HEAT TRANSFER AND HEAT EFFICIENCY OF PULSED ARK AS A FUNCTION OF CURRENT FREQUENCY

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Pulsed arc welding has influence on welding bead shape, and the relation between the welding parameters and the welding phenomena is complicated. The welding condition has been chosen by experiment and experience, such as the frequency and pulsed width ratio of current. Low frequency pulsed current less than 10 Hz in pulsed TIG welding is often used in order to control the heat flux for base material. However, the relation between heat transfer to the anode and welding condition has not been reported previously. In this paper, the input power, heat transfer and heat efficiency to the anode were measured and calculated, and characteristic of the heat transfer of pulsed arc is elucidated. Pulsed arc was generated by DC pulsed power supply in atmospheric pressure and ambient gas Ar. Steady arc and pulsed arc were compared on heat transfer with current frequency. From 0.1 to 100 Hz, mean current, voltage and heat transfer to the anode were measured by LabVIEW system and K type thermocouple for 30 minutes. And, heat transfer and heat efficiency were calculated under the same conditions by MHD simulation. As a result, heat transfer and heat efficiency were to be 850 W and 63% with increasing the current frequency. In addition, mean heat transfer changes to be 700 to 1,000 W with increasing the pulsed width ratio. However, mean heat efficiency doesn't depend on the pulsed width ratio derived by peak current time about from 62 to 69%. When the peak current time increases, mean heat transfer increased because heat flux to the anode was integrated during peak current time. Mean heat efficiency was almost constant because the coefficient of heat transfer as function of pulsed width ratio is almost equal to that of input power. Mean heat transfer to the anode has influence with not frequency of peak current but pulsed width ratio. In the calculation, heat transfer and heat efficiency show similar tendency. Therefore, peak current time is very important for plasma heating to the anode. In addition, pulsed arc becomes LTE state in each frequency under this experiment condition.