Abstract

RESEARCH AND EVALUATION OF WELDED FERRITE-AUSTENITIC STEEL JOINTS DEPENDING ON THE LINEAR ENERGY OF THE PROCESS

This Ph.D. thesis presents the state the art in the manufacturing welded joints in ferritic-austenitic steel by Gas Metal Arc Welding, as well as methods for testing and evaluating welded joints (chapter 2.). This analysis was the basis for defining the hypothesis, objectives, research problems and scope of the work (provided in chapter 3.). Chapter 4 presents theoretical and experimental methods for determining the amount of heat introduced into a welded joint.

The hypotheses of this dissertation are formulated as follows:

1. It should be assumed that in order to increase the accuracy of predicting the effect of the value of welding linear energy on selected properties of welded joints, such as macro and microstructure, deformation, weld cross-sectional areas, impact strength and hardness, it is necessary to take into account not only the value of linear energy when developing functional relationships, but also the relationships between the values of the parameters included in it, i.e. the values of current, arc voltage and welding speed.
1. It should be assumed that the standard determination of the amount of heat introduced in the GMAW welding process based on the set values of the process input parameters (arc voltage, current and welding speed), according to the standard formula, does not correspond to the actual amount of heat introduced into the joint, which does not allow to accurately predict the properties of welded joints. By determining the value of linear energy from the values of the actual welding process parameters (measured during the process), the properties of welded joints can be predicted with higher accuracy.

The main cognitive objective of the dissertation was to determine the effect of changes in the value of welding heat input, which is a generalized parameter set in the welding process (calculated from the measured values of the input parameters of the process, i.e., current intensity, arc voltage, and welding speed), on selected properties of welded joints, i.e., macro and microstructure, deformation, weld cross-sectional areas, impact strength and hardness in joints made of ferritic-austenitic steel using the GMAW method.

The goals of the Ph.D. thesis were achieved through experimental studies of the welding process presented in chapter 5. The obtained results of research and analysis formed the basis for the final conclusions, as well as the directions for further research, contained in chapter 6 of this work.