New Products & Technologies

KC-50 Gas Shielded Arc Welding Wire for Robot*

Mikio Sakashita** Takarou Matsumoto**

1 Introduction

In recent years, automation such as robot welding is rapidly proceeding, and as a factor obstructing this automation, weld spatter is cited, which is generated during welding at the welding torch. Under these circumstances, in search of reducing weld spatter, investigations on the welding phenomenon, etc., were conducted, and has been developed KC-50 solid wire, which generates a smaller quantity of spatter and have a more stabilized arc compared with the conventional product.

This report introduces the outline of the KC-50 gas shielded arc welding wire for robot.

2 Features of KC-50 Welding Wire for Robot

KC-50 Welding Wire for Robot has the following features:

(1) Weld spatter has been significantly reduced. Compared with the conventional YGW 11, the spatter quantity has been reduced to about 2/3 or below.

(2) Owing to the stabilized arc phenomena, welding has become easy to carry out.

3 Material Characteristics of KC-50 Welding Wire for Robot

3.1 Chemical Composition and JIS Standard of Wire

The chemical composition of the wire is shown in **Table 1**. In the JIS Standard, KC-50 corresponds to YGW 11.

Table 1 Chemical composition of welding wire

(mass%)

C	Si	Mn	P	S	Al	Ti	Ca
0.03	0.70	1.60	0.010	0.004	0.005	0.21	0.0005

Table 2 Standard size, packaged weight and style

Wire diameter (mm)	Style of winding
0.8	S, M
0.9, 1.0	S, M, RPS, RPM
1.2	S, M, RPS, RPM, RPL
1.4, 1.6	S, M, RPL

Note (1) Style of winding
S : Small spool wound (standard weight 10kg)
M : Medium spool wound (standard weight 20kg)
RPS : Small pail pack (standard weight 100kg)
RPM : Medium pail pack (standard weight 250kg)
RPL : Large pail pack (standard weight 350kg)

Standard wire sizes, packaged weights, and styles of winding are shown in **Table 2**.

3.2 Performance of All-Weld Metal

3.2.1 Welding conditions

Welding conditions are shown in **Table 3**. For the welding machine, DC supply of the thyristor control type was used and DCEP was adopted. Further, for the shield gas, carbon dioxide was used.

Table 3 Welding conditions of all deposited metal test

Welding wire (dia.)	Steel plate (thick.)	Current (A)	Voltage (V)	Speed (mm/min)	Heat input (kJ/mm)	Preheat temp. (℃)	Interpass temp. (℃)
KC-50 for robot (1.2 mm)	SM-400A (19 mm)	300	30	400	1.35	30	≦ 200

3.2.2 Mechanical properties

Results of the tensile test and Charpy impact test of all deposited metals of KC-50 welding wire are shown in **Table 4**. Both tensile properties and Charpy impact values fully satisfied the standard values and have become satisfactory values.

* Originally published in *Kawasaki Steel Giho*, **26**(1994)4, 186–187

** Staff Manager, Welding Rod Technology Sec., Shape & Bar Rolling Dept., Mizushima Works

Table 4 Mechanical properties of all deposited metal

Tensile properties[a]				Charpy impact properties[b]		
YP (MPa)	TS (MPa)	El (%)	RA (%)	Absorbed energy (J)		
				20℃	0℃	+20℃
460	550	34	70	100	160	200

[a] JIS Z 3111 A 1
[b] JIS Z 3112 No.4

3.3 Amount of Spatter Generated

3.3.1 Welding conditions

Welding conditions are shown in **Table 5**.

Table 5 Welding conditions of bead on plate test

Welding wire (dia.)	Steel plate (thick.)	Current (A)	Voltage (V)	Speed (mm/min)	Wire ext. (mm)	Shielding gas
KC-50 for robot (1.2 mm)	SM-400 A (19 mm)	300	33	300	20	CO_2
KC-50 conventional type (1.2 mm)						

3.2.2 Results of spatter measurement

Measured results of spatter generated in bead-on-plate welding are shown in **Table 6**. Compared with the conventional material, the spatter of KC-50 is particularly smaller. The reason is that, based on the study of wire composition, globule-shifting becomes smoother and spatter generation at the time of globule-breaking-away has become smaller.

Table 6 Test results of spatter generation

Welding wire	Spatter generation weight (g/min)
KC-50 (for robot)	0.5
KC-50 (conventional type)	0.8

3.4 Stability of Arc

3.4.1 Welding conditions and measuring conditions

Welding conditions are shown in **Table 7**. For the evaluation method of arc stability, an evaluation was made according to the standard deviation value of the welding current under the welding conditions shown in **Table 8**.

Table 7 Welding conditions of arc stability test

Welding wire. (dia.)	Steel plate (thick.)	Current (A)	Voltage (V)	Speed (mm/min)	Wire ext. (mm)
KC-50 for robot (1.2 mm)	SM-400 A (12 mm)	260	32	300	30
KC-50 conventional type (1.2 mm)					

Table 8 Measuring conditions of arc stability test

Measuring recorder	Welding time	Sampling speed	Low pass filter	Buffer memory
AR-1100 (Yokogawa)	60 s	200 Hz	40 Hz	16 K

3.4.2 Results of arc stability test

By the standard deviation value of the welding current, the stability evaluation of arc has been carried out. These results are shown in **Figs. 1** and **2**. It can be found that KC-50 welding wire shows less dispersion in the

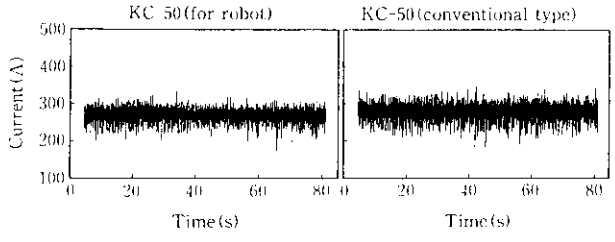

Fig. 1 Current wave of welding

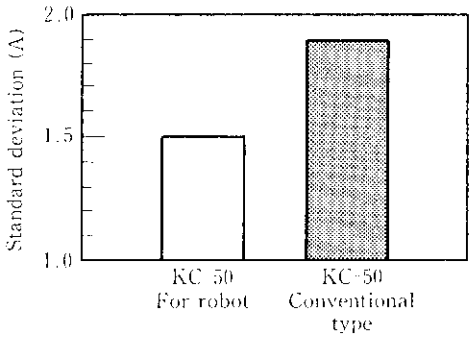

Fig. 2 Test results of arc stability

welding current value than the conventional material and is stabilized.

4 Concluding Remarks

As mentioned in this report, by developing KC-50 solid wire, which produces little spatter and is stable in welding, effectiveness is expected compared with the conventional product, particularly in the automation field such as robot welding.

For Further Information, Please Contact to:
Welding Rod Technology Sec., Shape & Bar Rolling Dept., Mizushima Works
Fax: (81) 86-447-3988 Phone: (81) 86-447-3985
Welding Rod Sec., Welding Rod Sales Dept.
Fax: (81) 3-3597-4158 Phone: (81) 3-3597-4057