BIULETYN INSTYTUTU SPAWALNICTWA

BULLETIN

OF THE INSTITUTE OF WELDING

ISSN 2300-1674

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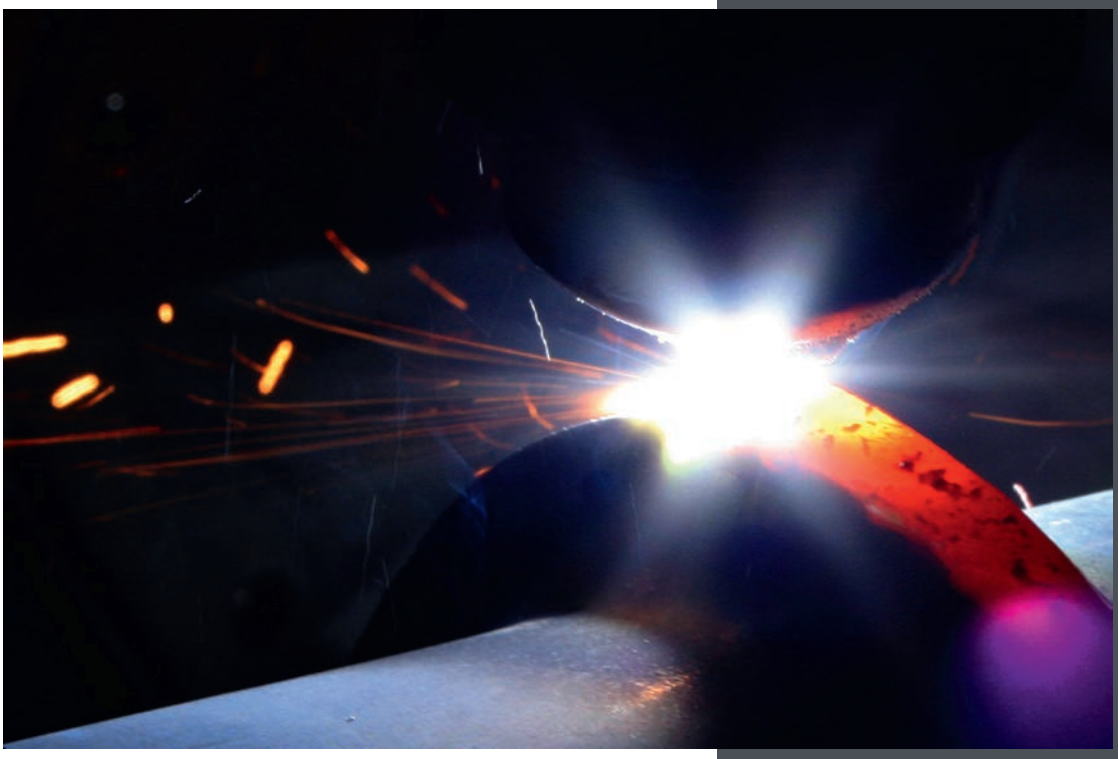
Institute
of Welding



No. 6/2022

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OF THE INSTITUTE OF WELDING

No. 6 BIMONTHLY Volume 66

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ŁUKASIEWICZ – INSTITUTE OF WELDING

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

Monika Górnik, Ewa Jonda, Leszek Łatka – The Comparison of the Effect of Powder Morphology on the Microstructure and Mechanical Properties of WC-Co-Cr Coatings HVOF-Sprayed on Substrates Made of Alloy AZ31

DOI: *10.17729/ebis.2022.6/1*

The paper presents results of comparative tests concerning the effect of the morphology and particle size of the WC-Co-Cr coating material on the microstructure and mechanical properties of coatings sprayed (using the high velocity oxy-fuel method (HVOF)) on substrates made of magnesium alloy AZ31. The tests involved the use of two types of commercial powders, i.e. agglomerated and sintered powder (AS) (Höganäs, Amperit 558.074) and sintered powder (S) (Höganäs, Amperit 554.071). The microstructures of the coatings were observed using digital light microscopy and scanning electron microscopy. The tests also involved the determination of porosity and roughness as well as measurements of instrumental hardness (H_{IT}) and Young's modulus (E_{IT}). The microscopic observations revealed that the coatings were characterized by the relatively compact, dense and uniform structure as well as good adhesion to the substrate. The porosity of the S-type coating was approximately 1.5 times higher than that of the AS-type coating. In addition, the S-type coating was visibly thinner (than the AS-type coating), which could be ascribed to a lower powder feed rate applied during the spraying process. The surface of the AS-type coating was characterized by lower roughness (R_a = 4.5 ± 0.1 μm) than that of the S-type coating (R_a = 5.8 ± 0.3 μm). The differences in terms of instrumental hardness (H_{IT}) and instrumental Young's modulus (E_{IT}) were also small. However, it could be noticed that the more compact structure and lower porosity of the AS-type coating resulted in the obtainment of slightly higher values of both H_{IT} and E_{IT}.

Karolina Poch, Ryszard Krawczyk, Jacek Słania – The Analysis of Parameters of Magnetic Tests in Respect of Quality Assessment of T-Joints with Fillet Welds

DOI: *10.17729/ebis.2022.6/2*

Welded joints with fillet welds constitute the majority of joints made in various structural elements. The crucial role of such joints is emphasized particularly in respect of structural quality control. The primary issue "troubling" T-joints with fillet welds is the lack of penetration in surfaces of elements, i.e. the welding imperfection affecting the strength of joints in service conditions. Joints containing fillet welds are usually tested using surface methods, which significantly limits appropriate assessment and does not ensure the detection of volumetric imperfections. The article discusses the magnetic particle test-based detectability of volumetric imperfections in T-joints with fillet welds. Magnetic particle tests provide extensive possibilities as regards the assessment of structural elements, including welded joints containing poorly detectable discontinuities. Particular attention should be paid to T-joints with fillet welds. The analysis of test results made it possible to identify test parameters and conditions enabling the detection of lacks of penetration. In addition, the analysis revealed the correlation between test parameters and dimensions of joints as well as enabled the determination of magnetic field intensity-related boundary conditions making it possible to obtain indications of discontinuities in T-joints with fillet welds.

Piotr Śliwiński, Kamil Kubik, Mateusz Kopyściański – Electron Beam Surface Hardening of Steel C45

DOI: *10.17729/ebis.2022.6/3*

Surface hardening makes it possible to obtain high wear resistance of components exposed to friction without the need for hardening the entire element, thereby reducing stresses and deformations as well as process costs. The electron beam, due to its ease of dynamic deflection and focusing as well as very high heating rates, makes it possible to obtain surface layers of required properties. The article presents results of metallographic tests and Vickers hardness tests of electron beam hardened shafts made of steel grade C45. The hardening process resulted in the obtainment of layers having thickness not exceeding 400 μm and hardness not exceeding 900 HV0.1.

Aleksandra Świerczyńska, Michał Landowski, Adrian Wolski, Grzegorz Lentka, Jerzy Łabanowski, Dariusz Fydrych – Effects of Storing Flux-Cored Wires under Various Conditions

DOI: *10.17729/ebis.2022.6/4*

Welding processes involving the use of flux-cored wires are becoming increasingly popular, particularly in shipbuilding as well as in off-shore and civil engineering. The article presents characteristics of the welding process, its areas of application as well as advantages and disadvantages (e.g. necessity of ensuring appropriate conditions for the storage of filler metal wires). The satisfaction of quality-related requirements concerning welded joints necessitates controlling the quality of flux-cored wires as their condition (apart from welding conditions) is one of the most important factors affecting the welding process and the quality of joints. The analysis of related reference publications and individual study revealed that the storage of wires under conditions inconsistent with requirements specified by producers affects welding process stability and weld deposit properties. Visual tests (VT) tasked with assessing the quality of wire surface do not always provide sufficient information as regards the usability of filler metal wires in welding processes.

Antoni Sawicki – The Modelling of Electric Arc with Stochastic Disturbances. Part 1. The Mapping of Stochastic Disturbances in Mathematical Models of Electric Arc

DOI: *10.17729/ebis.2022.6/5*

The heterogeneous physical structure of electric arc inspired a proposal to consider separately the generation of random disturbances of electric waveforms in the plasma column and in near-electrode areas. The article presents selected mathematical correlations which could be used to assess parameters of noisy signals in arc devices. Depending on the type of generated noise (white, pink, red), it is necessary to apply appropriate filters (which can be modelled using the ordinary differential equations presented in the article). The article discusses in detail the methods enabling the mapping of stochastic disturbances affecting the electric arc column. 1. By assuming specific systems of the physical effect of disturbances and thereby interfering in the input equation of energy balance it was possible to obtain the noisy Mayr-Voronin and Cassie-Voronin models of arc characterised by variable geometrical dimensions. 2. By assuming specific systems of the mathematical effect of parameter disturbances and thereby interfering in previously developed deterministic mathematical models it was possible to obtain the modified noisy Mayr, Cassie and Schwarz models as well as a model with the radius of a cylindrical column as a state variable. 3. The assumption of specific systems of the mathematical effect of disturbances on the deterministic load of the circuit with electric arc made it possible to consider macro-models with current or voltage noise generating sources additionally connected to arc.

Bulletin of the Institute of Welding /
Biuletyn Instytutu Spawalnictwa
ISSN 2300-1674
Publisher:
Łukasiewicz – Instytut Spawalnictwa


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