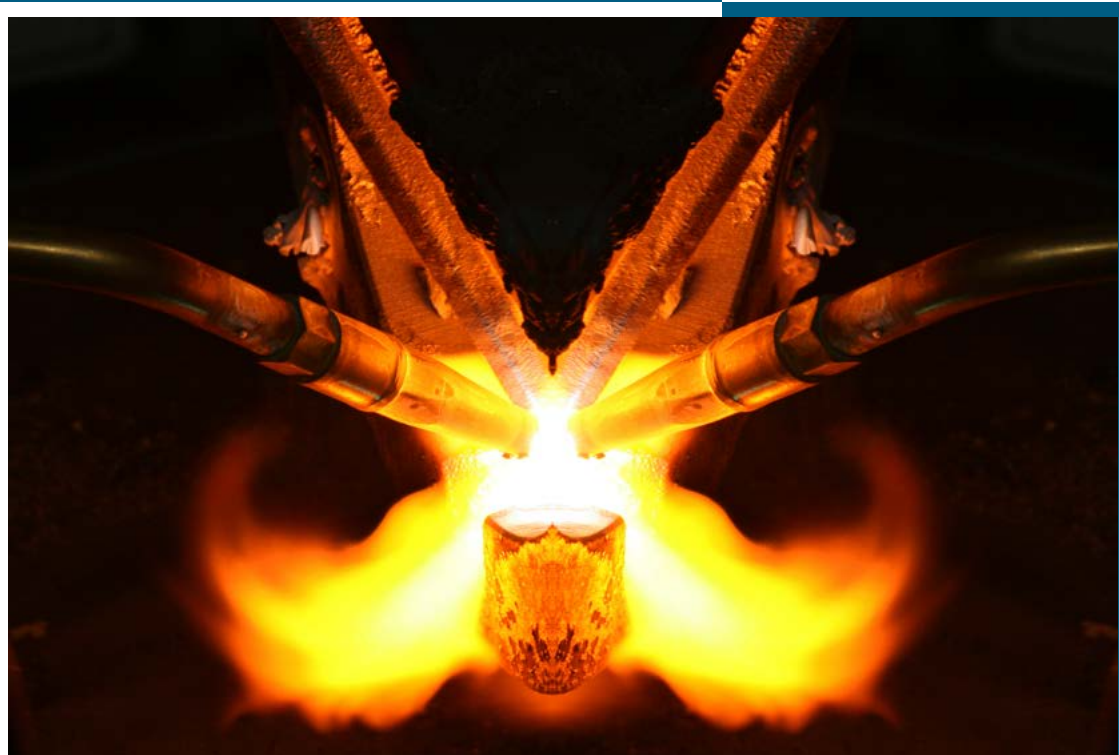


ISSN 2300-1674

# BIULETYN

INSTYTUTU SPAWALNICTWA



**No. 1/2018**

INSTITUTE OF WELDING BULLETIN  
**BIULETYN**  
INSTYTUTU SPAWALNICTWA

No. 1

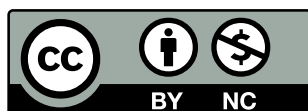
BIMONTHLY

Volume 62

CONTENTS

- *Structure and Properties of Nickel Alloy Overlay Welds Plasma Cladded on Creep-Resistant Steel Tubes*  
Tomasz Pfeifer ..... 7
- *Effect of the Post-Weld Surface Condition on the Corrosion Resistance of Austenitic Stainless Steel AISI 304*  
Grzegorz Rogalski, Mateusz Jurkowski, Jerzy Łabanowski, Dariusz Fydrych ..... 17
- *Electron Beam-Based Rapid Prototyping – State of the Art*  
Marek St. Węglowski ..... 25
- *Properties and Structure of Resistance Short-Circuit Welded Joints in TMCP Steel S700MC*  
Jacek Górka ..... 37
- *Plasma Powder Surfacing of Toughened Steel S690Q Performed Using the NiBSi Powder with a Tungsten Carbide Addition*  
Agnieszka Kiszka, Jacek Górka, Piotr Kiszka ..... 43
- *Properties of welded joints made of cast steel GX8CrNi12-1*  
Marek Gucwa, Sławomir Parzych, Marcin Kukuryk, Marcin Sobala ..... 51

This work is licenced under



Creative Commons Attribution-NonCommercial 3.0 License



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



## Summaries of the articles

### **T. Pfeifer – Structure and Properties of Nickel Alloy Overlay Welds Plasma Cladded on Creep-Resistant Steel Tubes**

DOI: [10.17729/ebis.2018.1/1](https://doi.org/10.17729/ebis.2018.1/1)

The article presents tests aimed to develop technological parameters of the plasma surfacing of Inconel 625 overlay welds onto boiler tubes ( $\varnothing 45 \times 5$  mm) made of steel 13CrMo4-5, providing the content of iron on the overlay weld surface below 5%. The research work involved macroscopic metallographic tests of overlay welds, the identification of the chemical composition of the overlay weld surface as well as microscopic metallographic tests and the microanalysis of the chemical composition across the overlay weld. It was ascertained that, under certain conditions, the use of plasma surfacing enables the obtainment of high-quality single-run overlay welds having a thickness of below 2 mm and characterised by the minimum stirring of the overlay weld metal with the substrate metal as well as the obtainment of an iron content of 2.5% on the overlay weld surface.

### **G. Rogalski, M. Jurkowski, J. Łabanowski, D. Fydrych – Effect of the Post-Weld Surface Condition on the Corrosion Resistance of Austenitic Stainless Steel AISI 304**

DOI: [10.17729/ebis.2018.1/2](https://doi.org/10.17729/ebis.2018.1/2)

Surfaces of welded elements made of corrosion-resistant (stainless) steels develop temper colours. The removal of thickened oxide layers off steels exposed to temperatures below 300°C is necessary and entails the restoring of high corrosion resistance of the stainless steel. The article presents tests concerned with the effect of a method applied to remove post-weld temper on the corrosion resistance of austenitic stainless steel AISI 304. It was ascertained that

the most favourable method enabling the obtainment of high corrosion resistance involved the use of an appropriate passivation process.

### **M. St. Węglowski – Electron Beam-Based Rapid Prototyping – State of the Art**

DOI: [10.17729/ebis.2018.1/3](https://doi.org/10.17729/ebis.2018.1/3)

Fast prototyping involving the use of an electron beam and a deposited material in the form of a wire is an efficient method enabling the making of elements having complicated shapes and made of expensive technical alloys, e.g. alloy steels, nickel or titanium alloys. The demand for fast prototyping results from the development of new technologies in the automotive, aviation and machine-building industries. The article discusses the advantages of fast prototyping methods confronted with conventional prototyping methods as well as presents ideas behind the fast prototyping and primary process parameters. The fast prototyping technology involving the use of a wire and an electron beam as the source of energy should gain recognition among Polish entrepreneurs intended to implement innovative solutions in their companies.

### **J. Górka – Properties and Structure of Resistance Short-Circuit Welded Joints in TMCP Steel S700MC**

DOI: [10.17729/ebis.2018.1/4](https://doi.org/10.17729/ebis.2018.1/4)

The article presents tests concerning the structure and properties of resistance short-circuit welded joints made of 10 mm thick high yield point steel S700MC. The tests revealed the significant effect of a welding thermal cycle leading to less favourable mechanical and plastic properties of the joints. The welding process led to a decrease in tensile strength from 820 MPa (base material strength) to 660 MPa in the

joint area. The welded area hardness decreased to 215 HV<sub>1</sub>, whereas that of the base material amounted to 290 HV<sub>1</sub>. The hardness in the HAZ area amounted to approximately 235 HV<sub>1</sub>. The welding process also resulted in a significant decrease in plastic properties. The toughness of the steel dropped from 50 J/cm<sup>2</sup> (testing temperature being 30°C) to approximately 6 J/cm<sup>2</sup> in the weld line, approximately 8 J/cm<sup>2</sup> in the area between the weld and the HAZ and to approximately 11 J/cm<sup>2</sup> in the HAZ area.

### **A. Kiszka, J. Górka, P. Kiszka – Plasma Powder Surfacing of Toughened Steel S690Q Performed Using the NiBSi Powder with a Tungsten Carbide Addition**

DOI: [10.17729/ebis.2018.1/5](https://doi.org/10.17729/ebis.2018.1/5)

The article presents results obtained during the plasma powder surfacing of steel s690Q. The tests involved the use of the NiBSi-based EuTroLoy PB 6503 powder with a tungsten carbide addition as well as the making of overlay welds on 30 mm thick plates. The tests involved the making of both simple and overlap runs with an overlap of 30÷70%. The overlay welds were subjected to hardness tests, abrasive wear tests as well as macro and microscopic tests. The tests made it possible to obtain high-quality overlay welds within a wide range of process parameters.

### **M. Gucwa, S. Parzych, M. Kukuryk, M. Sobala – Properties of welded joints made of cast steel GX8CrNi12-1**

DOI: [10.17729/ebis.2018.1/6](https://doi.org/10.17729/ebis.2018.1/6)

The article presents test results concerning welded joints made of cast steel GX8CrNi12-1. The above-named cast steel has a martensitic microstructure and can be used in pressure equipment operated at ambient and high temperature. The test joints were made in the horizontal position and in the vertical up position. The foregoing was dictated by the fact that the above-named positions are used in industrial conditions, e.g. when welding steel castings. The welding process performed in the above-named positions ensured that specimens were sampled from areas exposed to the lowest and highest arc linear energy. The article describes the process of manual metal arc welding (111) and the post-weld heat treatment. The test joints were subjected to destructive tests including transverse tensile tests, impact strength tests, hardness measurements as well as macro and microscopic tests. The test results revealed differences in properties of joints made in different positions, resulting from various heat inputs to joints during welding.

## Biuletyn Instytutu Spawalnictwa

ISSN 2300-1674

### Publisher:

Instytut Spawalnictwa (The Institute of Welding)

### Editor-in-chief: Prof. Jan Pilarczyk

Managing editor: *Alojzy Kajzerek*

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](mailto:biuletyn@is.gliwice.pl);

[Alojzy.Kajzerek@is.gliwice.pl](mailto:Alojzy.Kajzerek@is.gliwice.pl);

[Marek.Dragan@is.gliwice.pl](mailto:Marek.Dragan@is.gliwice.pl)

<http://bulletin.is.gliwice.pl/>

### Scientific Council:

Prof. Luisa Countinho

*European Federation for Welding, Joining  
and Cutting, Lisbon, Portugal*

Prof. Andrzej Klimpel

*Silesian University of Technology,  
Welding Department, Gliwice, Poland*

Prof. Slobodan Kralj

*Faculty of Mechanical Engineering and Naval Architecture,  
University of Zagreb, Croatia*

dr Cécile Mayer

*International Institute of Welding, Paris, France*

dr Mike J. Russell

*The Welding Institute (TWI), Cambridge, England*

Akademik Borys E. Paton

*Institut Elektrosvariki im. E.O. Patona, Kiev, Ukraine;  
Nacionalnaia Akademiia Nauk Ukrainy (Chairman)*

Prof. Jan Pilarczyk

*Instytut Spawalnictwa, Gliwice, Poland*

Prof. Edmund Tasak

*AGH University of Science and Technology,*

### Program Council:

#### External members:

Prof. Andrzej Ambroziak

*Wrocław University of Technology,*

Prof. Andrzej Gruszczyk

*Silesian University of Technology,*

Prof. Andrzej Kolasa

*Warsaw University of Technology,*

Prof. Jerzy Łabanowski

*Gdańsk University of Technology,*

Prof. Zbigniew Mirski

*Wrocław University of Technology,*

Prof. Jerzy Nowacki

*The West Pomeranian University of Technology,*

dr inż. Jan Plewniak

*Częstochowa University of Technology,*

Prof. Jacek Senkara

*Warsaw University of Technology,*

### International members:

Prof. Peter Bernasovsky

*Výskumný ústav zvaračský -*

*Priemyselny institút SR, Bratislava, Slovakia*

Prof. Alan Cocks

*University of Oxford, England*

dr Luca Costa

*Istituto Italiano della Saldatura, Genoa, Italy*

Prof. Petar Darjanow

*Technical University of Sofia, Bulgaria*

Prof. Dorin Dehelean

*Romanian Welding Society, Timisoara, Romania*

Prof. Hongbiao Dong

*University of Leicester, England*

dr Lars Johansson

*Swedish Welding Commission, Stockholm, Sweden*

Prof. Steffen Keitel

*Gesellschaft für Schweißtechnik International mbH,*

*Duisburg, Halle, Germany*

Eng. Peter Klamo

*Výskumný ústav zvaračský - Priemyselny institút SR,*

*Bratislava, Slovakia*

Akademik Leonid M. Lobanow

*Institut Elektrosvariki im. E.O. Patona, Kiev, Ukraine;*

Prof. Dr.-Ing. Hardy Mohrbacher

*NiobelCon bvba, Belgium*

Prof. Ian Richardson

*Delft University of Technology, Netherlands*

Mr Michel Rousseau

*Institut de Soudure, Paris, France*

Prof. Aleksander Zhelev

*Schweisstechnische Lehr- und Versuchsanstalt SLV-*

*München Bulgarien GmbH, Sofia*

### Instytut Spawalnictwa members:

dr inż. Bogusław Czwórnoóg;

dr hab. inż. Mirosław Łomozik prof. I.S.;

dr inż. Zygmunt Mikno,

dr inż. Adam Pietras; dr inż. Piotr Sędek prof. I.S.;

dr hab. inż. Jacek Słania prof. I.S.;

dr hab. inż. Eugeniusz Turyk prof. I.S.

