BIULETYN INSTYTUTU SPAWALNICTWA

BULLETIN

OF THE INSTITUTE OF WELDING

ISSN 2300-1674

63. INTERNATIONAL WELDING CONFERENCE

Łukasiewicz
Instytut
Spawalnictwa

No. 5/2022

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BULLETIN

OF THE INSTITUTE OF WELDING

No. 5/2022 **BIMONTHLY**

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ŁUKASIEWICZ – INSTITUTE OF WELDING

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

Summaries of the articles

Steffen Keitel, Amadeus Aurin, Uwe Mückenheim, Hendrik Neef – High-Performance Welding Processes – Comparison of Properties and Applications

DOI: *10.17729/ebis.2022.5/1*

The increasingly high level of productivity entails the growing popularity of high-performance welding methods in production processes. In addition, increasingly high occupational safety-related requirements stimulate the development of automated welding processes. The article compares methods of arc and laser welding technologies as well as presents primary process parameters in relation to values assumed in designs and with reference to permissible tolerances.

Krzysztof Kwieciński, Katarzyna Lota, Marcin Kiełbasiński, Janusz Pikuła, Marek St. Węglowski, Piotr Śliwiński, Sebastian Stano, Michał Urbańczyk, Szymon Kowieski, Piotr Śliwiński, Ewa Jankowska, Rafał Mańczak, Rafał Szostak – Advanced Methods of Joining Battery Cells in the Automotive Industry

DOI: *10.17729/ebis.2022.5/2*

The article discusses tests performed within a state budget-subsidised research project Research into the Development of Joining Techniques for Battery Packs. The subject of research work includes the selection and development of technologies enabling the joining of battery cells and accumulators used in modern electric cars. The works conducted previously involved the performance of tests related to the joining of cells using ultrasonic welding, resistance welding, laser beam welding, electron beam welding and plasma arc welding. The technologies developed within the project will make it possible to optimize the manufacturing of Polish batteries.

Lechosław Tuz, Sebastian Stano – The Effect of Heat Treatment on the Structure and Mechanical Properties of Laser-Welded Joints Made of Steel 17-4PH

DOI: *10.17729/ebis.2022.5/3*

Steel 17-4PH belongs to the group of corrosion-resistant martensitic steels. Because of its favourable mechanical properties and corrosion resistance, the steel has found applications in the aviation, petrochemical, chemical and other industries. The article present results of the laser butt welding of steel 17-4PH without the use of the filler metal as well as the effect of selected types of heat treatment on the structure and mechanical properties of the weld. The test results revealed that the welding process alone enabled the obtainment of favourable mechanical properties, whereas the use of heat treatment led to the homogenisation of the welded joint area.

Alexander Dumpies, Steffen Keitel, Lars Molter – Mechanical and Technological Aspects of Joining Fibrous Composite Hybrids with Metallic Semi-Finished Products

DOI: *10.17729/ebis.2022.5/4*

The sustainability of transport in the future requires the use of lightweight structures, with composites and steel playing a key role. One of the well-known methods used industrially to join the above-named materials is adhesive bonding. However, the method often fails to satisfy service life and fabrication cost-related requirements assumed at the stage of design, certification and manufacturing. The article discusses mechanical and technological issues concerned with the welding of fibrous composite materials with metallic elements.

Janusz Pikuła, Kamil Kubik, Piotr Sędek, Marek St. Węglowski, Krzysztof Kwieciński, Robert Czech, Marcin Spólnik – Numerical Analysis in the Welding of Structures with Respect to the Minimisation of Welding Distortions

DOI: *10.17729/ebis.2022.5/5*

The welding process is the subject of worldwide tests, primarily related to the effect of process conditions and parameters on the structure, geometry and the strength of joints as well as on the formation of welding stresses and strains (distortions). In spite of numerous test results, the welding process itself continues to be one of the reasons for the formation of distortions. Designers and manufacturers should follow principles contained in related standards and guidelines, specifying, among other things, acceptable dimensional deviations. The article presents FEM-based test results concerning the welding of a steel structure and analyses the effect of structure restraint on the formation of welding distortions.

Mateusz Sowa – The Structure and Properties of Sprayed and Deposited Layers Obtained Using Powders Containing Ceramic Particles

DOI: *10.17729/ebis.2022.5/6*

Powdered filler materials are increasingly commonly used in surfacing and spraying processes involving the use of concentrated energy (e.g. plasma arc or the laser beam). The article presents industrial applications of processes tasked with the protection of surfaces against abrasive and cavitation wear. Some of the methods enabling the obtainment of protective layers include plasma powder transferred arc surfacing or gas-powder spraying. Technological tests revealed the usability of both these technologies in relation to duplex steels and led to the obtainment of higher protection against and resistance to abrasive and cavitation wear when using NiBSi powders than those obtained by elements made of steel alone. Tests concerning resistance to abrasive and cavitation wear followed a six-month long period of operation. Test specimens were subjected to visual tests, macroscopic metallographic tests, microscopic measurements of sprayed layers and the analysis of the coating microstructure. The tests revealed the obtainment of high protective properties of coatings made using gas-powder spraying involving the post-spray remelting process.

Mirosław Nowak, Paweł Szostek, Marcin Nowak – Extended Friction Stir Welding Applications and the Use of an Innovative FSW Head

DOI: *10.17729/ebis.2022.5/7*

The article presents general information about friction stir welding process (FSW) as a welding method involving the stirring of the weld material, discusses the course of the welding process itself, describes the structure of the FSW joint, presents advantages and disadvantages of the method as well as discusses factors affecting the quality of FSW joints. In addition, the article describes an innovative FSW head (designed by Stirweld (France) and installed on CNC machines) as well as illustrates the operation of the head and enumerates the advantages resulting from the use of the head in comparison with those characteristic of "conventional" friction stir welding machines.

Łukasz Rawicki – Selected Aspects of Ultrasonic Tests of Dissimilar Welded Joints

DOI: *10.17729/ebis.2022.5/8*

The article presents factors affecting the performance of ultrasonic tests of dissimilar materials. Factors which influence the selection of an appropriate testing technique and the specific usability of testing transducers include the structure of materials subjected to tests, the coarse-grained anisotropic structure and the

grain size. Dissimilar materials enjoy popularity in many industrial sectors, including the power and chemical industries. The construction of chemical tankers requires the use of materials having the dual-phase structure (duplex steel). The detection of discontinuities requires the use of an appropriate testing technique and an evaluation technique (presented in the study).

Agnieszka Wolska, Andrzej Rybczyński, Mariusz Wisełka, Jolanta Matusiak – Scattered UV Radiation Hazards in the Vicinity of the Arc Welding Station

DOI: *10.17729/ebis.2022.5/9*

The requirement to assess risks to workers' health arising from the use of artificial optical radiation is imposed by Directive 2006/25 /EC and the regulations implementing the aforesaid directive in Poland. Research works concerning the above-named hazards have been focused on the assessment of the welders' exposure to direct ultraviolet radiation emitted by welding arc, yet they have not been concerned with persons working in the vicinity of the welding station. Part of optical radiation emitted by arc is reflected and scattered in the vicinity of welding station, thus reaching beyond welding screens or other collective protective equipment. Persons working behind the screens may be exposed to reflected UV radiation characterised by levels exceeding maximum permissible exposure (MPE). The article presents results of tests concerning the level of scattered UV radiation in the vicinity of welding arc during MAG, MAG-Pulse and TIG welding processes (in relation to selected welding parameters). The test results revealed the existence of potential risks in relation to the health of workers performing activities in the vicinity of welding stations, also in cases where protective screens are in place.

Bulletin of the Institute of Welding / Biuletyn Instytutu Spawalnictwa

ISSN 2300-1674

Publisher:

Łukasiewicz - Instytut Spawalnictwa

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