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DETERMINATION OF RESISTANCE WELDING PARAMETERS BY MATHEMATICAL MODELING

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At present, determination and selection of parameters for resistance projection welding of T-shaped joints using mathematical modeling methods is a promising direction.

The process of resistance projection welding is difficult to analyze from the point of view of mathematical computer modeling due to the presence of heat flux dynamics, changes in electric current density and material properties depending on temperature.

The mathematical model of the projection welding process should be built taking into account several factors that have a direct impact on the welding process, such as changes in the size and shape of the contact surface, which occur when the projection yields, redistribution of current density and contact pressures during the flow of electric current , changes in thermal and electrical resistance contacts, etc.

To build the mathematical model of resistance projection welding, a complex finite element method has been applied using a subroutine for linking submodules of electrical, thermal and mechanical analysis of the ANSYS commercial package.

When creating the mathematical model, the displacement h_{el} of the upper electrode during the welding process was evaluated at different stages of the process. This value shows the approximate value of plastic deformation of the metal due to the action of the compressive force of the electrodes on the welded parts, which are heated during the welding process by the action of heating pulses I_h and welding current pulses I_w.

The experiments were carried out on an Oliver MT-40 resistance welding machine using a program control system for the heat input power. The influence of the heating current I_h on the value of displacement of the upper electrode was determined experimentally and by mathematical modeling of the process of resistance projection welding of T-shaped joints.

The minimum value of displacement of the upper electrode during welding with the use of the program control system was h_{el} = 20 µm; the preheating current I_h was 30 % of the welding current I_w. The maximum value of displacement during welding was recorded with the heating current I_h, which comprised 65 % of the welding current I_w and was equal to h_{el} = 280 µm.

Thus, according to the characteristics of the displacement of the upper electrode, the parameters of the welding mode, in particular the heating current I_h, can be determined.