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KOBELCO Puts the Customer First with All-in-One Product and Service

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Round Robin Test Reports: Analysis of trace elements in Cr-Mo-V steel weld metal at IIW/C-II/SC-E

Dear KWT readers! It is my pleasure to introduce the most recent Round Robin Test (RRT) results of the International Institute of Welding's Committee II, Subcommittee E (IIW/C-II/SC-E) in which I am one of its members.

The following two RRT results concerning the measurement of impurities in weld metals that have been investigated in the IIW/C-II/SC-E in collaboration with welding consumable manufacturers as well as testing institutes in member countries and chaired by Dr Damian Kotecki were reported at the annual IIW assembly held in Melbourne, Australia, the last July. Below is a summary of the reports.

❶ II-E-705-16 Fourth RRT Report – Trace Elements in Cr-Mo-V Steel Weld Metal (by Damian Kotecki)

Three specimens of 2.25Cr-1Mo-V submerged arc weld metals with varying levels of Pb and Bi around 1 ppm respectively were produced and sent to nine laboratories for the RRTs, of which five employed Inductively Coupled Plasma Mass Spectrometry (ICP-MS), two used Glow Discharge Mass Spectrometry (GD-MS), one used Atomic Absorption Spectrometry (AA) and one used Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) for analysis.

The test results can be concluded as follows:

(1) ICP-OES: Neither Pb or Bi in the specimen could be detected.
(2) ICP-MS: The reproducibility of analysis around 1 ppm of Pb and around 1 ppm or less of Bi was confirmed with a standard deviation of 0.2 ppm and 0.1 ppm or less, respectively.
(3) GD-MS: It could reproduce an analysis within two standard deviations of the ICP-MS average results with one minor exception.
(4) AA: The reproducibility of analysis of Pb was more than two standard deviations higher than the ICP-MS average results but that of Bi was within two standard deviations of the ICP-MS average results.

The latest RRT has clearly indicated that both ICP-MS and GD-MS methods have the reproducibility of Pb and Bi analysis equal to or less than 1 ppm. However, a clear statement cannot be made for AA method, due to insufficient data. In addition, ICP-OES seems unsuitable.

❷ II-E-706r1-16 Position Statement – IIW/C-II: Analysis of Pb and Bi to Assess Susceptibility to Reheat Cracking (by Damian Kotecki)

Reheat cracking has been observed in submerged arc welds in heavy wall 2.25Cr-1Mo-0.25V hydrocrackers after immediate postweld heat treatment. It has been reported by Chauvy and Pillot that this reheat cracking can be attributed to contamination of the weld metal by low levels of Pb, Bi and Sb. These researchers proposed a Reheat Cracking Composition Factor (K Factor) Kf=Pb+Bi+0.03Sb which should be limited to 1.5 ppm, and it has been discussed by various standards organizations including the American Petroleum Institute (API).

However, the reproducibility of analyzing these trace elements at such low levels has been called into question, and a round robin measurement of these trace elements was conducted by IIW/C-II in advance of the IIW endorsing the above proposal. As a result, good reproducibility of analyzing As, P, Sb and Sn was obtained but not of Pb and Bi.

Another RRT was performed in the IIW/C-II with 2.25Cr-1Mo-0.25V submerged arc weld metal containing 1 ppm each of Pb and Bi, and it concluded that the analysis of Pb and Bi at such levels be limited to ICP-MS and GD-MS methods only. The interlaboratory standard deviation of measurement was found to be about 0.2 ppm for Pb and 0.1 ppm for Bi.

Given the interlaboratory standard deviations of measurement observed in the RRT and the well-known statistical fact that a 95% confidence interval for a decision based on measurements involves two standard deviations about the mean value measured, it is apparent that there will be a grey area that must be taken into account when enforcing the proposed Kf in fabrication standards. This grey area is on the order of ±0.5 ppm. This means that, if Kf is limited to 1.5 maximum, any value between 1.0 and 2.0 has to be taken as uncertain. Any accept/reject decision needs to take this uncertainty into account.

Reported by **Hiroshi Saito**
Manager
Quality Management Department
Welding Business

Three "M"s: Marketing, Monodzukuri and Manpower

Dear KWT readers, I wish all of you a Happy New Year! I'd like to express my heartfelt gratitude for your warm patronage to Kobelco products. I also thank you for your kind support of Kobelco Welding Today, which has finally arrived at Volume 20, this year.

"KOBELCO VISION G+," the latest five-year mid-term management plan of the Kobe Steel Group, began last year. In the Welding Business, we'll continue to move ahead to become Asian No. 1, under the slogan "aiming to remain the most reliable enterprise for total welding solutions in the world."

However, demand for welding consumable has become increasingly severe, because, as crude oil prices have fallen, the offshore structure and energy industries have remained sluggish, and orders for ships, particularly bulk carriers, have decreased,

In order to expand our business under such unfavorable winds, it is especially important for us to heighten the quality of our products and services. I would, therefore, suggest that we enforce the "three M powers – Marketing power, Monodzukuri power and Manpower."

One of three "M"s comes from the Japanese term, "Monodzukuri." In the highly reputed world of Japanese quality control, "Monodzukuri" is an important word, much like "Kaizen." "Monodzukuri power" refers to the technical strength and service capabilities that, in addition to stable quality, are relied on by customers worldwide. I'd like "Monodzukuri power" to be well-understood throughout the welding industry.

Last year, at the welding exhibition held in Osaka, Japan, we displayed a newly developed robot-controller, together with welding consumables for diverse industries. We also participated in exhibitions in Beijing, China; Mumbai, India; Moscow, Russia; and Las Vegas in the USA, and I was able to get acquainted with many of you in these locations. As the next German Essen Fair, a once-every-four-years event, happens this year, we plan to advertise our "Monodzukuri power" there.

I, along with other members of the Kobelco team, look forward to visiting your country or region so that we may communicate while taking part in the exhibitions that I mentioned. We hope to learn about your welding issues and needs, as well as enjoy a drink or a meal, if possible. Lastly, I do pray that you may have a successful and fruitful year in 2017.

Fusaki Koshiishi
The Head of the Welding Business
and the Managing Director,
Kobe Steel, Ltd.

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TRUSTARC™ DW-A62LSR (A5.29 E91T1-GM) improves notch toughness of HSLA weld metal after PWHT

In the construction of structures such as spherical tanks and pressure vessels, weldments are subjected to postweld heat treatment (PWHT) in order to reduce the residual stresses induced by welding and for improving the fracture toughness and fatigue properties of the welds. As these structures have grown larger in size and are being operated at even-higher pressures, in tandem with recent growth in energy demand, the steel materials used have been increasingly strengthened. To comply with such a trend, DW-A62LSR, a rutile type flux cored wire (FCW) for HT610 or higher class steel materials, has been developed and confirmed to satisfy the following requirements:

As welded: TS≧621MPa (90ksi), vE≧27J at -60℃
PWHT: TS≧586MPa (85ksi), vE≧27J at -40℃

Table 1 shows the typical chemical compositions of deposited metal with DW-A62LSR.

Table 1: Chemical compositions of deposited metal (mass%)

C	Si	Mn	P	S	Ni	Others
0.05	1.14	1.29	0.007	0.008	2.59	Mo, Ti, B

Figures 1 and 2 show the relationship between PWHT conditions and mechanical properties of the deposited metal.

The effect of heat input (cooling rate at 540℃ [℃/sec], calculated by Rosenthal's equation) on the tensile strength and absorbed energy of deposited metal in as welded and PWHT conditions was studied and the results are shown in Figures 3 and 4, respectively.

A butt joint weld test was conducted under the conditions shown in Table 2.

Figure 5 shows the macrostructures of the welded joints in 1G, 2G and 3G positions. The test results of mechanical properties in as welded and PWHT conditions are shown in Tables 3.

Figure 1: Relationship between tensile strength and the Larson Miller's Temper Parameter (LMTP) LMTP=T(20+log t).
(T: Temperature [K]; t: holding time [hour])

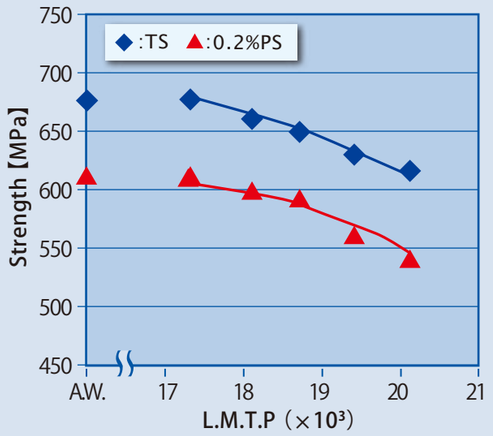


Figure 2: Relationship between absorbed energy and LMTP

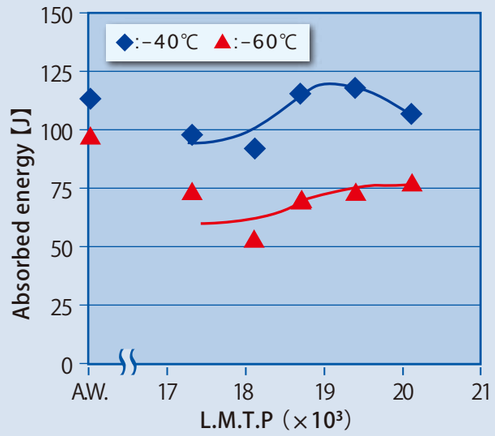


Figure 5: Macrostructure of welded joints (1G, 2G and 3G positions from the left to the right)

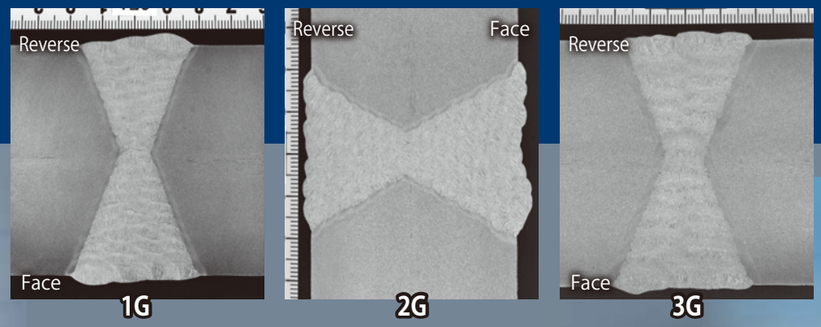
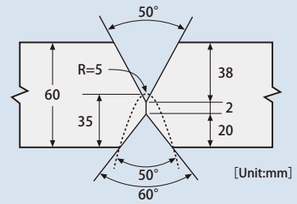


Table 2: Welding conditions

Welding wire	DW-A62LSR (1.2mmΦ)
Base metal	TS610MPa class steel (60mm thick)
Dimension of groove	 After welding the face side, the groove of reverse side was machined to a shape of 50° angle and 35 mm depth.
Welding position & parameters (heat input)	(1) Flat (1G): 270A-28V (1.2 kJ/mm) (2) Horizontal (2G): 260A-28V (0.8 kJ/mm) (3) Vertical-up (3G): 220A-24V (2.4 kJ/mm)
PWHT	As welded & 620℃x 8 hours (LMTP18.7x10³)
Preheating & interpass temperature	90-110℃ and 140-160℃
Shielding gas	80%Ar-20%CO_2; 25 liter/min

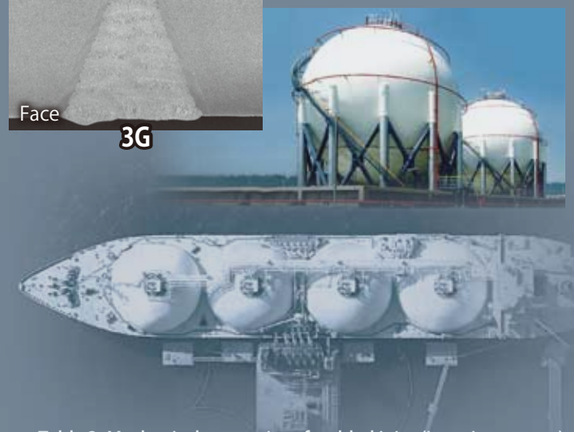


Table 3: Mechanical properties of welded joint (Location: center)

Position	PWHT condition	Tensile properties 0.2%PS [MPa]	TS [MPa]	El [%]	Notch toughness Absorbed energy [J] -60℃	-40℃
1G	AW *1	713	748	22	67	81
	PWHT *2	627	692	22	41	61
2G	AW *1	722	752	22	81	91
	PWHT *2	678	721	27	47	62
3G	AW *1	640	706	24	61	90
	PWHT *2	619	686	28	31	64

*1 AW: as welded *2 PWHT: 620℃ x 8 hours

Figure 3: Relationship between tensile strength and cooling rate at 540℃ in as welded and PWHT (620℃x 8 hours; LMTP=18.7x10³) conditions
Solid line: as-welded; Dotted line: PWHT

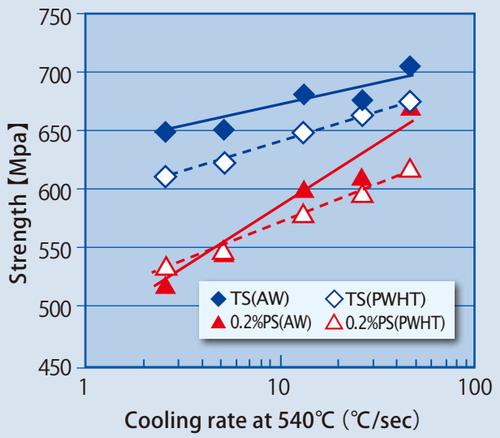
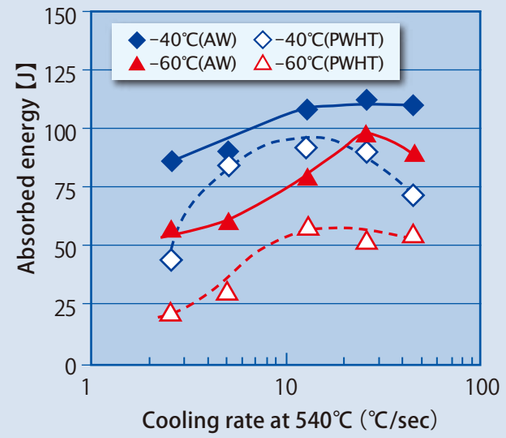


Figure 4: Relationship between absorbed energy and cooling rate at 540℃ in as welded and PWHT (620℃ x 8 hours; LMTP=18.7x10³) conditions
Solid line: as-welded; Dotted line: PWHT



The 7th India Essen 2016 in Mumbai

Dear KWT readers! I have been in charge of sales and marketing of welding systems for the Indian market since the beginning of 2016. Recently, I took part in the 7th India Essen Welding and Cutting that was held in Mumbai, the industrial metropolis located on India's west coast, from October 5 to 7.

There were 125 exhibitors from 15 nations, most of whom displayed general-purpose products for mild steel.

On the other hand, Kobe Steel's Indian subsidiary, Kobelco Welding India Private Limited, focused on welding consumables for pressure vessels like reactors and boilers with displays of CM-95B91 and TG-S90B91, covered electrodes for P91 steel. In addition, Mr Banno, a research engineer with the Welding Process Department at the Technical Center, presented "A study on the Development of Welding Consumables applied to P91 Steel for Thermal Power Plants" at the technical seminar held by the Indian Welding Society (IWS). Happily, it drew the keen interest of many of our customers.

The booth was also aimed at attracting the interest of local agents, under the principles of penetrating the Kobelco brand into the market, searching for powerful and influential partners, and communicating efficiently and usefully with clients. It, therefore, also featured welding consumables for general-purposes, with displays of products made not only by KSL in Japan but also KWK in Korea (DW-100) and KWAP in Singapore (LB-7018-1) as well as panels on welding consumables recommended for shipbuilding, car manufacturing, and robotic welding systems.

During the exhibition, the Kobelco booth was an active spot, with visits by more than 300 potential customers working for around 150 fabricators and agents. I understood this activity as a sign of the great trust customers have toward Kobelco and its products, and was also impressed that the whole world has great expectations for the Indian market.

Reported by **Hajime Kamata**
a member of Global Operations & Marketing Department, the Welding Business

Joint booth of Kobelco group

Kobelco Welding India's booth

Mr Banno's presentation at the IWS technical seminar

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WELDEX 2016: Welding Exhibition in Moscow

Dear KWT readers! I'm happy to describe Kobe Steel's first experience of displaying at a Russian welding exhibition, WELDEX 2016: the 16th International exhibition for welding materials, equipment and technologies. It was held from October 11-14, 2016 at the Sokolniki Exhibition and Convention Center, located in the huge Sokolniki Park, about 5 km away from the center of Moscow.

Held annually, it is the largest welding-related exhibition in Russia; in 2016, 190 world-renowned manufacturers from 17 nations were on hand with displays of welding consumables and equipment.

According to the organizer, about 5,400 visitors from 26 nations as well as 69 regions throughout Russia participated in the show over four days. The Kobe Steel booth welcomed many guests and viewers every day.

The picture above shows an overview of Pavilions 4 in the exhibition hall.

As inquiries from Russian companies in a diverse range of industries, such as pipeline construction, shipbuilding and offshore fabrication, have been increasing, we felt encouraged to exhibit at WELDEX. In accordance with these inquiries, we focused on introducing flux cored wires (FCWs) for both carbon and stainless steels as well as the total welding solutions that would apply to such industries.

As Kobelco's FCW line-up covers a wide range of applications, from carbon to high alloy steels, it has received a high amount of interest from the Russian market. Although the application of FCWs in the market is still limited, it is expected to begin growing in the near future.

Our purpose is to provide our customers with not only good-quality welding consumables but also total welding solutions, including welding education, procedure guidance and automation. For more details, please refer to Kobe Steel's web-site, available in English, Russian, Portuguese and Spanish languages.
http://www.kobelco-welding.jp/index.html

Reported by **Shunji Oki**
Manager, Global Operations & Marketing Department, the Welding Business

Overview of WELDEX Pavilions 4

At the Kobelco booth