بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــســـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

A Study on

ROLE OF NITROGEN IN 316L STAINLESS STEEL WELDMENTS

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science
in
METALLURGICAL ENGINEERING

by

Eng. Mohamed Ashour Saad

B. Sc. in Metallurgical Engineering
Faculty of Petroleum and Mining Engineering,
Suez Canal University

Under the Supervision of

Prof.Dr. Abd El-Hamid A. Hussein **Prof.Dr. El-Sayed M. El-Banna**

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ABSTRACT

Nitrogen is increasingly becoming a popular alloying element in austenitic stainless steel. This is due to the remarkable improvements provided by nitrogen to austenitic stainless steel. Nitrogen increases the strength, toughness, corrosion resistance, and austenite stability. Nitrogen represents a good substitute for nickel, thereby, reducing alloying elements cost. This study was conducted to make use of these valuable effects of nitrogen in welding of 316L stainless steel. In addition, newly developed tungsten electrodes activated with rare earth metals oxides were used to optimize the welding process.

Welding was done with autogenous automatic gas tungsten arc welding (GTAW) process using bead on plate technique. Nitrogen was introduced to the shielding gas with 10%, 5%, and 3.5% by volume. Pure argon was used for comparison. Ceriated, lanthanised, and yttriated tungsten electrodes were used in addition to the conventional thoriated tungsten electrode. The welding performance was evaluated by recording arc voltage and current, measuring the arc efficiency, and visual examination of surface appearance of the weldments. Properties of weld metal were examined by measuring weld metal area, weld metal hardness, nitrogen content of weld metal, ferrite content, and corrosion resistance. In addition, the hot cracking tendency was investigated.

The results showed that, 3.5% of nitrogen in shielding gas is characterized by a stable arc, deep penetration, and high arc efficiency for all tungsten electrodes. The presence of dissolved nitrogen in weld metal resulted in an increase in weld metal hardness and corrosion resistance without affecting hot cracking tendency.

Among the used tungsten electrodes; the ceriated electrode showed the highest arc efficiency and corrosion resistance of weld metal while the yttriated electrode showed the lowest arc efficiency and corrosion resistance of weld metal.

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