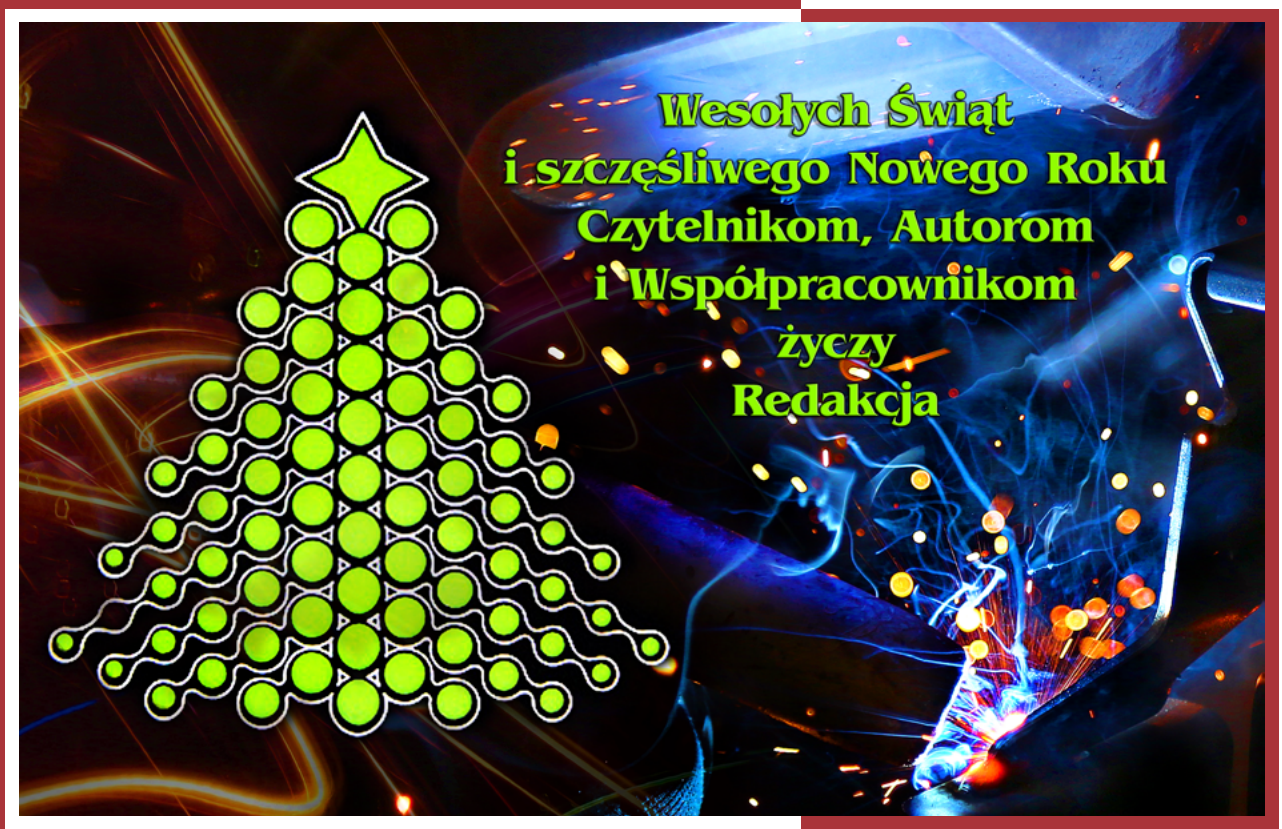
ISSN 2300-1674

BIULETYN
INSTYTUTU SPAWALNICTWA

Łukasiewicz
Instytut
Spawalnictwa



No. 6/2020

INSTITUTE OF WELDING BULLETIN

BIULETYN INSTYTUTU SPAWALNICTWA

No. 6 BIMONTHLY

CONTENTS

- ***Hardfacing of Copper***
  Anatoliy A. Babinets, Igor A. Ryabtsev, Igor I. Ryabtsev, Eugeniusz Turyk, Evgeniy F. Perepletchikov, Ivan P. Lentyugov .....
- ***Hybrid Surfacing: Laser + MAG Electric Arc***
  Michał Urbańczyk .....
- ***The Analysis of the Post-Operation Microstructure and Mechanical Properties of the Similar Welded Joint***
  Agata Merda, Klaudia Klimaszewska .....
- ***The Effect of the Selection of a Function Approximating Static Characteristics on the Modelling of Electric Arc***
  Antoni Sawicki .....
- ***Direction of the Rolling of Plates Made of Steel Grade 0H18N9 versus Welding Distortions***
  Damian Grzesiak.....
- ***Effect of Material Structure on the Noise Level in Phased Array Ultrasonic Tests***
  Karol Kaczmarek, Leszek Grolik.....
- ***Microstructure and Mechanical Properties of Welded Joints in Austenitic Steel TP347HFG after Operation***
  Kwiryn Wojsyk, Agata Merda, Klaudia Klimaszewska, Paweł Urbańczyk, Grzegorz Golański .....

INSTITUTE OF WELDING

The International Institute of Welding and The European Federation for Welding, Joining and Cutting member

Summaries of the articles

A. A. Babinets, I. A. Ryabtsev, I. I. Ryabtsev, E. Turyk, E. F. Perepletchikov, I. P. Lentyugov – Hardfacing of Copper

DOI: 10.17729/ebis.2020.6/1

The article discusses the primary issues of the hardfacing of copper elements exposed to intense abrasive wear, gas-abrasive wear at high temperature and in contact with liquid metal. In addition, the article presents test results concerning the surfacing of copper grade M1 performed using a self-shielded flux-cored wire providing weld deposit Fe14 and plasma powder surfacing performed using powder providing weld deposit Ni3 ((in accordance with EN 14700).

M. Urbańczyk – Hybrid Surfacing: Laser + MAG Electric Arc

DOI: 10.17729/ebis.2020.6/2

The article discusses technological tests involving the use of the hybrid process (laser + electric arc (MAG)) for the efficient application of layers (surfacing). The objective of the tests was to determine the effect of an additional welding power source (laser beam) on the possibility of increasing a surfacing rate (in comparison with surfacing rates obtainable using the MAG method) as well as on the formation (shaping) of the overlay weld geometry and the degree of dilution (of the base material in the overly weld). The technological tests of the hybrid (HLAW (laser + MAG)) surfacing process involved the use of steel grade 41Cr4 and filler metal grade LNM 307.

A. Merda, K. Klimaszewska – The Analysis of the Post-Operation Microstructure and Mechanical Properties of the Similar Welded Joint

DOI: 10.17729/ebis.2020.6/3

The test material was a specimen sampled from sections of a pipe operated for 41,914 hours at a temperature of 575°C and under a steam pressure of 28.2 MPa. The specimen subjected to metallurgical tests was a welded joint made of austenitic steel TP347HFG. The non-destructive tests and the macroscopic tests confirmed the lack of any welding imperfections. The test joint represented quality level B in accordance with related standard requirements. The microstructural tests of the heat-affected zone (HAZ) revealed the presence of the fine-grained austenitic structure with numerous precipitates on grain boundaries – probably M23C6 carbides. In spite of long-lasting operation, the mechanical properties of the test welded joint were high and did not exceed the standard-related requirements concerning the base material.

A. Sawicki – The Effect of the Selection of a Function Approximating Static Characteristics on the Modelling of Electric Arc

DOI: 10.17729/ebis.2020.6/4

The article presents selected tapering functions useful when creating hybrid models and functions approximating static current-voltage characteristics of arc. The research work involved the formation and verification of families of static current-voltage characteristics with defined values of voltage ignition and the extension of approximating possibilities of the formulas through the use of tapering functions. The effective use of various functions approximating static characteristics in the modelling of dynamic states in the circuit with electric arc was verified through simulation.

D. Grzesiak – Direction of the Rolling of Plates Made of Steel Grade 0H18N9 versus Welding Distortions

DOI: 10.17729/ebis.2020.6/5

The article presents the results of tests

concerning the effect of the direction of the rolling of plates made in steel 0H18N9 on welding distortions. The research-related analysis was concerned with the rolling direction in relation to the longer edge of specimens. The specimens were welded using the MAG method involving the use of pulsed arc. The acquisition of surface flatness-related data was performed using a GOM ATOS 5M blue light scanner. The analysis of the results revealed that the mean surface flatness of the specimens was similar in relation to all of the rolling directions related to analysis. However, the direction of distortions parallel and perpendicular to the weld varied depending on the direction of rolling.

K. Kaczmarek, L. Grolik – Effect of Material Structure on the Noise Level in Phased Array Ultrasonic Tests

DOI: *10.17729/ebis.2020.6/6*

This article presents results of tests performed to determine the noise level in ultrasonic Phased Array testing. The tests, involving non-alloy steel S355 and austenitic steel X5CrNi18-10, were carried out applying a frequently used test configuration and 16-element 5 MHz array probes having an aperture of 10 mm×10 mm. The obtainment of a differentiated structure, i.e. characterised by various grain sizes, required the performance of special heat treatment processes. Metallographic tests, concerning both steel grades, were performed to quantify the grain size. Specimens containing artificially made SDH Ø3 cylindrical reflectors and spherical reflectors having various diameters were made of the material prepared in the above-presented manner. The tests also involved amplitude measurements and the identification of the noise level of the reflectors. The test results enabled the quantitative determination of the signal-noise ratio, affecting the detection of low-amplitude indications.

K. Wojsyk, A. Merda, K. Klimaszewska, P. Urbańczyk, G. Golański – Microstructure and Mechanical Properties of Welded Joints in Austenitic Steel TP347HFG after Operation

DOI: *10.17729/ebis.2020.6/7*

The analysis involved a similar welded joint made of steel TP347HFG after operation at a temperature of 580°C. Tests revealed that the primary mechanism responsible for the degradation of the microstructure in all areas of the joint subjected to analysis were precipitation processes occurring within grains and along grain boundaries. The grain boundaries contained two morphologies forming a continuous lattice. Precipitation processes resulted in the high tensile strength of the joint and high hardness within the weld face area. After operation, the test joint was characterised by relatively high impact energy, which could be attributed to the fine-grained microstructure and the presence of numerous annealing twins.

Biuletyn Instytutu Spawalnictwa
ISSN 2300-1674

Publisher:
Łukasiewicz - Instytut Spawalnictwa

Editor-in-chief: ***dr hab. inż. Mirosław Łomozik***

Managing editor: *Marek Dragan*
Language editor: *R. Scott Henderson*

Address:
ul. Bł. Czesława 16-18, 44-100 Gliwice, Poland
tel: +48 32 335 82 01(02); fax: +48 32 231 46 52
biuletyn@is.gliwice.pl;
Marek.Dragan@is.gliwice.pl
http://bulletin.is.gliwice.pl/

Łukasiewicz
Instytut
Spawalnictwa