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APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

EVALUATION OF A LOCAL MILD STEEL COVERED ARC WELDING ELECTRODES

BY

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ASRCT, BANGKOK 1976

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MISCELLANEOUS INVESTIGATION NO. 86

EVALUATION OF MILD STEEL COVERED ARC WELDING ELECTRODES MADE WITH G.S. STEEL CORE WIRES

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By Narong Sukapaddhanadhi* and Robert Mullin*

SUMMARY

Previous tests on weld-metal prepared from locally produced welding electrodes made with G.S. steel core wire have shown tensile strength exceeding the upper limit called for in the Thai Industrial Standard Specification TIS 49-2516. An attempt has been made to decrease the tensile strength by lowering the carbon content of the steel core wire to about 0.07%. The results indicate that by lowering the carbon content, the strength can be reduced but it still exceeds the maximum limit by a small margin (2 kg/mm^2). All the other properties of the weld-metal, however, conform to the TIS Specification.

INTRODUCTION

An investigation of locally manufactured welding electrodes (Thai Kobe Welding Co. Ltd. and Bangkok Welding Co. Ltd.) using G.S. steel core wires has recently been reported+. It was found that the mechanical properties of the deposited weld-metal prepared and tested in accordance with the TIS 49-2516, could satisfy the minimum requirements of the TIS 49-2516, Grade 4201 and Grade 4202. With all the electrodes examined, it was noted in each case that the tensile strength values were in excess of the maximum limit of the specification, and it was thought that the high strength could partly be due to the relatively high carbon content in the steel core wire. As a result, the present investigation has been initiated to evaluate the mechanical properties of weld-metals produced from core wires with lower carbon content. G.S. Steel Co. Ltd. and Thai Kobe Welding Co. Ltd. have agreed to support the investigation and furnished the materials for ASRCT to perform the tests.

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+BALAJIVA, Kasem and SUKAPADDHANADHI, Narong (1975).—Evaluation of mild steel covered arc welding electrodes made with G.S. steel core wires. Mimeographed. Bangkok: ASRCT. (Report no. 1 on Miscellaneous Investigation no. 86.)

MATERIALS AND METHOD

Mild steel core wire

The steel core wires were produced by G.S. Steel Co. Ltd. as a 20-tonne melt by an electric arc furnace and the chemical composition is shown in Table 1. The steel is fully-killed and has been processed to wire size B.W.G. 8 under normal production conditions.

TABLE 1. COMPOSITION OF THE STEEL CORE WIRE

Cast No.	Composition weight (%) C	Si	Mn	P	S	Cu	Sn
Fully-kiled core wire 17200	0.07	0.01	0.03	0.01	0.03	0.17	0.03
TIS 49-2516	0.09 max.	0.03 max.	0.35 0.65	0.03 max.	0.03 max.	0.30 max.	-

Electrode preparation

At the Thai Kobe Welding Electrode Co. Ltd., the core wire was finally cold-drawn to 4 mm diameter before coating under the works conditions. Only the 4 mm electrodes made with core wire were used throughout this investigation.

Test specimen and test procedure

The same technique used in Report no. 1 (Balajiva and Sukapaddhanadhi 1975) were also applied to prepare the test specimens. The same testing procedure has also followed.

RESULTS AND DISCUSSION

The chemical composition of the core wire shown in Table 1 conforms to the TIS Specification.

The carbon and silicon contents in this core wire had been maintained as low as practicable with a fully-killed technique, while the contents of the other elements were similar to those of the steels in the previous report.

The tensile and impact properties of the weld-metal are given in Table 2. As will be noted, the tensile strength is lower than that in the previous report but is still slightly greater than the upper limit specified in the Thai Industrial Standard. This small excess of strength is not considered detrimental to the performance of a welded joint and, in fact, it may be advantageous so long as the ductility and toughness are in excess of the minimum requirement of the Specification. It is suggested, therefore, that the TIS Specification should be revised to raise the upper limit of tensile strength to 20 kg/mm^2 in accordance with the British Standard (BS 639) or this limiting factor be totally eliminated as in the American Standard (ASTM-A233), the Australian Standard (AS 1552) and the Japanese Standard (JIS Z 3211). This revision should be carried out in the near future so that the TIS Specification can be applied to the general practice particularly in this country.

TABLE 2. WELD-METAL TENSILE AND IMPACT PROPERTIES

		Yield strength (kg/mm^2)	Tensile strength (kg/mm^2)	Elongation on 50 mm gauge strength (%)	Impact strength at room temp. (kg-M.)
G.S.-cast No. 17200 Fully-killed		50	55	24	6.9
TIS 49-2516	E4201	35	43-53	17	-
	E4202	35	43-53	22	5.5
	E4203	35	43-53	25	7.5
	E4903	40	50-60	25	7.5

All other mechanical properties of the weld-joints in this investigation such as transverse tensile and cold bend properties were found to be satisfactory and conform to the TIS Specification Grade 4202.

CONCLUSIONS

The following conclusions can be drawn from this investigation.

1) The fully-killed steel core wire coated with Thai Kobe covering materials are considered adequate for the TIS 49-2510 Grades 4201 and 4202.

2) The Thai Industrial Standard Specification TIS 49-2516 should be revised to eliminate or increase the upper limit requirement for tensile strength as is currently accepted in several overseas standards.

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