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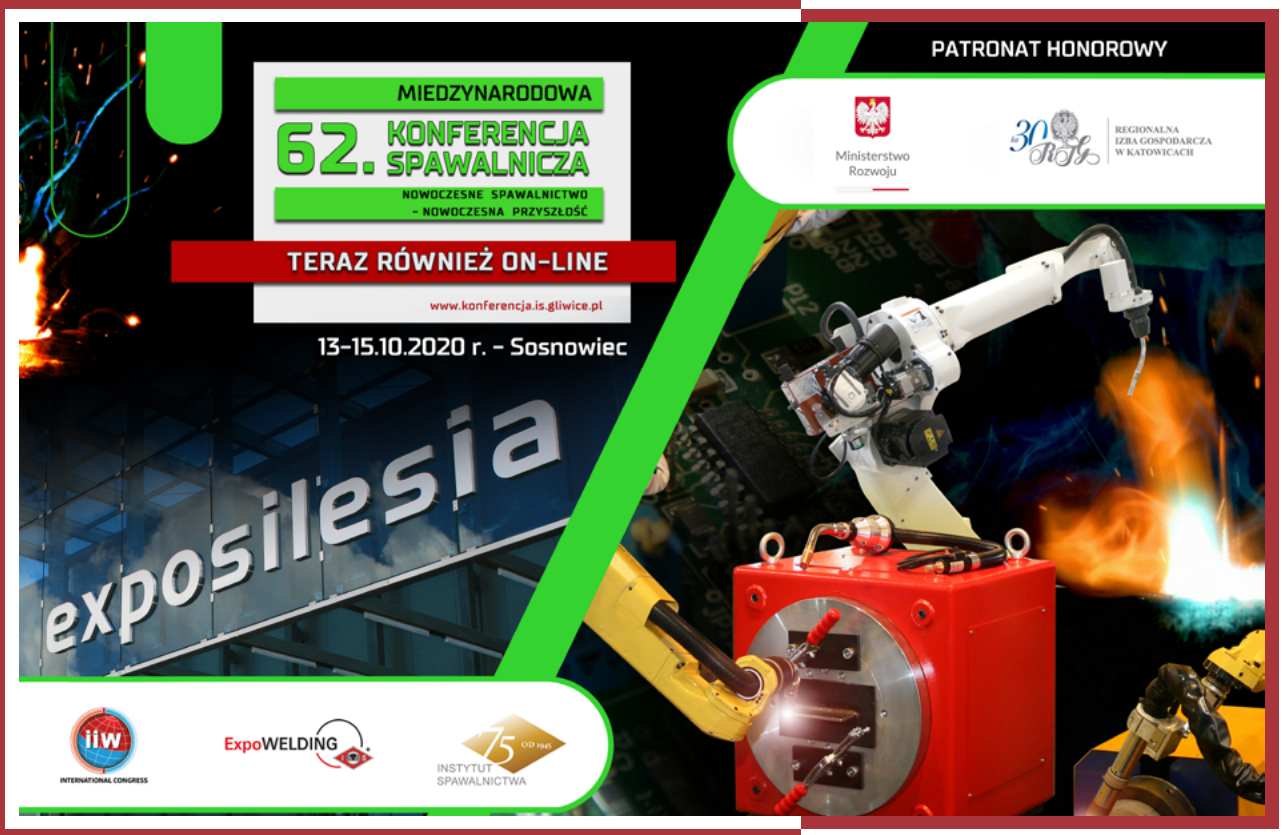

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No. 4 BIMONTHLY

CONTENTS

J. Górka, S. Błacha, D. Zagrobelny – Electron Beam Welding of TMCP steel S700MC

DOI: *10.17729/ebis.2020.4/1*

The article discusses tests aimed to determine the effect of electron beam welding on the properties of butt welded joints made in 10 mm thick TMCP steel S700MC. The welding process was performed in the flat position (PA) using an XW150:30/756 welding and surface processing machine (Cambridge Vacuum Engineering). The joints obtained in the tests were subjected to non-destructive tests including visual tests and magnetic particle tests. The joints were also subjected to destructive tests including static tensile tests, bend tests, toughness tests (performed at a temperature of -30°C), hardness tests as well as macro and microscopic metallographic tests. The destructive tests revealed that the joint represented quality level B in accordance with the PN EN ISO 13919-1 standard. The analysis of the destructive test results related to the electron beam butt welded joint (made in steel S700MC) revealed its high mechanical and plastic properties. The toughness tests revealed a decrease in toughness in the HAZ (27 J/cm^2) in comparison with that of the base material (50 J/cm^2). In addition, the hardness of the HAZ and of the weld increased up to approximately 330 HV; the hardness of the base material amounted to 280 HV.

J. Adamiec, M.Urbańczyk, K. Głowik, M. Boryczka, M. Majzner - Combined Welding of Modern Steel P460NL2 mod. Used for Welding Railway Tanks

DOI: *10.17729/ebis.2020.4/2*

There have been presented test results of welding P460NL2 mod. steel in two configurations: combined laser + arc welding and hybrid laser + MAG welding, with various geometry of the joints. There have been assumed requirements for the joints (strength, toughness and hardness) specified in VdTUV 531 act and in PN-EN ISO 15614-1, PN-EN ISO 15614-11 i PN-EN ISO 15614-14 Standards. As a supplement there have been conducted macroscopic metallographic tests. Proper technological parameters of hybrid and combined welding enable to obtain properly formed butt-welded joints. Hybrid welded joints do not meet requirements of the standards, due to exceeded maximum hardness (over 380 HV10). However, combined welding provides obtaining proper welded joint with maximum hardness 360 HV10, strength 665 MPa and toughness over 27 J. The results above meet the technological requirements. Obtained test results are the guidelines for developing the technology possible to adapt in industrial conditions.

M. Stępień, Z. Mikno – The Reduction of Welding Current Asymmetry in Multispot Welding Machines by Differentiating the Cross-Section of Welding Machine Arms

DOI: *10.17729/ebis.2020.4/3*

The article discusses the analysis of the propagation of current in resistance multispot welding machines and the adjustment of the cross-section of the welding machine arms aimed to compensate the asymmetry of welding current in individual welds. The analysis involved the effect of the length of multispot welding machines where the span of the arms (distance between welds) amounted up to 2 m, the arms were characterised by various cross-sections and the structural material was characterised by various resistivity (resulting from changes in temperature). The analysis was performed in relation to welding machines using a nominal welding current of 5 kA. The tests made it possible to determine the effect of changes in the value of current on the cross-section of the weld nugget.

A. Gruszczyk, M. Pawlyta – Primary Reasons for the Brittleness of Welded Joints in Steel T/P24

DOI: *10.17729/ebis.2020.4/4*

The article presents results of tests concerning the susceptibility of welds made of steel T/P24 (7CrMoVTiB10-10) to secondary hardness as well as the structure and the mechanical properties of the welds (KV, Rm, A5, Z and HV1) in the as-made state and after heat treatment performed at temperature restricted within the range of 100°C to 750°C. The tests revealed that the welding process triggered the decomposition of phases hardening steel 7CrMoVTiB10-10 and the transition of alloying components and impurities to the solution of body-centred cubic lattice A2 (bcc). A thesis formulated by the Authors in relation to the test results stated that the primary reason for the deterioration of the plastic properties of the welds was the phenomenon of solid solution hardening. The Authors emphasized the necessity of performing the detailed analysis of interactions of substitution atoms and other defects of the Feα lattice with interstitial atoms. In addition, the Authors indicated the necessity of changing the criteria applied when assessing the weldability of technologically advanced steels as well as pointed mistakes made during the industrial implementation of steel 7CrMoVTiB10-10.

D. Nowak, G. Chruścielski, A. Ambroziak, I. Elkin – The Preliminary Analysis of the Effect of Low-Energy Plasma Treatment on Internal Stresses in a Welded Plate of Steel S355

DOI: *10.17729/ebis.2020.4/5*

The articles presents a pilot study aimed to provide preliminary assessment concerning the effect of the low-energy plasma treatment on the level of internal stresses in welded plates. In addition, the article discusses the similarity of a stress relief mechanism based on annealing and that based on low-energy plasma treatment. The extensormetric measurements of internal stresses involving steel S355 after welding and after treatment in the plasma chamber revealed the low-energy plasma treatment-induced reduction of internal stresses.

B. Szczucka-Lasota, T. Węgrzyn, B. Łazarz, A. Jurek, K.I. Wilczyński – MAG Welding of Structures Used in Means of Transport and Made of Steel DOCOL 1200M

DOI: *10.17729/ebis.2020.4/6*

Steels of the DOCOL group, characterised by high tensile strength and yield point, play an important role in the manufacturing of means of transport. However, the above-named steels are difficult to weld and joints made in them do not guarantee comparable mechanical properties. The research work discussed in the article aimed to determine process parameters suitable for the welding of a moving platform made of steel DOCOL 1200M as well as to assess the effect of welding parameters on the quality of obtained joints. The tests also involved analysing the effect of shielding gases, preheating and interpass temperature on the quality of an 8 mm thick MAG welded moving platform structure.

Lechosław Tuz – The Assessment of Selected Properties of Welded Joints in High-Strength Steels

DOI: *10.17729/ebis.2020.4/7*

The use of technologically advanced structural materials entails the necessity of adjusting typical welding processes to special requirements resulting from the limited weldability of certain material groups. Difficulties obtaining high-quality joints may be the consequence of deteriorated mechanical properties and structural changes in materials (beyond requirements of related standards). One of the aforementioned materials is steel characterised by a guaranteed yield point of 1300 MPa, where high strength is obtained through the addition of slight amounts of carbide-forming elements

and the application of complex heat treatment processes. A heat input during welding may worsen the aforesaid properties not only in the weld but also in the adjacent material. The tests discussed in the article revealed that the crucial area was that heated below a temperature of 600°C, where the hardness of the material decreased from approximately 520 HV to 330 HV.

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