New Products & Technologies

FG-50M Metal Cored Wire for Gas Shielded Arc Welding*

Mikio Sakashita** Kazukuni Hase***

1 Introduction

Metal cored wire which contains, in the wire, flux that mainly consists of metal powder, gives a smaller amount of spatter compared with the solid wire, and the amount of slag generated is also smaller compared with that of the conventional wire. In view of these facts, the metal cored wire is recently has particularly come to be used widely in the field where improvement in welding efficiency is desired.

Kawasaki Steel also has newly developed FG-50M metal cored wire for gas shielded arc welding by improving the flux composition, etc. This report introduces the outline of the new wire.

2 Features of FG-50M

FG-50M has the following features, because the flux contained inside the wire mainly consists of metallic powder, as shown in **Fig. 1**:

(1) Compared with solid wire, FG-50M has become capable of more stabilized welding, and its spatter generation has become smaller owing to the effect of arc stabilizing elements such as alkaline metallic oxide, etc., in the flux.

(2) Compared with the conventional fluxed wire, the slag generation of FG-50M has become significantly smaller, because the flux composition is mainly metallic powder, thereby permitting continuous multilayer welding.

3 Material Characteristics of FG-50M

3.1 Standards and Dimensions

The JIS Standard of FG-50M corresponds to YFW-C 50 DM. Standard wire sizes, packaged weights, and styles of winding are shown in **Table 1**.

Table 1 Standard size, packaged weight and style

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

Note (1) Style of winding
S : Small spool wound (standard weight 12.5 kg)
M : Medium spool wound (standard weight 20 kg)
RPM : Medium pail pack (standard weight 200 kg)
RPL : Large pail pack (standard weight 300 kg)

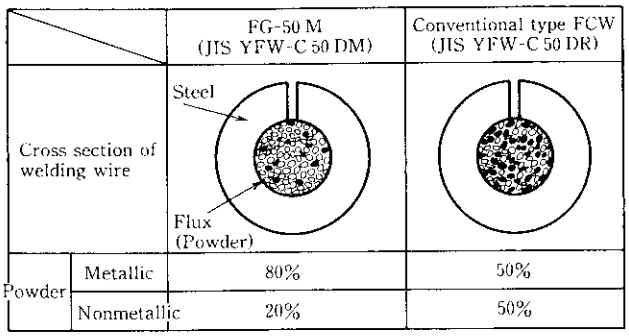

Fig. 1 Comparison of welding wire

* Originally published in *Kawasaki Steel Giho*, **26**(1994)4, 190-191

** Staff Manager, Welding Rod Technology Sec., Shape & Bar Rolling Dept., Mizushima Works
*** Joining & Physical Metallurgy Lab., Heavy Steel Products Res. Dept., Technical Res. Labs.

3.2 Performance of All-Weld Metal

3.2.1 Welding conditions

The welding conditions of FG-50M are shown in **Table 2**. For the welding machine, DC power of the thyristor control type was used, and DC reversed polarity was adopted. Further, for the shield gas, carbon dioxide was used.

Table 2 Welding conditions of all deposited test

Welding wire (dia.)	Steel plate (thick.)	Current (A)	Voltage (V)	Speed (mm/min)	Heat input (kJ/mm)	Preheat temp. (℃)	Interpass temp. (℃)
FG-50 M (1.2 mm)	SM-400A (19 mm)	250	30	300	1.5	30	≦ 200

3.2.2 Mechanical properties

Results of the tensile test and Charpy impact test of all-weld metal of FG-50M are shown in **Table 3**. Both tensile performance and Charpy impact test performance have sufficiently satisfied standard values, thereby giving satisfactory values.

Table 3 Mechanical properties of deposited metal

Tensile properties[a]				Charpy impact properties[b]		
YP (MPa)	TS (MPa)	El (%)	RA (%)	Absorbed energy (J)		
				−20℃	0℃	+20℃
510	570	30	67	65	100	130

[a] JIS Z 3111 A 1 [b] JIS Z 3112 4

3.3 Welding Workability

3.3.1 Amount of spatter generated

Regarding the spatter generated during welding, a comparison was made between FG-50M and solid wire (YGW 11) under the conditions shown in **Table 4**.

Compared with the YGW 11 solid wire, the weld spatter of FG-50M has become less, as shown in **Fig. 2**. By the above, obstacles to welding efficiency such as spatter adhesion to the steel plate have been removed, and reduction in man hours to remove the spatter has become possible.

The reasons why the spatter generation has been reduced are that since the flux that has been included in the wire contains arc stabilizing materials such as alkaline metal oxide, the pushing-up force of the arc to the globule is negligible (**Fig. 3**), and further because the arc

Table 4 Welding conditions of bead on plate

Welding wire (dia.)	Steel plate (thickness)	Current (A)	Voltage (V)	Speed (mm/min)	Wire ext. (mm)	Shielding gas
FG-50 M (1.2 mm)	SM 400 A (12 mm)	250	30	300	20	CO_2
YGW-11 (1.2 mm)						

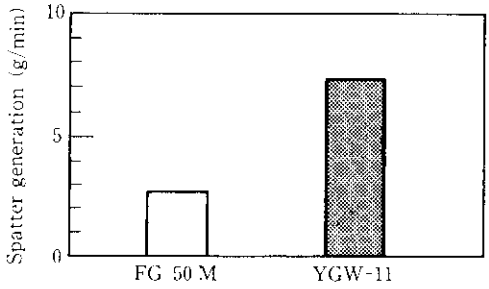

Fig. 2 Test results of spatter generation

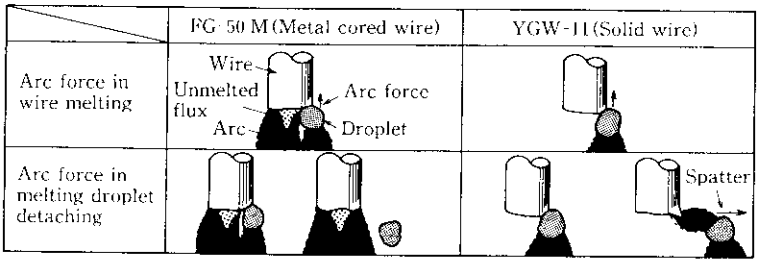

Fig. 3 Arc phenomena of metal cored wire and solid wire

generation between the globule and the wire is small, the dispersion of the globule at the wire tip has become smaller.

3.3.2 Amount of slag generated

Regarding the slag weight generated at the time of welding, a test for comparison with the YGW 11 solid wire and conventional-type flux-cored wire (YFW-C50DR) has been carried out under the welding conditions of Table 4. The result is shown in **Fig. 4**.

When the conventional-type flux-cored wire and FG-50M are compared, the slag generation of the latter has dropped to about 1/2 of the former or below, and has made possible continuous multi-layer welding (about three layers at flat welding). The weld bead appearance of FG-50M, which is shown in **Photo 1**, is compared with that of the conventional-type flux-cored wire. The result shows the exposure of beaded surface in FG-50M, because the slag generation was small.

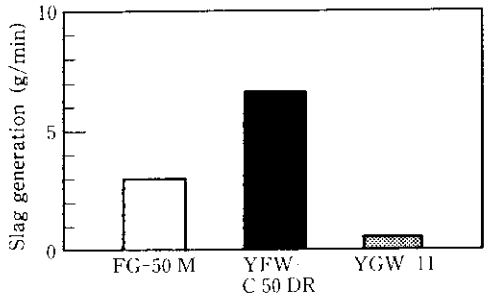

Fig. 4 Test results of slag generation

Photo 1 Bead appearance of FG-50M

4 Concluding Remarks

As mentioned in this report, through the development of FG-50M metal-cored wire, which has caused smaller amounts of spatter and slag generations, a large improvement in welding efficiency compared with the past is expected.

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