yield strength over 16Mo3, partly caused by niobium's grain-refining effect. Additional hardening by copper precipitation also increases the yield strength. Molybdenum's strengthening potential cannot be used fully, since creep ductility decreases strongly with increasing molybdenum content. Another limitation in the application of Mo steels is decomposition of iron carbides above 500°C, known as graphitization. A solution to both problems was to alloy with chromium in combination with molybdenum. In fact, Cr-Mo steels were the first to allow steam temperatures in power stations to exceed 500°C. The creep-rupture strengths of these alloys exceed those of the simple Mo steels by a substantial margin [Figure 2(a)] because of their

**From the website of International Molybdenum Association and AWS Welding Handbook, 8th Edition, Vol.4*

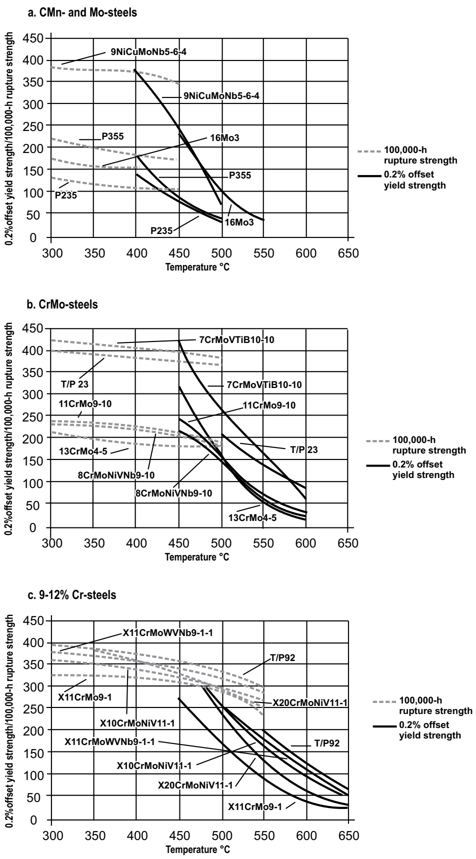

Figure 2. *Creep-rupture strength of heat-resistant steels*

higher Mo content. Cr-Mo steels form chromium carbides that are stable above 500°C, which prevents graphitization. Chromium also improves oxidation resistance at higher temperatures. The strengths of the newly developed steels are raised considerably by additional alloying with titanium, vanadium and boron in the case of T/P24, and tungsten, vanadium, niobium and boron in T/P23.

The increase of chromium to above 7% in Cr-Mo steels leads to a group of steels containing martensite. This microstructure introduces a new element of structural hardening. Further improvements, especially of the creep strength, have been achieved by alloying with vanadium, niobium, tungsten and boron. The introduction of such steels allowed major increases in power plant efficiency. The transformation behavior and microstructure of this alloy are comparable to those of X11CrMo9-1. The higher creep-rupture strength of X20CrMoNiV11-1 results mainly from the larger volume of $M_{23}C_6$ carbides in the microstructure, a result of the alloy's higher carbon content. The modified 9% Cr steel T/P91 (EN designation: X10CrMoVNb9-1) invented in the USA is now used in power plants all over the world, both in new plants and in refurbishment work

Table 1 *Standard high-temperature structural steels*

EN designation	ASTM grade	Chemical composition (mass%)						
		C	Cr	Ni	Mo	V	Nb	Others
Mo Steels								
16Mo3		0.12 –0.20			**0.25 –0.35**			
9NiCuMoNb5-6-4		max. 0.17	max. 0.30	1.00 –1.30	**0.25 –0.50**		0.015–0.045	0.50-0.80 Cu
Cr-Mo-steels								
13CrMo4-5	T/P11	0.10 –0.17	0.70 –1.10		**0.45 –0.65**			
11CrMo9-10	T/P22	0.08 –0.15	2.00 –2.50		**0.90 –1.20**			
8CrMoNiNb9-10		max. 0.10	2.00 –2.50	0.30 –0.80	**0.90 –1.10**		min. 10x%C	
7CrMoVTiB10-10	T/P24	0.05 –0.10	2.20 –2.60		**0.90 –1.10**	0.20 –0.30		0.05-0.10 Ti 15-70 ppm B
	T/P23	0.04 –0.10	1.90 –2.60		**0.05 –0.30**	0.20 –0.30	0.02 –0.08	1.45-1.75 W
9-12% Cr-steels								
X11CrMo9-1	T/P9	0.08 –0.15	8.0 –10.0		**0.90–1.00**			
X20CrMoNiV11-1		0.17 –0.23	10.0 –12.5	0.30 –0.80	**0.80 –1.20**	0.25 –0.35		
X10CrMoVNb9-1	T/P91	0.08 –0.12	8.00 –9.50	max. 0.40	**0.85 –1.05**	0.18 –0.25	0.06 –0.10	
X11CrMoWVNb9-1-1	T/P911	0.09 –0.13	8.50 –9.50	0.10 –0.40	**0.90 –1.10**	0.18 –0.25	0.06 –0.10	0.90-1.10 W
	T/P92	0.07 –0.13	8.50 –9.50	max. 0.40	**0.30 –0.60**	0.15 –0.25	0.04 –0.09	1.50-2.00 W
	T/P122	0.07 –0.13	10.0 –12.5	max. 0.50	**0.25 –0.60**	0.15 –0.30	0.04 –0.10	0.30-1.70 Cu 1.50-2.50 W

of high-pressure/high-temperature piping systems. Although the carbon content of T/P91 is lower than that of X20CrMoNiV11-1, its creep rupture strength is distinctly higher. This improvement is achieved by alloying with vanadium and niobium. T/P91 takes advantage of finely dispersed type MX Nb/V-carbonitride precipitates for additional strengthening. It was essential to balance the alloy's composition because the optimum MX-precipitate dispersion and particle size can be achieved only by optimizing the Nb/V ratio and nitrogen content. Subsequently, new steel grades like (T/P911), T/P92 and T/P122 have been developed based on T/P91. These grades represent the current state of development for creep-resistant ferritic steels. Ferritic steel grades appear to reach their limit at live steam temperatures around 620°C. Future USC power plants will need to use austenitic steels and, more likely, superalloys like Inconel 617 in areas of the highest temperatures (Figure 3). Such alloys contain up to 10% Mo.

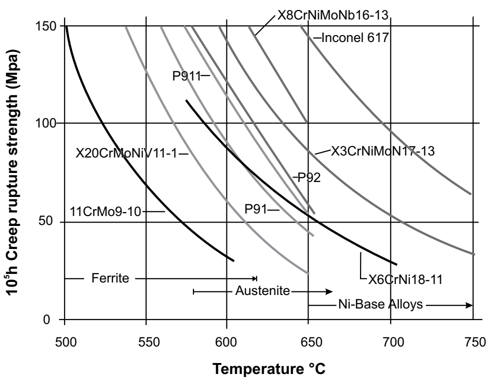

Fig. 3. *Materials for main steam pipes in power plants*

Welding of Cr-Mo Steels for Power Plant Applications

Cr-Mo steels are readily joined using, the welding and brazing processes commonly used for carbon steel.

Joint Design

Joint design used in Cr-Mo steel weldments should minimize notch conditions which might contribute to stress concentration. Sharp corners and rapid changes in section size are to be avoided. Fit-up for single-welded joints should assure complete join penetration without excessive melt-through.

Preheat

Preheat is required to prevent hardening and cackling when welding Cr-Mo steels. Recommended minimum preheat and interpass temperatures for various thicknesses are given in table 2. These temperatures generally increase with the alloy content and the section thickness.

Table 2: *Recommended minimum preheat temperature*

Steel	Up - 13 mm (° C)	13 - 25 mm (° C)	Over 25 mm (° C)
½ Cr-½ Mo	40	95	150
1 Cr-½ Mo 1 ¼ Cr-½ Mo	120	150	150
2 Cr-½ Mo 2¼ Cr-1 Mo 3 Cr-1 Mo	150	175	175
5 Cr-½ Mo 7 Cr-½ Mo 9 Cr-1 Mo 9 Cr-1 MoV+Nb+N	175	210	210

The preheat and interpass temperatures should be increased if cracking is encountered, particularly if hydrogen is suspected as the cause. Higher preheat temperature should be employed when the carbon content of the steel exceeds 0.15%. Unless limited by applicable codes and regulations, lower preheat and interpass temperatures may be used if the welding heatinput is relatively high or the available hydrogen is very low, as in gas tungsten arc welding (GTAW).

Based on industrial experience, some general suggestions can be made regarding interruption of the heating cycle during the welding of Cr-Mo steels. These suggestions should not be applied indiscriminately; rather, they should be interpreted in the light of the specific job conditions and the general factors given previously. Planned interruptions of the welding procedure in which the weld is allowed to cool to room temperature should be avoided, unless intra-weld soaking or other heat treatment is used to prevent cracking. In any case if a procedure interruption must occur when welding a section thickness of less than 25 mm, then the weld deposit prior to interruption should be at least 33% of the thickness or at least two weld layers, whichever is greater, for very thick sections, 33% of the thickness may be excessive, and in such cases a minimum weld thickness should be specified. The heating cycle may be interrupted safely with Cr-Mo steel containing less than 4% Cr in thickness under 25 mm provided the welding is performed under low-hydrogen conditions. When the welding consumables are a potential source of hydrogen, such as with covered electrodes, the temperature of the weld should be raised above the preheat and interpass temperature by 55°C), and held there for one hour before cooling to room temperature, to allow hydrogen to escape, this step is not necessary when the welding consumables are essentially free of hydrogen. When the chromium content exceeds 4% or when thickness exceeds 25 mm postweld heat treatment should proceed immediately after welding is completed. Alternatively, a short tempering treatment (about 20 minutes) at 650 to 700°C may be applied to the weld joint before dropping the metal temperature to below preheat requirements.

Filler Metals

The filler metal should be low-hydrogen type and should have the same nominal composition as the base metal except for carbon content, which normally is lower than that of the base metal. When several grades of Cr-Mo steels are to be welded on one job, limiting the number of different filler metals used will simplify material control. Filler metal of the same or slightly higher alloy content can be used for welding several Cr-Mo steels. For example, 2 ¼ Cr-1 Mo filler metal can be used for 1¼ Cr-½Mo or 2Cr-½Mo steels. In any case, each welded joint must possess the required properties for the intended service after postweld heat treatment. Where service requires corrosion or oxidation resistance, the characteristics of the filler metal and base metal should be matched as closely as possible. The most frequently used electrode-flux combinations for submerged arc welding deposits are 1¼Cr-½ Mo and 2 ¼Cr-1Mo weld metals. In general, the weld metal is lower in carbon, manganese, and chromium and higher in silicon than the electrode. Usually the electrode contains less than 0.50% silicon, but the weld metal may contain up to 0.80% because of flux reactions. Deoxidized welding rod containing at least 0.50% silicon should be selected to avoid porosity in the weld. The carbon content of the filler metal may be 0.05% or less (ER80S-B2L as an example for good ductility and corrosion resistance). Low-carbon consumable welds in thin sections of steels containing 0.5 to 2.25% Cr and 0.5 or 1% Mo. However, since low-carbon electrodes have lower high- temperature properties, they should not be selected if creep is a design consideration.Typical carbon content of weld metal is about 0.07%.

Type 309 austenitic stainless steel, and some high nickel alloys such as ENiCrFe-3, are used as filler metals to weld Cr-Mo steels to stainless steels and nickel alloys. They are sometimes preferred for applications in which the weldment cannot be given a postweld heat treatment due to their lower yield strength and better ductility than “as-welded” Cr-Mo steels. Thus, they behave like a plastic hinge, absorbing most of the strain and thereby reducing the risk of cracking in the Cr-Mo base metal. However, an austenitic stainless steel filler metal is not satisfactory for a Cr-Mo welded joint if the joint will be subjected to cyclic temperature services. This condition can promote early failure, particularly when aided by carbon migration. When joining dissimilar Cr-Mo steels, or when joining carbon steels and Cr-Mo steels, a filler metal with a composition similar to the lower-alloy steel or to an intermediate composition is commonly used for butt joints. Normally, the weld metal need not be stronger or more resistant to creep or corrosion than the lower-alloy base metal. An exception to this is the attachment of auxiliary parts where the weld metal becomes an integral part of the main structure. In this case, the filler metal should yield weld metal with mechanical and chemical properties equivalent to those of steel in the main structure.

“Here’s to the crazy ones. The misfits. The rebels. The troublemakers. The round pegs in the square holes. The ones who see things differently. They’re not fond of rules. And they have no respect for the status quo. You can quote them, disagree with them, glorify or vilify them. About the only thing you can’t do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think they can change the world, are the ones who do.” - Apple Inc.

Importance of Stick-out and gun (torch) angle in GMAW*

The basic technique for GMAW is quite simple. The electrode is fed automatically through the torch. GMAW requires only that the operator guide the welding gun with proper orientation and position along the area being welded. The electrical stick-out is the distance between the end of the contact tip and the end of the wire. The short, normal or long stick-out length influences the electrical characteristics and thereby the weld bead profile. An increase in the electrical stick-out results in an increase in the electrical resistance. The consequent increase in temperature has a positive influence in the melt-off rate of the wire that will have an influence on the weldbead profile. With a long stick out, the wire heats up too much from resistance and melts off at a different rate. It is not as crisp and does not have as much arc force as when a short stick out is used. Keeping a consistent contact tip-to-work distance (the stick out distance) (Fig. 1) is important, because a long stick-out distance can cause the electrode to overheat and also wastes shielding gas. Stick-out distance varies for different GMAW weld processes and applications. The orientation of the torch is also important - it should be held so as to bisect the angle between the workpieces; that is, at 45 degrees for a fillet weld and 90 degrees for welding a flat surface. The travel angle, or lead angle, is the angle of the torch with respect to the direction of travel and it should generally remain approximately vertical. However, the desirable angle changes somewhat depending on the type of shielding gas used - with pure inert gases; the bottom of the torch is often slightly in front of the upper section, while the opposite is true when the welding atmosphere is carbon dioxide.

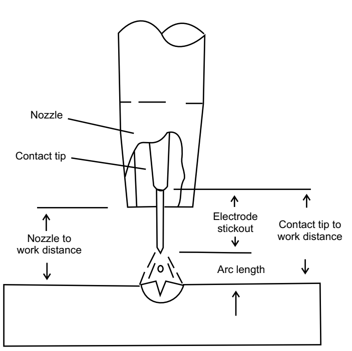

Fig. 1 *Terminologies used in GMAW*

It may be questioned that if the Constant Voltage power source ensures that the arc length is always constant, then if the gun is held farther away from the puddle or held closer why one needs to pay so much attention to maintain proper stick-out. So is it critical to keep the stick-out as constant as possible?

The answer is yes. Yes, it's critical. Although the machine is varying current to keep your arc length (voltage) constant, the amount of heat you are inputting is changing. Heat input is a function of voltage times current. Voltage always stays the same but with a shorter stick-out current is greater so overall heat input is more and vice versa with longer stick-out. So it is important that stick-out stay constant or varied at the right time depending on the needs of the puddle. That way one will create the most consistent welds. A constant stick-out is beneficial, but sometimes hard to accomplish if you need to do a lot of manoeuvring. That is one of the nicer aspects of CV machines and wire feed welding. To achieve good weld deposit wire speed, shield gas pressure, voltage, stick-out, wire size, material, welding position, gun angle, push/drag, and arc characteristics - to name a few - will all be factors to some extent or another. Shortening the stick-out seems to flatten the bead and give a much smoother bead. Holding the torch very close (like 6mm in SST) gives much better quality and better looking welds than holding it a bit farther away, especially for thicker materials.

The stick-out and the voltage setting correspond with each other. If one sets up the machine for a certain amount of stick-out and have fine tuned the voltage to a given stick-out (where one hears just a buzzing sound) however when one starts welding one gets all sorts of sputtering noise and gets a lot of splatter, then, more times than not, change the stick-out (longer or closer) than what the original set up was (stick-out to voltage setting). When MIG welding aluminium in spray transfer mode the wire should stick out about 25mm. This was important, as to short of wire stick-out from the electrode lead

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Tips for Gas Tungsten Arc Welding of Titanium

"Titanium flows like honey...but it's sticky too!"

GTAW of Titanium is hard! GTAW of titanium is easy! I say it's hard and it's easy. So Which is it? The answer is YES. It means yes to both questions.

Well, it is hard because there are more things that need attention than with GTAW of stainless steel. However, the 3 C's nevertheless come into play: CLEAN, CLEAN, and CLEAN. Titanium has to be very clean from oil, grease, coatings, and oxides before welding takes place. Oil or grease will cause porosity like one can see in the x-ray negative of a titanium weld as shown in Fig. 1. But porosity is the least of the problems.

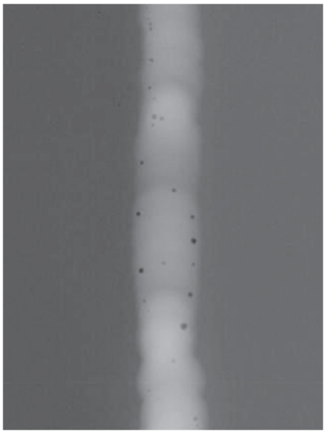

Fig. 1 *Porosity in a titanium weld*

While GTAW Titanium the rod often becomes very gummy and it tends to stick on the outskirts of the weld. However, the same could be avoided by feeding the rod into the center hot part of the puddle.

Titanium Welding Colors

Discoloration on titanium is not a problem by itself and is more of an indicator that there might be a problem. Titanium absorbs elements like oxygen and nitrogen while welding and depending on what reference one uses, say 425°C, seems to be the cut off for keeping the weldment argon shielded. Because it is known that it happens in a certain sequence: straw, brown, purple, blue, dull salmon pink, grey with oxide flakes it is generally a part of the inspection criteria. These images show the varying levels of discoloration in Fig. 2.

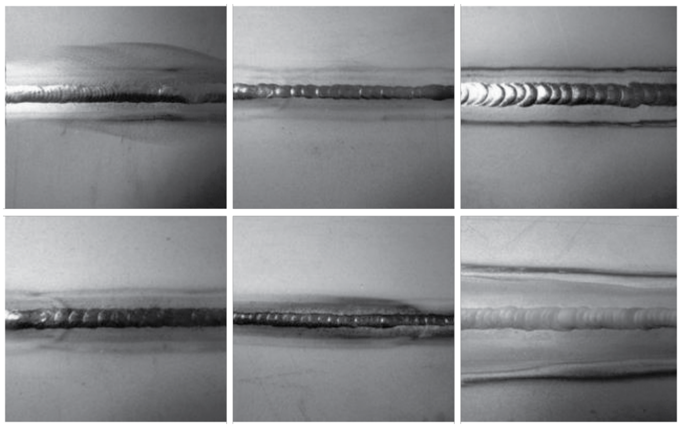

Fig. 2 *Varying levels of discoloration in Titanium weld*

Titanium Welding Colors and Contamination

The worst problems arise from:

1. Using a filler rod other than titanium (like stainless steel or nickel alloy rod)
   - If one welds titanium with anything other than titanium, one will hear the sound of the weld cracking like glass: tink, tink, tink… in fact, one can actually break the weld by tapping it lightly with a ballpen and it is brittle.

2. Not shielding the back side of the weld with argon
   - If what you are welding is thin enough to penetrate or even get red hot, you absolutely must shield both sides of the weld adequately or the weld will be very brittle.

3. Not using a large nozzle/cup or trailing shield to shield the weld puddle
   - Using a normal size nozzle like a #7 (7/16" diameter) will not effectively shield the heated area to prevent the embrittlement that occurs when titanium gets too hot without shielding gas.

Some welding codes limit discoloration to straw color while some other welding codes allow a little blue discoloration in certain applications. Ideally the weld will be perfectly silver like the first weld shown in Fig. 2. That should be the goal. Light straw and even brown discoloration can be acceptable if the discoloration is on the welded side. Discoloration on the penetration side of a full penetration weld means that the actual puddle was exposed to contamination from air. That is why purge monitors should be used to verify purity of purge when welding titanium. For availability and details of purge monitor please contact Nivek Agencies: nivek@vsnl.net

It is a common practice to use a Glove box Welding Chamber welding of Titanium. It is advisable not to build one by yourself. Because by the time one buys the metal, bend it, weld it, buy a flexible enclosure say from Huntingdon Fusion Technologies and start using it straightway. For availability and details of purge monitor please contact Nivek Agencies: nivek@vsnl.net

Shielding of weldment

There is only one shot with titanium welding and since often one has to use oversize homemade or nonstandard cups/nozzles to get adequate shielding, one should better check everything out first to make sure that the shielding works. A titanium disc like the one shown Fig. 3 comes in really handy whether one welds in a chamber or outside with oversize cups and trailing shields. In fact it's an excellent way to make sure that the shielding gas coming out of the cup is good no matter what kind of metal one is welding. You just puddle a small area for a few seconds and then terminate the arc and hold the torch still. If any discoloration other than slight straw is obtained, it means that there may not be good enough argon shielding to weld titanium or anything else. It may be a good idea to carry out one of these titanium weld test coins on the key chain.

Fig. 3 *Titanium disc*

...continued from page 8

to increased burn back. About 18mm is usually good for spray for other materials as well. For thin metal especially it is a big advantage in having the gap between the contact tip and the work very small. It makes things much more controllable, can turn the wire speed down without all the popping one would normally get, and can have the torch at more of an angle so that one can see what he is doing. It is found to be more useful for thin material on outside corner joints.

Stick out will vary from joint to joint, and will depend on the diameter of the shroud, for fillets you can use a smaller shroud this will allow you to get into the corner without excessive stick-out, smaller shrouds give less gas cover but fillets contain the gas.

Torch Angle

As already mentioned that torch angle is equally important. In fact there are two torch angle settings - one along the line of travel and the second along transverse direction of travel (orientation of the torch with respect to the work-piece). The recommended angles of the torch varies based on whether the welding is fillet or butt weld configuration. It is recommended to stay somewhere between perpendicular and 45 degrees to the work-piece based on fillet or butt weld configuration to have a good penetration and shielding. To get auniform penetration and bead 45° for fillet and 90° for butt weld with the work-piece are recommended whereas the angles should be 90° and 45° with respect to line of travel for fillet and but weld respectively.

It is common to hold the gun almost perpendicular to the work or a little bit of push and the head tilted for looking across the weld and the puddle. Holding the torch like that can make it hard to see what's going on under the nozzle (the puddle) though. For a better view, one may tip the head over a bit. It is also recommended that when welding metals of different thicknesses the gun should be steered so it tilts toward the thicker material, but in terms of angling toward or away from direction of travel. This is to have better penetration of the thicker metal and to avoid burn through of the thinner section.

High-Precision Arc Welding Technology

A seminar cum workshop on High-Precision Arc Welding Technology in India was organised by CII in association with Panasonic Welding Systems (PSWI) and Japan International Cooperation Agency (JICA) on 25th November, 2015 at Ahmedabad. Mr. Samir J. Shah, Chairman, CII, Gujarat State, delivered the welcome address in which he emphasised the importance of skill development. He urged entrepreneurs to participate in Make in India programme and congratulated Panasonic who have set an example. Mr Sanjay Prasad, Principal Secretary, Labour and Employment Department, Government of Gujarat, delivered the key note addresses. He too emphasized on skill development and investing in Gujarat. The inaugural address by Mr. Toshihide Takahashi, M.D., PSWI, presented the product range in their Indian factory and its performance. Some of the other eminent faculty included Prof. Amitava De, Indian Institute of Technology, Bombay; Prof. Manabu Tanaka, Director & Chief – Joining & Welding Research Institute, Osaka University; Prof Masaharu Sato, Japan Welding Engineering Society. With an aim to support 'Make in India' vision, this seminar initiative is expected to foster the growth of personnel engaged in the manufacturing sector, Welders and Welding Technologists in particular.

The seminar was followed by a demonstration of high precision spatterless robotic welding at Kurita Machinery. Over eighty delegates from twenty two organisations including three from Nivek Agencies attended the seminar.

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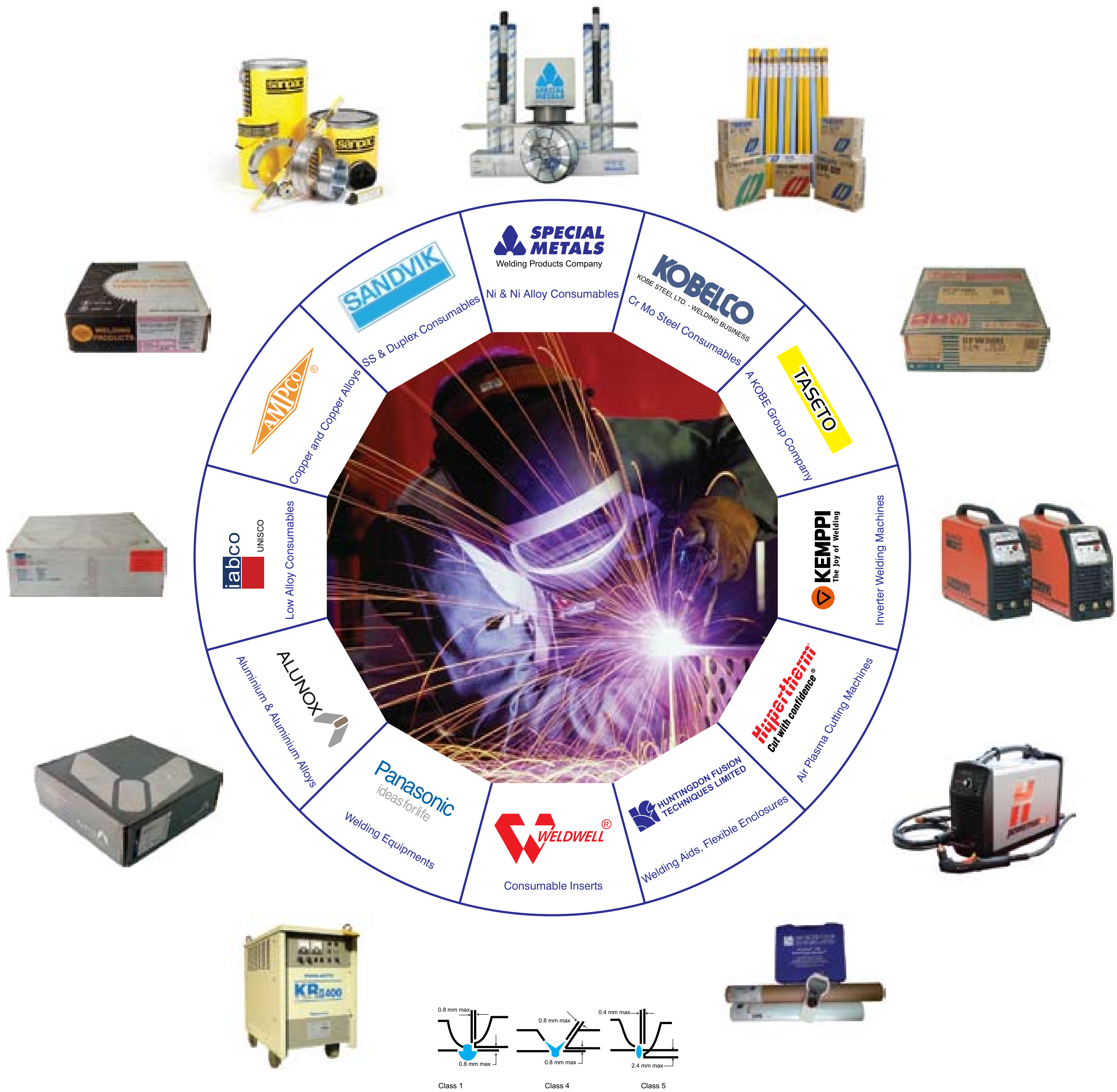

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