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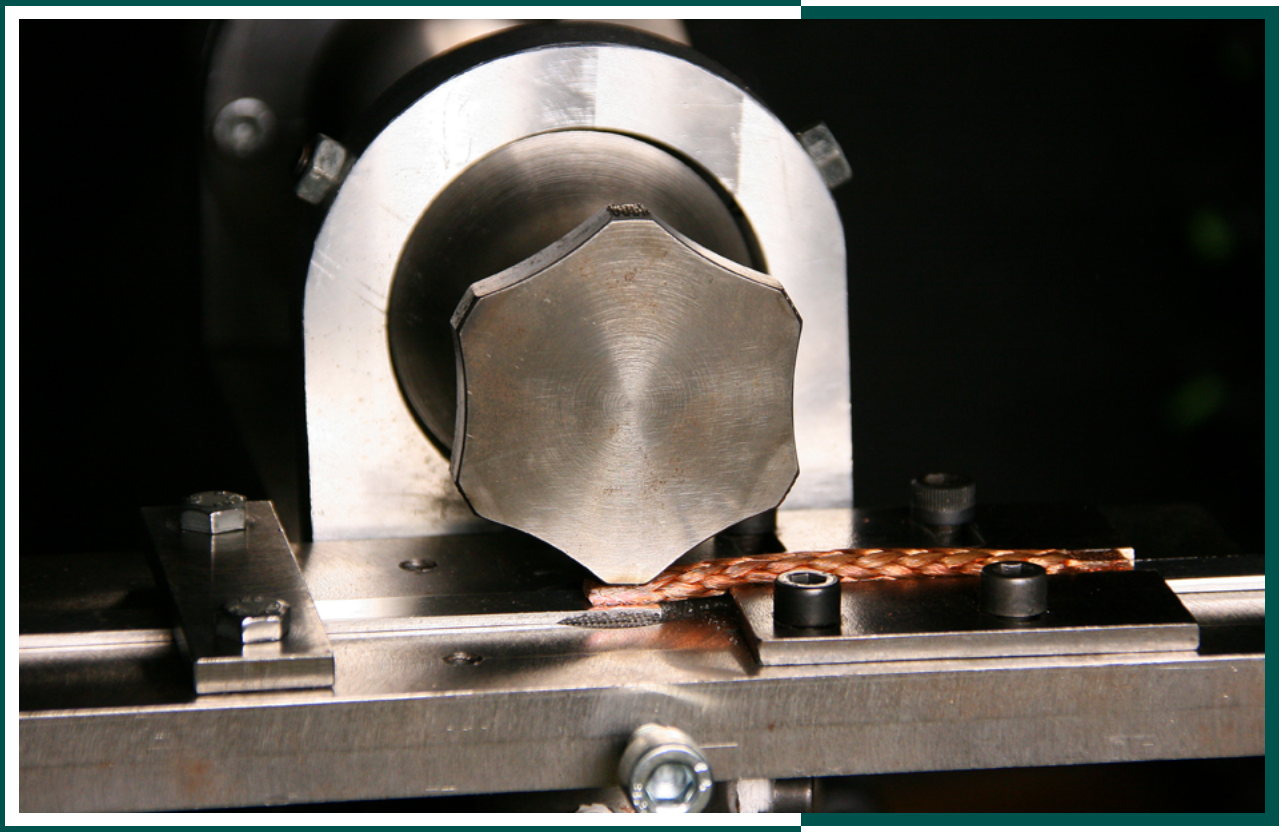

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INSTITUTE OF WELDING BULLETIN

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No. 5 BIMONTHLY

CONTENTS

INSTITUTE OF WELDING

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

Z. Mikno, M. Gradkowski – The Pneumatic Force System in Resistance Welding

DOI: *10.17729/ebis.2019.5/1*

The study involved the analysis of the pneumatic force system, used in resistance welding machines, in relation to the dynamics of electrode displacement. The analysis was performed in relation to two phases of the technological cycle, i.e. positioning pneumatics (from the activation of the pneumatic valve to the moment when electrodes come into contact with the material being welded) as well as the pneumatics of force accretion before and during the flow of current. The analysis, performed using the Festo software programme (phase 1) as well as using elements of the automatics system (phase 2), was focused on two important elements, i.e. time at which electrodes reached their stabilised position and the kinetic energy of electrode impact.

J. Górka, A. Ozgowicz, K. Matusek – The Effect of Selected Spot Resistance Welding Parameters on Properties of Martensite-Structured AHSS

DOI: *10.17729/ebis.2019.5/2*

The paper presents the effect of welding current and clamping force on the properties of spot resistance-welded joints made of 1.8 mm thick steel Docol 1200M. Because of the fact that martensite-structured steel Docol 1200M is hardened when exposed to deforming force, it is used to make energy absorbers or car header panels. Test joints, made using a robotic welding station, were subjected to macro and microscopic metallographic tests, hardness measurements and strength tests. The obtained test joints were subjected to strength verification performed in accordance with PN-EN ISO 14273:2016. The tests demonstrated that excessively high clamping force combined with relatively low welding current do not guarantee the obtainment of a joint characterised by required strength. However, by increasing welding current and reducing clamping force it is possible to increase the strength of welded joints. The use of appropriate spot resistance welding parameters enables the making of joints in steel Docol 1200M steel characterised by a satisfactory level of strength.

A. Węglowska – The Application of the Bobbin Tool in the Friction Stir Welding of Aluminium Sheets

DOI: *10.17729/ebis.2019.5/3*

The article presents the effect of the technological parameters of the friction stir welding of 2 mm thick aluminium sheets made of aluminium alloy EN AW 6082 performed using of the bobbin tool. The tests included static tensile tests, hardness tests and macroscopic metallographic tests. The tests revealed that properly selected welding parameters enabled the obtainment of joints characterised by material continuity, compact structure and the lack of welding imperfections in the welding area. The application of the bobbin tool made it possible to obtain joints of aluminium sheets characterised by high strength, i.e. amounting to 61% of the base material strength.

S. Sobolewski, M. Korzeniowski, T. Piwowarczyk – The Effect of the Weld Pitch on Shunting in Robotic Resistance Welding

DOI: *10.17729/ebis.2019.5/4*

The shunting of welding current during the process of spot resistance welding is a phenomenon which should be taken into consideration both at the design stage of load-bearing structures and during the process of their fabrication. As regards the intensity of shunting, the most important parameter is the distance between

neighbouring welds (weld pitch). In spite of technological guidelines concerning the size of the pitch, scientific publications lack information about the correlation between the distance between welds and the size of the weld nugget. The article presents results of individual research aimed to analyse the effect of the pitch size on the diameter of the weld nugget. The welding process was performed using a robotic welding station. Verification (measurements of the weld nugget diameter) was based on advanced ultrasonic testing methods including scanning acoustic microscopy (SAM) and the RSWA (Resistance Spot Weld Analyser) devise provided with a phased-array mosaic transducer.

B. Rams, T. Bugalski – The Application of Advanced Surface Preparation Methods in the Adhesive Bonding Process

DOI: *10.17729/ebis.2019.5/5*

An important part in the process of adhesive bonding is played by the appropriate preparation of surfaces to be subjected to adhesive bonding. The objective of the tests discussed in the article was to identify the effect of various surface preparation methods, including cleaning, grinding, atmospheric plasma treatment and the ATOP method on the strength of adhesive-bonded joints. The tests involved the use of specimens made of aluminium alloy EN AW 5754 as well as specimens made of glass fibre-reinforced epoxy-based plastics. The specimens were subjected to overlap adhesive bonding involving the use of Araldite two-component epoxy adhesive (Huntsman). The article presents results of the static shear test (of the overlap joints) in relation to a given surface preparation method applied before the adhesive bonding process. The highest strength of the adhesive-bonded joints made in the aluminium alloy was obtained in relation to the ATOP method-based treatment. In addition, the above-named method makes it possible to properly prepare a cleaned surface by forming a protective layer ensuring proper surface preparation for several months. In turn, the highest strength of the adhesive-bonded joints made of glass fibre-reinforced plastics was obtained in relation to the surface treatment performed using atmospheric plasma.

T. Kik – Numerical Analyses in the Spot Resistance Welding Process

DOI: *10.17729/ebis.2019.5/6*

The article presents results of numerical analyses of the spot resistance welding process in relation to selected thicknesses of sheets/plates subjected to welding, radiuses of electrode work surface curvature and electrode squeezing force. The two-sided one-spot welding of two sheets made of steel DC04 (discussed in the article) demonstrated the extensive analytical possibilities of the Visual Weld state-of-the-art software application (SYSWELD). The objective of the article was to present possibilities offered to engineers by state-of-the-art computing techniques.

M. Stępień, Z. Mikno, B. Grzesik – The Effect of the Welding Power Source on the Resistance Welding Process

DOI: *10.17729/ebis.2019.5/7*

The research presented in the article involved the analysis of various factors, including 1) type, length and the cross-section of the supply conduit, 2) synchronous/asynchronous operation of welding machines and 3) temperature of the conduit on supply voltage drop in resistance welding machines. The article discusses the unfavourable effect of the above-named voltage drop on the quality of welds, including a decrease in the weld nugget diameter and the reduction of weld strength.

W. Grzechowiak – The Welding of Vignoles Rails and Tram Rails Using the Two-Way (Rail-and-Road) Mobile Welding System Equipped with the AMS 100 Head

DOI: *10.17729/ebis.2019.5/8*

The article discusses the resistance flash butt welding of Vignoles rails and tram rails performed using a two-way (rail-and-road) track welding system. Particular emphasis was given to the welding of tram rails.

W. Jopek – High-Performance System for Simultaneous Multielement Resistance Welding

DOI: *10.17729/ebis.2019.5/9*

The article presents initial results related to a newly developed system enabling the quasi-simultaneous welding of elements requiring high dimensional tolerances. The above-named system was developed in response to a new market demand for elements made in very short production cycles. A response to such a demand is an innovative solution including a digital system enabling the switching of welding current with a flexible frequency of even up to 10 kHz. The above-named solution makes it possible to control welding current in individual branches of equipment so that the welding power source is not able to notice a break in the welding process and all of the welds are formed at the same time with the precise definition of the current path.

S. Bednarek, P. Sokołowski, T. Piwowarczyk, A. Ambroziak, K. Nowak, K. Janowicz – Adhesive Bonding of Elements Made Using the Multi Jet Fusion Additive Technique

DOI: *10.17729/ebis.2019.5/10*

The research discussed the application potential of adhesive bonding in the joining of 3D printed structures made using the Multi Jet Fusion (MJF) state-of-the-art additive technology (HP). The research involved the performance of technological tests aimed to assess the adhesive properties of 3D printout surfaces in the function of a surface layer treatment method as well as to evaluate adhesives used in the joining of 3D printed structures. The tests performed within the research included roughness measurements, wetting angle measurements, peel strength tests, shear strength tests and bend tests. The results obtained in the tests made it possible to assess the joinability of MJF printouts as well as to identify reasons for problems accompanying the joining of such elements.

K. Klimaszewska, A. Merda, P. Urbańczyk, G. Golański – The Effect of Operating Conditions on the Microstructure and Mechanical Properties of Dissimilar Welded Joints Made of Steel TP347HFG and T91

DOI: *10.17729/ebis.2019.5/11*

The tests discussed in the article involved dissimilar welded joints made using austenitic steel TP347HFG and martensitic steel X10CrMoVNb9-1 (T91). The material used in the tests was sampled from a section of the fresh steam superheater coil exposed to a maximum operating temperature of approximately 540°C for approximately 106 000 hours. The tests involved the analysis of chemical composition, macro and microstructural tests, tests of mechanical properties and a shortened creep test. The tests revealed that the highest degradation of microstructure and mechanical properties could be observed in the heat affected zone (HAZ) on the steel T91 side, which could probably be ascribed to the precipitation of the continuous lattice of M23C6 carbides along grain boundaries. The expected time of safe operation (estimated using the shortened test) amounted to approximately 70 000 hours (without changing the presently applied operating parameter).

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