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Author: H.L. Li D. Liu N. Guo H. Chen Y.P. Du J.C. Feng

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The effect of alumino-thermic addition on underwater wet welding process stability

H.L. Li[a], D. Liu[b]*, N. Guo[a,b], H. Chen[a], Y.P. Du[a], J.C. Feng[a,b]

([a] State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin 150001, China

[b] Shandong Provincial Key Laboratory of Special Welding Technology, Harbin Institute of Technology at Weihai, Weihai 264209, China)

Abstract: Real-time electric signal data, metal transfer images and weld appearances at different alumino-thermic additions in underwater wet flux-cored arc welding (FCAW) were obtained. The electric signal results showed that the thermite addition would improve the stability of the wet welding process while the weld appearances at larger content of thermite displayed numerous tiny spatters. The shock in weld pool due to metallurgical reaction was responsible for the tiny spatters. Two typical modes of metal transfer process, globular repelled transfer mode and surface tension transfer mode, were observed. The aluminum flux addition changed the droplet diameter, transfer time and relative proportion of metal transfer mode. When the thermite addition increased from 0 to 50%, the weld penetration depth increased from 2 mm to 4 mm, and the weld dilution rate increased from 22% to 37%.

Keywords: Underwater wet welding; FCAW; Welding process stability; Alumino-thermic.

1. Introduction

Underwater wet welding has been applied widespreadly in the construction and repairing of offshore steel structures due to its easy operation and cost-effectiveness. According to Fydrych et al. (2016), rapid cooling rate, high diffusible hydrogen content in deposited metal, limited visibility and increased pressure with water depth were crucial issues in wet environment. Łabanowski et al. (2008) suggested that welding arc became unstable and loss of alloying

* Corresponding author. Tel/Fax: +86 631 5677156.
E-mail address: liuduo0376@163.com (D. Liu).