Message From The President

Introduction

It is a good time for our term of office to ponder over the future of SWS. We have been in existence since 1976 and have grown in numbers and more importantly our stature. A few years back, we had less than 100 corporate members and to-date the numbers have grown close to 200. Overall active memberships have been stable and average around 400.

Our membership makeup is well represented; we have members from the ship building and repair, aeronautical, oil, gas, chemicals, petroleum and power industry, non destructive testing and inspection companies, testing laboratories, just to name a few.

We must thank the pioneers who formed SWS and saw the need for Singapore to have a society that caters to the welding industries. They recognised the need to have a focal point for networking and growth of the welding industries and welding businesses, and a need for training of personnel and maintenance of skills and standards. Due to their foresight, SWS provides the services to support and assist them, enabling us to grow to this day.

Growth is a vital element. It is this thought that brought us to continually think and to discuss on the "what" and "how" for
the future of SWS. The Technical Forum that we have organised last month was precisely one of the actions. We want to make a start to move into the arena of welding research and development and to be on the frontier of welding technology rather than just being the applicators. We want to explore areas where Welding R & D can assist our members to do things differently and to be more efficient and increase their productivities.

The Institute of Material Research (IMRE), SPRING, and Sintec are providing assistance and support. What we need now is for our corporate members to come forward and participate with us in identifying the areas of needs. This is a significant first step towards the future of the welding industry in Singapore. Our Secretariat will engage you in the coming weeks and we are looking forward to your active participation, without which our move to the future will be difficult.

International Institute of Welding

I attended the usual IIW meeting in Paris and sat at the International Authorization Board (IAB) meeting, Authorized National Body (ANB) both A and B meetings and the Regional Activity (RA) meeting. As we have communicated to you at the last Newsletter, we are on target to be ready for the lead assessor review of the QA system that we are developing. Key personalities from industry, the Authorities and Universities have been invited to sit in the various committees. We are therefore ready to achieve formal endorsement as an IIW ANB.

Asian Welding Federation

The next AWF meeting will be held in South Korea, Seoul on 8 May 2007. Korean Welding Industry Cooperatives and Korean Welding Society will be hosting the meeting. The key focal areas will be on the progress made on the MOS platform, review and final endorsement on the comments on the welder qualification and the Young Researchers forum. The next meeting has also been scheduled and will be held in Indonesia, Bali and the Indonesian Welding Society will be playing the host. It is indeed an encouraging sign that member countries are actively supporting AWF, which is great for the Asian welding industry.

At the last AWF meeting in Bangkok, the ASEAN Welding competition was successfully held, this is another example where AWF can help in promoting higher level of welders’ skills performance and through such event, the welders were given the opportunities to learn from one another. You will read more of this in the article written by Max Ng, Chairman of the Organising Committee for this event.

Social Event

Members’ Nite is one of the regular events that we organise. We had a very relaxing and enjoyable Members’ Nite at the Asia Pacific Brewery. Such event is intended for members to network with one another and also for you to meet with Council members directly. We hope more members will find time to join us in the next one. There are photographs and a write up, in this newsletter by Goh Lak Hee, Chairman, Membership Committee.

Finally, let me thank all who have contributed to make this Newsletter possible and in particular Mabel Chan, from the editorial team who has the difficult task of coordinating the timely submissions of articles and getting the print on time.

Till the next issue, take care, be safe and hope to hear your comments.

Ang Chee Pheng
President
SWS
IIW Meeting in Paris

The IIW Meeting took place in Paris from 12-19 January 2007, attended by Mr Ang Chee Pheng, President of SWS.

International Affairs

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Singapore Welding Society (SWS) and Institute of Materials Research and Engineering (IMRE) successfully organised a Welding Technology Forum at IMRE on 13 February 2007. More than 50 people from local companies, research institutes and universities took an active part in the Forum.

Mr Ang Chee Pheng, SWS President and Dr Lim Khiang Wee, Executive Director of IMRE gave warm welcome addresses. They both highlighted the importance of welding technology and encouraged close collaboration in welding-related R&D between SWS corporate members and A*Star research institutes such as IMRE, SIMTech (Singapore Institute of Manufacturing Technology) and IHPC (Institute of High Performance Computing).

Dr Emma Philpott, Cluster Manager of IMRE and Dr Sun Zheng, Business Manager of SIMTech made informative and lively presentations on the R&D capabilities of the two institutes. The participants at the Forum were invited to have a guided tour of the labs and they were deeply impressed by IMRE’s facilities for new materials development and nanoscale characterization of materials and structures.

Of great interest to the audience was the presentation on SPRING Singapore’s Technology Innovation Programme (TIP) by Mr Too York Lou, Head, Technology Specialists and Mr Yeoh Choon Jin, Manager, Technology Specialists. After the presentation, the two officers from SPRING Singapore answered many questions about TIP.

It is worthwhile to note that TIP contains a range of very generous co-funding and other support schemes that help Singapore-based SMEs to meet the costs of technology innovation. The co-funding can cover up to 70% of the costs of hiring technical experts on secondment. More information on TIP can be obtained from the EnterpriseOne website at www.business.gov.sg.

Last part of the Forum was a brainstorming and open dialogue session for SWS members to come out with welding R&D ideas that could enhance and improve their business operations. Some members expressed their views about their specific needs for the types of welding R&D in Singapore. Mr Tan Tian Chong, President of SSSS and a special guest of SWS, shared his experience on how R&D helped construction industry. An example given by him was that the computing capability at IHPC has helped considerably to improve design of ventilation systems.

The Welding Technology Forum was the first ever organised by SWS. It has succeeded in serving its purposes of promoting welding R&D in Singapore, exploring collaboration opportunities with A*Star institutes, and helping SWS members gain understanding of R&D co-funding schemes from government agencies.
Welding 9% Nickel Steel for LNG Applications

Authors: Jan Hilkes, Fred Neessen, Lincoln Smitweld bv, Nijmegen, the Netherlands

The welding of 9%Ni steel for LNG applications determines for a great deal the structural integrity of the total construction. It is therefore very important to evaluate the welding processes that can be applied as well as the possibilities in type and chemical composition of the consumables. The optimum combination should provide the best mechanical properties to assure the integrity in combination with a suitable economy. The requirement for 9%Ni steel LNG tanks these days are very strict and have been increased over the years to make optimum use of the strength of this material. Combining all the specifications for projects Lincoln has recently been involved in would give the following mechanical requirements for the weldmetal of the consumables to be used for welding 9%Ni steel:

- **Yield Strength:**
  - > 430 MPa
- **Ultimate Tensile Strength:**
  - > 690-825 MPa
- **Elongation:**
  - > 35 %
- **Impact Toughness (CVN):**
  - > 70 J @ -196°C
- **Lateral Expansion:**
  - > 0.38 mm @ -196°C
- **Shear fraction:**
  - > 80 % @ -196°C
- **CTOD:**
  - > 0.30 mm @ -165°C / -196°C

**Welding Processes for 9%Ni steel**

The welding processes suitable for welding 9%Ni steel are most of the actual arc welding processes such as with stick electrodes (SMAW), with solid wire and gas (GTAW & GMAW) and with submerged arc welding wire & flux (SAW). The gas welding processes are very suitable for shop-welding of piping and thin plate material but are usually not very appropriate for site welding under severe outdoor conditions that could jeopardize the gas-protection needed to assure the quality of the welded joint. Particularly GTAW is also very low in deposition rates, which makes it unfavorable for a reasonable economy. Manual GMAW requires very skilled welders with an endless concentration ability to keep the proper pace required for sufficient welding progress in the vertical up position. In addition, this process is relatively prone to welding failures such as lack of fusion, especially in heavy thickness applications.

Welding with stick electrodes however, is still a very flexible and viable process for welding under site conditions, all positions and all materials. A respected economy is also offered when using high recovery electrodes that are 450mm long. Whenever feasible submerged arc welding offers the highest productivity due to increased deposition rates, especially when mechanized as for example with girth welding systems. This process is suitable for almost all fillet and butt welds in the horizontal welding position. For site welding of 9%Ni steel storage tanks the most effective welding processes are SMAW and SAW.

**Welding consumable considerations**

Welding consumables for 9%Ni steel have been a subject of discussion as long as the base material is around which means for over five decades. Consumables have been developed from “matching” ferritic types to high Nickel alloys as 80Ni/20Cr/0.26C. Obviously, consumables with 80% nickel are extremely expensive and are more suitable for heat resistant applications. “Matching” ferritic consumables with up to about 12% nickel would offer an economic advantage in sheer cost of the product, but are still not accepted as a viable solution for storage tanks in sizes that are common in today’s industry. Although a matching ferritic consumable has been successfully applied by mechanized GTAW to build a spherical model tank with 2m diameter under laboratory conditions, this process is not widely used on site for welding storage tanks with 27.5mm thickness and 75m diameter.

Matching ferritic consumables with submerged arc welding has been used successfully in the production of 9%Ni steel pipe. However, to obtain the required mechanical properties a post weld heat treatment had to be applied. This is feasible in a pipe factory but utterly difficult and impractical if not impossible on site or under most site conditions. Some literature indicates that matching consumables with GMAW and GTAW in 20mm plate only show 17 and 20% elongation respectively. One of the drawbacks of the matching consumable is the low elongation. Because it is similar to that of the base material, the residual stresses will be highest in the HAZ since on neither side of the HAZ the material can give in. For this reason consumables are needed that have a high elongation (>35%).

A further point of interest is thermal expansion, the LNG tank expansion and contraction while in service. LNG storage tanks, with all the welded joints, are subject to extreme thermal cycles. When the difference in coefficient of thermal linear expansion for the 9%Ni steel and the weld metal are too different, high thermal stress concentrations may give rise to thermal fatigue and failure of the tank. The coefficient of linear thermal expansion should therefore be as low as possible and that of the weldmetal should be as close as possible to that of 9%Ni steel. Obviously matching consumable would score best but would not be an alternative for reasons as discussed before.
Figure 6 shows the coefficient of linear thermal expansion for 9%Ni steel in comparison with various types of weldmetal in function of the temperatures. The consumables included are an E308L type of stainless steel with 19Cr/9Ni, an ENi-CrFe-2 type of nickel alloy with 70Ni/19Cr and an ENiCrMo-6 type of nickel alloy with 68Ni/13Cr/6Mo. This graph shows that the ENiCrMo-6 type of consumable has a coefficient of linear thermal expansion that is closest to that of the 9%Ni base material. This is no coincidence because this type of consumable has been designed for welding 9%Ni steel.

Welding consumables for 9%Ni steel
As discussed above before the sensible choice of consumable for welding 9%Ni steel is within the high nickel alloy range. Both for ductility/elongation and thermal expansion reasons nickel alloy consumables are the most appropriate. Obviously the cost of consumables is always being evaluated but all the properties, features and structural integrity that are present when using nickel alloy consumables, still offer the best overall solution. Within the scope of this paper the consumables for the SMAW and SAW processes will be discussed specifically and in more detail.

The welding consumable options with chemical composition and mechanical properties for SMAW covered electrodes are listed in Figure 7 with the corresponding classification according AWS A5.11. Depending on the specific project requirements a selection can be made. Although it seems that many options are at hand, only two electrode types meet the actual requirements as listed at the beginning of this chapter. The typical All-Weld-Metal (AWM) values listed show that the NiCro 60/20 (ENiCrMo-3) and Nyloid 2 (ENiCrMo-6) provide sound properties with sufficient cushion in view of the mentioned requirements. The Nyloid 2 is the most economical option of the two, both for cost of the product and for higher economy during welding because it is especially designed for welding 9%Ni steel. It also meets the CTOD, lateral expansion and shear fraction requirements at -196°C. This electrode has been around for over 30 years and has been constantly improved and updated following the higher industrial standards and requirements for LNG storage tanks. In this context it should be noted that Nyloid 2 is also very suitable for economical welding of 3.5 and 5%Ni steel, as will be mentioned to in the chapter on applications. Specific features and benefits of the Nyloid 2 electrode are:

- Basic coated stick electrode for all welding positions
- 150 % recovery
- Weldable on AC as well as DC
- Electrode length is 350mm, except for 5.0mm with a length of 450mm
- Standard vacuum packaging in Sahara ReadyPack (SRP)
The basic coating provides optimal resistance against hot cracking due to the purifying effect on the weldmetal. All position capability applies to all sizes except 5mm diameter, which is most suitable for down hand welding. A recovery of 150% implies that in addition to the 100% weldmetal derived from the core wire an extra 50% of weldmetal is produced from the electrode covering. This in addition with 450mm electrode-length gives a high productivity and high economy. The electrode is designed with a nickel core wire to have a low electrical resistance in order to prevent overheating and subsequent deterioration of the covering. Weldability on AC is required since 9%Ni steel is notorious for having some magnetism that could give arc blow with possible subsequent weld-defects. Another advantage is the Sahara ReadyPack which is a vacuum packaging containing a convenient amount of electrodes for the welder and which assures the required quality and condition of the electrodes used on site. As far as production is concerned, the electrodes can be manufactured according any lot classification, e.g. C3 or C5, as defined in AWS A-5.01-92. It also makes sense to obtain corresponding test certificates with actual values for the respective lot of electrodes.

The welding consumable options with chemical composition and mechanical properties for SAW wires and wire/flux combinations are listed in Figure 8 with the corresponding classification according AWS A5.14. As for the electrodes there are various options for welding consumable selection. Apparently the ER NiMo-8, ER NiMo-9 en ER Ni-CrMo-8 types of submerged arc welding wire are more used in Asia than in Europe and the USA. More common for this part of the world are ERNiCrMo-3 (LNS NiCr 60/20) and ERNiCrMo-4 (LNS NiCrMo 60/16) wires. Together with the appropriate submerged arc welding flux the wire/flux combination will provide very satisfactory results, meeting the requirements as listed at the beginning of this chapter. Available fluxes are P7000, P2000, P240 and LW380. P7000 is designated “SA AB 2 69 AC H5” according EN 760-96, has a basicity of 2.5 and is especially designed for high nickel alloy wires to assure minimal risk of hot cracking. Due to the high basicity the slag-detachability may not meet expectations. P2000 is designated “A AF 2 63 DC” according EN 760-92, has a basicity of 1.7 and a nicer weldability, including slag release and is designed for stainless steel and nickel alloys. P240 is actually designed for structural steels in offshore applications but with a basicity of 2.9 it will provide crack free weldmetal. In the past P240 with LNS NiCrMo 60/16 has been tested with satisfying results. LW 380 is a fused flux with the advantage of not being hygroscopic, so ideal for site conditions. This flux is used in practice with an LNS NiCrMo 60/16 type of wire. Typical application for this wire/flux combination is welding in 2G position, on both sides simultaneously. Since further information is proprietary no more details can be given. As shown in Figure 8 the wire/flux combinations that meet the requirements as set out in this paper are LNS NiCrMo 60/16 - P2000 and LNS NiCrMo 60/16 - P7000. The All Weld Metal properties for both variations do not differ much. The main difference is in the sensitivity to hot cracking and in cost/kg. LNS NiCrMo 60/20 is lower in cost/kg, for the same diameter, but due to its relatively high.

**Figure 8: SAW consumables for welding 9%Ni steel. (Solid Wires: AWS A 5.14)**

<table>
<thead>
<tr>
<th>Element</th>
<th>ERNiMo-8</th>
<th>ERNiMo-9</th>
<th>ERNiCrMo-8</th>
<th>ERNiCrMo-3</th>
<th>LNS NiCr 60/20</th>
<th>LNS NiCrMo 60/16</th>
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</thead>
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<tr>
<td>C</td>
<td>0.10</td>
<td>0.10</td>
<td>0.03</td>
<td>0.10</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
<td>Mn</td>
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<td>1.0</td>
<td>0.50</td>
<td>0.1</td>
<td>1.0</td>
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<tr>
<td>Fe</td>
<td>10.0</td>
<td>5.0</td>
<td>Rem</td>
<td>5.0</td>
<td>0.4</td>
<td>4.0 - 7.0</td>
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<tr>
<td>Si</td>
<td>0.50</td>
<td>0.50</td>
<td>1.0</td>
<td>0.50</td>
<td>0.4</td>
<td>0.08</td>
</tr>
<tr>
<td>Cu</td>
<td>0.50</td>
<td>0.3 - 1.3</td>
<td>0.7 - 1.2</td>
<td>0.50</td>
<td>0.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Ni</td>
<td>min. 60.0</td>
<td>min. 65.0</td>
<td>47.0 - 52.0</td>
<td>min. 50.0</td>
<td>64.3</td>
<td>Rem. balance</td>
</tr>
<tr>
<td>Co</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N.D.</td>
<td>2.5</td>
</tr>
<tr>
<td>Al</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>Ti</td>
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<td>--</td>
<td>0.40</td>
<td>0.08</td>
<td>--</td>
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<tr>
<td>Cr</td>
<td>0.5 - 3.5</td>
<td>--</td>
<td>23.0 - 26.0</td>
<td>20.0 - 23.0</td>
<td>21.8</td>
<td>14.5 - 16.5</td>
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<tr>
<td>Nb (+Ta)</td>
<td>--</td>
<td>--</td>
<td>3.15 - 4.15</td>
<td>3.84</td>
<td>0.08</td>
<td>--</td>
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<tr>
<td>Mo</td>
<td>19.0 - 21.0</td>
<td>19.5 - 22.0</td>
<td>5.0 - 7.0</td>
<td>8.0 - 10.0</td>
<td>0.08</td>
<td>15.0</td>
</tr>
<tr>
<td>V</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N.D.</td>
<td>0.35</td>
</tr>
<tr>
<td>W</td>
<td>2.0 - 4.0</td>
<td>2.0 - 4.0</td>
<td>--</td>
<td>--</td>
<td>N.D.</td>
<td>3.0 - 4.5</td>
</tr>
</tbody>
</table>

Rm in MPa | Not specified | 760 | 510 | 720 |
Rp0.2 in MPa | 46% | 35% |
Elongation (%) | 80 | 80 |
procedure development for a recent 9%Ni steel project.

In addition to the listed mechanical properties, LNS NiCroMo 60/16 - P2000 also fulfills the previously mentioned requirements regarding CTOD, lateral expansion and shear fraction at -196°C. This has been tested as part of welding requirements regarding CTOD, lateral expansion and shear fraction at -196°C. This has been tested as part of welding procedure development for a recent 9%Ni steel project.

Welding 9%Ni steel LNG tanks with SMAW and SAW

After having discussed the 9%Ni steel base material and the welding consumables it is time to actually start to weld. Figure 9 shows a schematic cross-section of a full containment tank as mentioned before in order to explain the various welding operations on site. It is clearly shown that the 9%Ni steel inner vessel is constructed out of large plates. The sizes depend on the supplier’s rolling and heat treatment capacity and will therefore vary per supplier. For our example the sizes are 2.36 x 3.38m as used for the Dabhol project. The plate thickness ranges from 27.5 to 10 mm for 1st to the 11th course. The shell stiffeners are 6 to 14 mm, the first bottom is 16.7 mm and the secondary bottom is 5 mm. All horizontal and vertical welds are butt welded, stiffeners to shell are fillet welded and the secondary bottom is constructed with lap welds due to one side accessibility.

Welding joint preparations could be carried out by the supplier of the plates, in order to prevent additional handling and treatment on site. Joint preparations on site can be carried out by means of machining, plasma cutting or flame cutting. For the last two, the weld edges need to be cleaned by grinding to remove the overheated layer. When machining is used with a lot of deformation of the edges it is possible to end up with magnetism in the plate. Machining should therefore be carried out carefully in order to prevent this. It is also suggested to also clean the adjacent base material on either side of the joint. Subsequent cleaning with for example acetone is required to prevent any contamination of the weld that could cause defects.

The 16.7 mm annular plates (first bottom) are welded in the flat position with SMAW for flexibility and it can be carried out with more welders at the same time for increased productivity. AC is used to prevent any possible arc blow that may be caused by magnetism in the 9%Ni steel base material. A maximum interpass temperature of 150°C should be respected and a heat input up to about 3kJ/mm is acceptable. High speed root runs are made with Nyloid 2 in 3.2 mm diameter on ceramic backing. The 5 mm diameter and 450 mm long electrode will contribute to productivity for filling and capping. SAW can be used in addition after sufficient weldmetal is present to support the SAW without risking burn through. The groove preparation is a standard V-70° (V-groove with 70° included angle). The lap welds for the 5 mm bottom plate were made with the high recovery Nyloid 2 since the edges are too thin for SAW (also with a tractor).

The first heavy horizontal weld is the first course of the shell to the annular plate, 27.5 to 16.7 mm. Weld preparation is a K-45° with little spacing. Due to limited accessibility the electrodes have been used here as well. With a diameter of 75 mm the welding length of the circumference is 235.5 m to go around the tank once. All vertical welds can be produced with stick electrodes out of position. Roots are usually made with a 2.5 mm electrode and subsequent filling and capping with 3.2 and 4.0 mm. Figure 10 shows a typical joint preparation with weld-bead filling and capping. SAW can be used in addition after sufficient weldmetal is present to support the SAW without risking burn through. The groove preparation is a standard V-70° (V-groove with 70° included angle). The lap welds for the 5 mm bottom plate were made with the high recovery Nyloid 2 since the edges are too thin for SAW (also with a tractor).

During procedure development all optimal currents have been established and documented in Welding Procedure Records, Specifications and Qualifications (WPR, WPS, WPQ). The welder qualifications have been carried out in accordance with the respective WPQ’s. It has to be noted that the welders have to be properly trained and be made aware of the ins and outs of welding 9%Ni steel with a high nickel alloy consumable prior to welding qualifications.

All horizontal weld between the courses can be carried out with SAW after a root has been put in with stick electrodes. For this purpose a girth welding system is used to travel with the equipment along the courses during welding. As discussed it is possible to use the wire LNS NiCro 60/20 or LNS NiCroMo 60/16 both with flux P2000. The diameter is very important since it influences the deposition rate at a given current, hence, also the bead shape and the position of the bead in the joint. Optimum results have been obtained with LNS NiCro 60/20
in 1.6mm and welding parameters as 220-250 A, 30 V and 500-620 mm/min. Depending on the position of the bead in the joint, the parameters are adjusted within this range. Figure 10 shows the weld-joint preparation and bead sequence for submerged arc welding in the 2G position. The first course is 27.5mm and the last four are 10mm, which can all be welded with SAW. The last courses in 10mm will have only have a single-V preparation. An open root will allow a nice root run made with stick electrodes. If for whatever reason the root is closed, full penetration will not be achieved and back grinding with subsequent welding will be necessary. To obtain an optimum deposition rate DCEN polarity is recommended. In general, the deposition rate is primarily governed by the current density in the wire. Obviously the electrical resistance and IR effect in the wire plays a role but the main contribution is current density. Figure 11 shows deposition rates for 1.6 and 2.4mm nickel alloy wire with P2000 for various currents and polarities in the flat position. This shows clearly that a 1.6mm wire can be welded with up to 300 A to give a deposition rate of 150 g/min. To obtain the same deposition rate with a 2.4mm wire, the current has to be at least 350 A. This will be in the area where the bead is unacceptable regarding bead appearance and risk of hot cracking. It would be even more difficult to control the welding, i.e. welding pool and slag, when this was to be carried out in the 2G position. This implies that in order to have a 10-20% higher deposition rate with a 2.4mm as with a 1.6mm, the current has to be close to 400 A. This will not produce the desired bead-shapes and welded joint, hence, there is no need for using wires over 1.6mm. Even when an ENiCrMo-4 type of wire in 2.4mm diameter was to be used with less risk of hot cracking, there would be no advantage towards the welding economy. To be continued.

<table>
<thead>
<tr>
<th>Current</th>
<th>Wire diameter / polarity</th>
<th>Wire diameter / polarity</th>
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<tr>
<td></td>
<td>1,6 mm</td>
<td>2,4 mm</td>
</tr>
<tr>
<td></td>
<td>DC + 30 - 31V (gr/min)</td>
<td>DC + 30 - 31V (gr/min)</td>
</tr>
<tr>
<td></td>
<td>DC - 33 - 34 V (gr/min)</td>
<td>DC - 33 - 34 V (gr/min)</td>
</tr>
<tr>
<td></td>
<td>current density [A/mm²]</td>
<td>current density [A/mm²]</td>
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<td>200</td>
<td>73</td>
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<tr>
<td>400</td>
<td>Accept</td>
<td>125</td>
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</table>

Figure 11: Deposition rate for Submerged Arc Welding with LNS NiCro 60/20 - P2000 in function of welding current, wire diameter and polarity.

**Figure 10:** Weld preparation in 9%Ni steel for welding with stick electrodes (SMAW) in 3G vertical up position and for submerged arc welding (SAW) in the 2G horizontal-vertical position.
An Evening with The Golden Tiger  
- by Goh Lak Hee

A SWS members’ night was organised on 24 January 2007. We received an overwhelming turnout of over 80 members at the home of the Tiger Brewery. The program of the evening included a tour of the brewery, followed by delicious buffet dinner.

At the Tiger Brew House, members were shown state-of-the-art packaging facilities before proceeding to the Tiger Tavern for beer appreciation. All members received an exclusive Tiger Brewery souvenir and a satiated stomach.

Mr Ang Chee Pheng, President of SWS, chatting with members.

Tour of the Tiger Brewery.

Sumptuous buffet dinner at the Tiger Tavern.

Satisfied members relaxing after the tour.
The Thailand Welding competition 2006 was held in conjunction with “METALEX 2006” at BITEC, Bangkok, Thailand. This event was a result of the tripartite cooperation between the Thailand Government (Department of Skill Development, Ministry of Labour), The Thai Welding Society and Reed Tradex Co. Ltd, with support from the Asian Welding Federation.

The objectives of the competition were:
(i) To elevate Thais’ welding skill to international standard.
(ii) To increase Thais’ welding efficiency per government’s call.
(iii) To provide an international stage for welders in ASEAN to compete for the best welder title.

The Singapore Welding Society would like to congratulate the Thai Welding Society for the tremendous success in organising the Thailand Welding Competition 2006.

On 23 - 26 November 2006, Asia was able to witness the best of talents gathered in Bangkok. This was indeed a major milestone for the Thai Welding Society and Asian Welding Federation. We are honored to be a part of this history.

The Singapore contingent consisted of Mr Chow Ngai Mun (SWS), Mr Max Ng (SWS), Mr Krishnan Kumar (Aztech Heat Exchangers Pte Ltd), Mr Lawrence Ong (Mectrade Engineering Pte Ltd) and Mr Xia Zhibo (Mectrade Engineering Pte Ltd). Representing Singapore in the competition were Mr Kumar and Mr Xia, who were winners in the Singapore Welding Competition 2006 held earlier in October.

After rounds of intense competition, the Best ASEAN welder title goes to Mr. Aran Khunharn of Thailand. Our admiration for his excellence welding skill and performance displayed in the competition. Although no luck with the title, the Singapore Team has shown encouraging results in the category as follows:

The Best welder award from other country (except Thailand)
Winner: Mr Krishnan Kumar (Singapore)
1st runner up: Mr Endro Yukristiono (Indonesia)
2nd runner up: Mr Xia Zhibo (Singapore)
Consolation: Mr Ganarajan Michael Nadar (India)

Congratulations and thanks to Mr Kumar and Mr Xia for doing us proud. To sum up, it had been a fruitful expedition for the Singapore Team. Much had been achieved and learnt. A special thank you goes to Aztech Heat Exchangers Pte Ltd and Mectrade Engineering Pte Ltd. We would not have come this far without your support.

Notice of SWS AGM
The 28th Annual General Meeting (AGM) will be held on Friday 25th May 2007 at 1930 hours at the Jurong Country Club (Ficus 2), 9 Science Centre Road Singapore 609078
SWS endorsed the contribution by Mr S Inoue for the strong support of the Thailand Welding Competition 2006, October
NEW MEMBERSHIP

NOVEMBER 2006
Corporate Membership
Verchem Asia Pacific Pte Ltd

DECEMBER 2006
Corporate Membership
ASSP Engineering Services
Corpus Construction & Engineering
Makotoh Pte Ltd
LKW Mechanical Engineering Pte Ltd
China Petroleum 7th Construction Co (Spore Branch)

Full Membership
Arumugam Karthik QA/QC Inspector Hi-Tech NDT Inspection Services (S) Pte Ltd
Terence Tan Wah Hong Engineer Tervin & Karyl Consultants
J Venugopal Inspection EngineerCelanese Singapore Pte Ltd

JANUARY 2007
Corporate Membership
Chino Engineering Construction Pte Ltd
Aedge Technologies Pte Ltd
WEC Engineers & Constructors Pte Ltd

Associate Membership
Lim Boon Kiat Production Manager Siemens Pte Ltd
Rasidah Bte Wagiman QA Co ordinator OMS Oilfield Services
S Saravanan Asst QC Weerah Shima Engineering & Construction Pte Ltd
Chua Sung Huat Inspector Jasscan Inspection Pte Ltd
Chu Chee Hiong Inspector Jasscan Inspection Pte Ltd
Peter Gilo Valdez Technical Officer Worley Parsons Pte Ltd
Derrek See Workshop Asst Manager Diesel & Offshore Engineering Pte Ltd
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<tr>
<th>Name</th>
<th>Position</th>
<th>Company</th>
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<td>Koh Choon Hong</td>
<td>Project Engineer</td>
<td>Siemens Pte Ltd</td>
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<td>Mohammad Basheer</td>
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<td>Bin Abdul Kader</td>
<td>Supervisor</td>
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<td>Manager</td>
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<td>V Srinivasan</td>
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<td>Keppel FELS</td>
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<td>Mohammad Abu Taher</td>
<td>QA/QC Inspector</td>
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<td>E.A.C. Premakumara</td>
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<td>Ramon Pineda</td>
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<td>Ronaldo G Olaes</td>
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<td>Singapore Test Services Pte Ltd</td>
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<td>Mohammad Billal</td>
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<td>Keppel Shipyard Ltd</td>
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<td>Mohammad Musarrof</td>
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<td>Hossen</td>
<td>Mechanical Engineering Technician</td>
<td>Metal Plas Engineering Pte Ltd</td>
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<td>Welding QC</td>
<td>OMS Oilfield Services</td>
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<td>QC Controller</td>
<td>Sun Sup Seng Engineering Pte Ltd</td>
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<td>FEBRUARY 2007</td>
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<td>Corporate Membership</td>
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<td>Krishnamoorthy</td>
<td>Snr Welder</td>
<td>Singapore Technologies Kinetics Ltd</td>
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<td>Manager</td>
<td>LPJ Marine Services Pte Ltd</td>
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<td>Ponnusamy Ramesh</td>
<td>QA/QC Inspector</td>
<td>B Focus NDT Pte Ltd</td>
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<td>Md Nazrul Islam s/o</td>
<td>Lead Welder/QC Inspector</td>
<td>Megaway Engineering &amp; Shipbuilding</td>
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<td>Md Ayub Ali</td>
<td>Civil &amp; Structural Engineer</td>
<td>Jurong Engineering Ltd</td>
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*Interested parties, please contact Ms Carol Lau (Secretariat of iMOS) at (65) 6779 7706 for more details.*

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