

UDC 621.791.37

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## **ARC TIG BRAZE WELDING OF WELD ART STRUCTURES**

Features of the design of art products are presence of elements of different thicknesses and different geometric shapes, asymmetry of the design as a whole and the location of joints on it in particular. In addition, the places of joints and their configuration primarily depend on the artistic design, which is why they are not always optimal, and if traditional methods of electric arc welding are used, areas may appear on the structure that are repeatedly subjected to heating-cooling cycles. In turn, this leads to deterioration of the mechanical characteristics of the joints and to formation of unfavorable levels of residual welding stresses and strains.

In order to solve technological problems of the production of weld art, it is often necessary to time the processes of parts' heating and of introducing a filler. For this purpose the technology of arc TIG braze welding [1] was chosen.

Copper-based fillers (CuSi3) guarantee a high level of physico-chemical compatibility with the base material of the structure/product and provide a high level of physico-mechanical and anti-corrosion characteristics of the joint, a low level of residual stresses and deformations of thin-sheet structural elements [2, 3].

A detailed description of solving a number of technological problems that arose during the manufacture of non-standard structural elements of the sculptures "Minion", "Macho", "Into the Future!" is given. "Minion" (Fig. 1, a) includes: the connection of solid profiles, the connection of wires with a pipe, the connection of a bundle of thin wires with a hemisphere, and the connection of wires of different diameters at acute angles.

Sculpture "To the Future!" (Fig. 1, b) was accepted to participate in the exhibition of weld art products "2023 UN Sustainable Development Goals Digital Collection", which will be held on July 16-21, 2023 in Singapore as part of the Annual Assembly of the International Institute of Welding.

The main elements of the sculpture are: a double ring, figures of a young man and a girl inside a globe, a base and elements of stiffness behind the ring. The part of the ring under the feet of the boy and girl is designed to be sunk into the foundation. The other part of the ring above the foundation symbolizes the portal (entrance) to a new life. The globe represents limitless opportunities for young people in the future life. Dimensions of the sculpture: height 2.3 m, width 2.3 m, depth 1.5 m. Weight about 150 kg. The construction material is low-carbon steel. The artistic configuration of the sculpture was developed using computer processing of a photo through the adaptation of a real photo into graphics and, as a result, creation of a 3D model of a sculpture.

The main advantages of the TIG braze welding are: the melting point of the CuSi3 filler is lower than that of the base material: high fluidity and good wetting of the surface of the base material with the liquid filler; low level of residual stresses and deformations; sufficiently high level of mechanical properties of the joint.



Fig. 1 – Sculptures with TIG braze welded joints produced in the workshop Smart Art (department of Welding Production of E.O. Paton Institute of Materials’ Science and Welding): a) “Macho”; b) “Into the Future!”; c) “Minion”; d) joints of wires 3, 4 and 5 mm dia e) joints of solid elements 10x10 mm

The developed technologies of TIG braze welding with CuSi3 copper wire significantly expand the possibilities of high-quality production of steel art products with complex geometric shape, which have a large number of non-standard joints and were successfully used in the production of a number of sculptures according to the creative idea and design of Associate Professor Sergey Minakov.

#### References

1. (2022) Terminological dictionary of welding and related technologies. Lobanov L.M., Demchenko Yu.V., Makovetska O.K., Kyiv, Akademperiodyka, E. O. Paton Electric Welding Institute [In Ukrainian]. Available at: <https://doi.org/10.15407/akademperiodyka.474.329>.
2. Braze Welding (no date). Available at: <https://www.twi-global.com/technical-knowledge/job-knowledge/braze-welding-134> (Accessed: 14 April 2023).
3. Strelenko N.M. (2014) Physical and Chemical Interaction of Liquid Solder and Base Metal in Brazing and Soldering Tekhnologichni Systemy, **3**, 41-44 [In Ukrainian].