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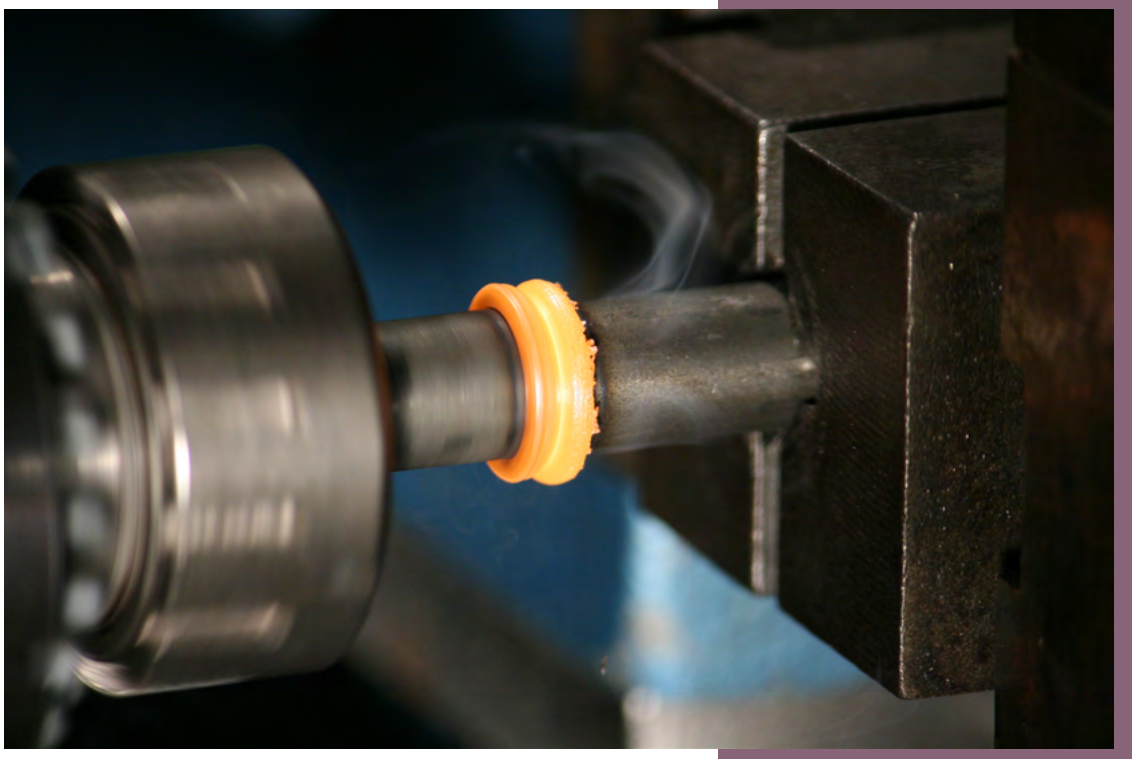

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CONTENTS

ŁUKASIEWICZ – INSTITUTE OF WELDING

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

Summaries of the articles

Mariusz Stępień, Zygmunt Mikno – Selected Aspects of the FEM-Based Numerical Modelling of Current Propagation in the Resistance Multispot Cruciform Welding of Bars

DOI: *10.17729/ebis.2021.4/1*

The article presents selected aspects of the FEM-based analysis concerning resistance welding processes performed using multispot welding systems. The analysis was based on a three-spot welding machine used for the joining bars in the cruciform configuration. Both two and three-dimensional modelling was performed as the comparative analysis of two computing software packages, i.e. the commercial ANSYS Mechanical software package and the ARTAP software package, available on an open access basis. The research work involved the determination of current propagation in various welding process configurations as well as the identification of the percentage loss of welding current and power resulting from the bridging of current by neighbouring welds. The article discusses the effect of the method of the power supply and the earthing of the system of electrodes along with the welded material on the manner of current propagation. The analyses presented in the article were performed in relation to the DC power supply (inverter welding machine). Related calculations were performed using averaged (in terms of heat and resistance) material parameters.

Damian Miara – Friction Stir Welding of Wrought Aluminium Alloy EN AW-6082

DOI: *10.17729/ebis.2021.4/2*

The article presents results of the friction stir welding of 6 mm thick plates made of wrought aluminium alloy EN AW-6082. Tests discussed in the article involved the identification of the effect of primary welding process parameters on the quality of welds. Test welds were subjected to visual tests, measurements of temperature (inside the weld), tensile strength tests as well as macro and microscopic metallographic tests and structural tests (performed using a scanning electron microscope). The application of the appropriate values of the primary welding process parameters (i.e. the tool rotation rate and the welding rate) enabled the obtainment of the high and repeatable quality of FSW joints made of aluminium alloy EN AW-6082. The test results presented in the article can offer technological solutions for potential users representing, among others, the railway, automotive or aviation industries.

Damian Miara, Jolanta Matusiak, Adam Pietras, Mateusz Świetlik – High-Speed Friction Welding as an Innovative Technology for Joining Solenoid Valve Elements Made of Steel Grades 11SMnPb37 and 11SMn37

DOI: *10.17729/ebis.2021.4/3*

High-speed friction welding (HSFW) is a solid-state joining process involving the use of friction heat emitted during the technological process. The application of the HSFW technology enables the fast and repeatable making of joints characterised by favourable properties. The article presents tests concerning the development of the HSFW-based technology enabling the joining of solenoid valve elements made of two grades of free-cutting steel, i.e. 11SMnPb37 and 11SMn37. The article also discusses the course of technological tests, the making of a test rig, the determination of ranges of technological parameters and selected test results concerning welded joints.

Paweł Kustroń, Marcin Korzeniowski, Tomasz Piwowarczyk, Paweł Sokołowski – Hybrid Welding of Metal-Polymer Composites with a Non-Conducting Polymer Layer

DOI: *10.17729/ebis.2021.4/4*

Metal-polymer composites (MPCs) are becoming increasingly popular primarily because of their high strength-to-weight ratio. Metal-polymer composites consist of three layers, i.e. two external metallic sheets (linings) and the core made of plastic. The presence of the internal plastic layer makes MPCs impossible to join using conventional welding processes, which significantly limits their usability. One of the solutions to the problem involves the use of hybrid methods, e.g. ultrasonic method-aided resistance welding. The research work discussed in the article involved the development of a prototype test rig and a technology enabling the joining of the Litecor® composite with steel DP600. The joining process consisted of two stages. The first stage involved the removal of the non-conducting layer of polymer from the welding area and the making of an appropriate electric contact for resistance welding. The second stage was the classical resistance spot welding process. The development of the concept posed a challenge as it was necessary to develop an appropriate acoustic waveguide for high-power ultrasonic waves which, at the same time, could transfer loads in the form of electrode force as well as provide appropriate electric and thermal conductivity without compromising acoustic parameters during the welding process. The development of the test rig was followed by the performance of numerous tests aimed to identify the appropriate window of process parameters. Test joints were subjected to macrographic, strength, ultrasonic and topographic tests.

Antoni Sawicki – Effect of Ultrasonic Techniques on Welding Technologies

DOI: *10.17729/ebis.2021.4/5*

The article discusses selected physical properties of industrial ultrasonic equipment utilising the magnetostrictive or electrostrictive effect. Particular attention was paid to equipment enabling the ultrasonic welding of various metals and thermoplastics. The research involved the comparison of various designs and operation of technological equipment, taking into account selected energy, control and environmental aspects. Based on reference publications it was possible to determine and categorise general features concerning the application of ultrasonic technologies as well as to indicate factors responsible for the formation of imperfections during the ultrasonic welding process.

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