RESEARCH ON THE IMPACT OF THE AMPLITUDE OF VIBRATIONS ON THE ELECTRICAL PARAMETERS OF THE VIBROARC WELD OVERLAY IN ARGON

Mitko Nikolov

Summary: *The criteria used for assessing the flow of the electric arc process and the formation of the weld overlay clad surfaces are: short circuit voltage, voltage at the start of the arc combustion, short circuit amperage and amperage at the end of the arc combustion. It has been found that the amplitude of vibrations has a significant impact on the vibroarc process and minimum amperage of a short circuit and lowest voltage at the start of the arc combustion is realized at 2mm amplitude of the vibrations.*

Key words: *Vibroarc weld overlay in argon, amplitude of vibrations, electrical parameters.*

Vibroarc weld overlay is used to restore various components of small or large sizes, of simple or complex shape, with inner or outer surfaces of different metals and alloys. The argon reliably shields the arc and the weld overlay clad metal from the impact of the oxygen and nitrogen in the air and at the same time prevents from the formation of pores, oxides and nitrides which heighten the fragility of the weld overlay clad layer [3, 4].

The electrical parameters (voltage and amperage) of the process of vibroarc weld overlay bear a significant impact on the transportation of the molten metal and the formation of the restorative coverage.

The increase in the voltage leads to an increase in the arc interval, the time for the electric arc cycle, the combustion of the alloying elements and the defects in the weld overlay clad metal. The increase in the short circuit amperage and especially the speed of increase of this amperage results in an increment in the area of thermal impact and dispersion of the electrode metal. The change in these parameters in relation to the amplitude of vibrations during vibroarc weld overlay in argon has not been a subject of many a research. [1, 2].

Aim of the research is to determine the impact of the amplitude of vibrations on the electrical parameters during vibroarc weld overlay in argon.

The object of the study is the restored components from the tractors and farm machinery whereas the subject of the study is the process of formation of vibroarc weld overlay clad surfaces in argon.

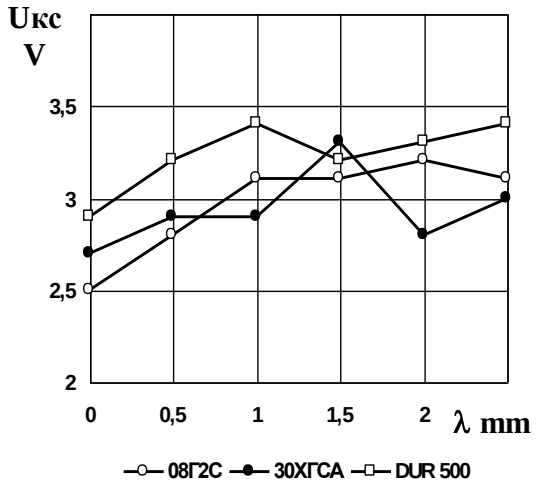

Fig.1. Impact of the amplitude of vibrations (λ) on the short circuit voltage (U short circuit) during vibroarc weld overlay in Ar with different electrode wires

Exposition: The criteria taken for assessing the flow of the processes for vibroarc weld overlay in argon and the starting parameters of the model for studying are:

- The vector of the parameters of the voltage (short circuit voltage, voltage at the start of the arc combustion);
- The vector of the parameters of the amperage (amperage of the short circuit and amperage at the end of the arc combustion).

As an input factor of the model for studying the amplitude of vibrations has been chosen.

The study has been carried out on a vibroarc system for weld overlay in shielding gases “ENTON-60” with an axial inertia vibrator. The argon is fed into the nozzle of the vibroarc apparatus under pressure from a bottle via standard gas equipment.

Experimental models made of steel 45, 50mm in diameter and 250mm length, have been used for weld overlay, corresponding to the modal values from the statistical research of the construction and technological characteristics of the components from the tractor and farm machinery [5,6].

The weld overlay has been carried out using low, medium and high carbon wires (Св 08Г2С, Нп 30ХГСА and DUR 500) 1,6 mm in diameter in the following mode: operating voltage - 20 V, amperage 195 A, speed of weld overlay – 0,9 m/min, wire feed speed - 2,3 m/min, pace of weld overlay 3 mm, outlet of wire electrode - 15 mm, shielding gas consumption - 15 l/min, frequency of vibrations - 46,7 Hz, angle of the point of arc combustion -45^0, angle of directing the wire electrode in the vertical plane -30^0 and in the horizontal plane -15^0.

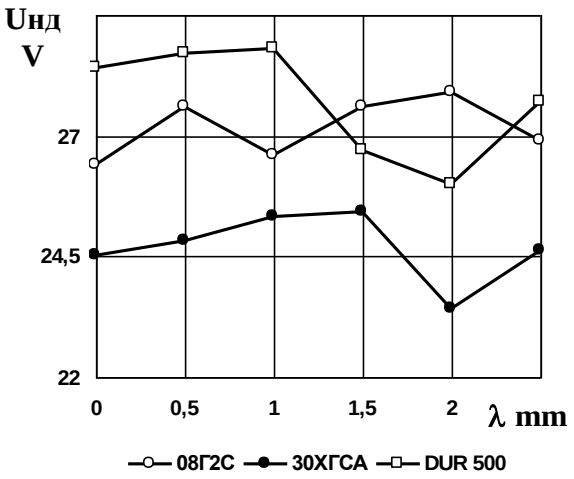

Fig.2 Impact of the amplitude of vibrations (λ) on the voltage at the start of arc combustion (U start of arc combustion) during vibroarc weld overlay in Ar with different wire electrodes

The amplitude of vibrations changed within the range of 0 to 2,5 mm.

The oscillogrammes of the voltage and amperage have been obtained with the help of an oscillograph 12S-1. The data obtained from the oscillographic recording of the electric arc process have been processed using the popular statistical methods.

The graphical dependencies for the impact of the amplitude of vibrations on the electrical parametres of the vibroarc process and the weld overlay clad layer have been deduced based on the processed data. (fig.1…4).

The increase in the amplitude of vibrations to 1 mm leads to an increase in the short circuit voltage (fig. 1), whereas with the further increase in the amplitude of vibrations the short circuit voltage keeps the values almost constant at 3...3,4 V. When weld overlaying with the high carbon wire DUR 500 we get the highest short circuit voltage and an increased burning of the alloying elements in comparison with the other wire electrodes.

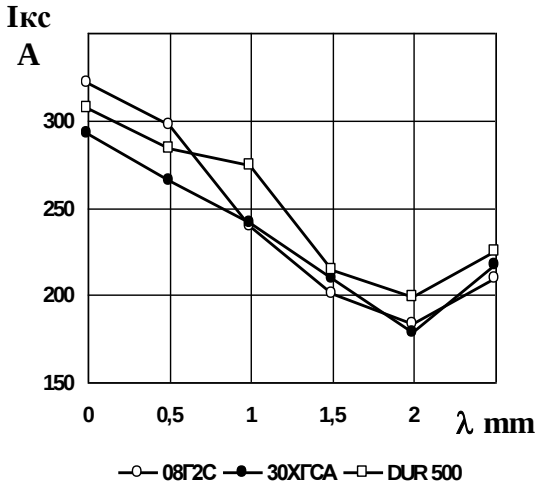

Fig.3. Impact of the amplitude of vibrations (λ) on the short circuit amperage (I short circuit) during vibroarc weld overlay in Ar with different wire electrodes

The amplitude of vibrations has a considerable impact on the voltage at the start of the arc combustion (fig. 2). The change in that voltage for the low and medium carbon wires is of extreme nature and the minimum values are obtained at amplitude of vibrations of 2 mm. This is more characteristic for electrode wires 30ХГСА and DUR 500.

Weld overlaying with low (Св 08Г2С) and medium (Нп 30ХГСА) carbon wires is done at lower voltage at the start of arc combustion in comparison with the high carbon wire DUR 500. The change in the voltage at the start of the arc combustion bears a significant impact on the roughness of the weld overlay clad layer. There is a correlation between the change in the voltage at the start of arc combustion and the roughness of the layer. [Klush].

One of the main parametres of the electric arc process is the short circuit amperage and the amperage at the end of arc combustion.

The short circuit amperage and the amperage at the end of the arc combustion depend primarily on the amplitude of vibrations. The change in the short circuit amperage is of extreme nature (fig. 3), with minimum obtained values at an amplitude of 2 mm. This results in lower dispersion of the electrode metal at drop detachment. When weld overlaying with the medium wire electrode (Нп 30ХГСА) the short circuit amperage is lower during the whole range of change in the amplitude of vibrations than when weld overlaying with the low and high carbon wires.

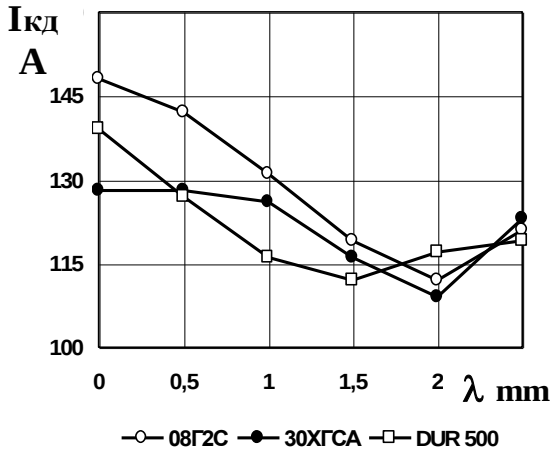

Fig.4. Impact of the amplitude of vibrations (λ) on the amperage at the end of arc combustion (length of arc combustion) during vibroarc weld overlay in Ar with different wire electrodes

When increasing the amplitude of vibrations the amperage at the end of the arc combustion is of extreme nature and minimum values are obtained again at an amplitude of 2 mm (fig.4). The short circuit amperage has a greater speed of change as opposed to the amperage at the end of arc combustion. The medium and high alloyed wires Нп-30ХГСА and DUR-500 have lower values of amperage at the end of arc combustion in comparison to the low carbon wire Св-08Г2С.

Conclusions:

1. The amplitude of vibrations has a significant impact on the parameters of the voltage and amperage (short circuit voltage, voltage at the start of the arc combustion, short circuit amperage and amperage at the end of the arc combustion).
2. The increase in the amplitude of vibrations leads to an extreme change in the short circuit amperage and the amperage at the end of the arc combustion, the voltage at the start of the arc combustion and the minimum values are obtained at an amplitude of vibrations of 2 mm.
3. For an amplitude of 2 mm the values of the short circuit amperage and the amperage at the end of the arc combustion when weld overlaying with the medium carbon wire (Нп 30ХГСА) are the lowest.

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Contact details:

Associate professor Mitko Ivanov Nikolov, PhD, department of Repair, reliability and Chemical Technologies, ‘Angel Kanchev’ University of Ruse, tel. 082 888 223;