Experimental and Non-Equilibrium Numerical Investigations of a Transferred Argon Electric Arc

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Abstract

Thermal plasmas generated either by direct current (DC) transferred arcs or plasma torches are involved in many industrial processes, such as plasma spraying, cutting, welding, metal purification, extractive metallurgy and powder synthesis, *etc*. Their effective utilizations and exploitations require a thorough understanding to the heat transfer mechanisms between the arc column and the electrodes.

In the present study, two-dimensional (2D), two-temperature, steady state numerical simulations of a transferred arc stabilized by a constricting nozzle, as shown in Fig. 1(a), are conducted. In this modeling work, both the arc column region and the solid electrode regions are included in the calculation domain. The near-cathode layer is described by the model of the non-linear surface heating, while a simplified technique, using harmonic mean value of the electrical conductivity, is still used at the plasma-anode interface [1].

In parallel, a transferred arc reactor (see Fig. 1(b)) was designed to generate a stable arc jet, using pure argon as the plasma-forming gas (Q=4-10 slpm) and power supplied by a current regulated source (I=15-40 A) [2]. The predicted values of the arc voltages and heat powers transferred to the electrodes have been compared to the experimental data.

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References

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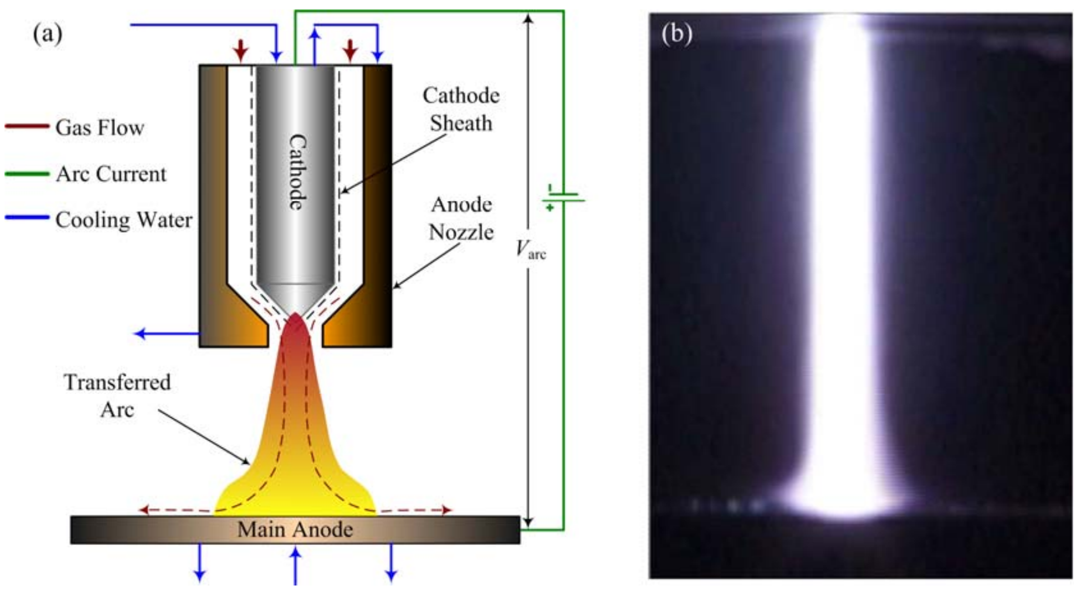

Fig. 1 Schematic diagram of the transferred arc (a) and the typical arc image (b).