Scaling-up of Reverse Vortex Flow Gliding Arc Discharge

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Abstract: This contribution reports results from work done on the scale up of a reverse vortex flow gliding arc discharge to power levels of up to 20 kW and its characterisation.

1. Introduction

Gliding arc discharge (GAD) is a transitional plasma discharge that can be selective and stable during atmospheric pressure operations. While there are other discharges that can operate in transitional regime such as microwave discharge; simple operation, atmospheric pressure operability, and relatively low-cost energy supply make GAD an attractive candidate for potential industrial applications. Previously Rabinovich et al [1] investigated characteristics of a scaled up 10 kW reverse vortex flow GAD and reported the limit of non-equilibrium regime in it was 2 kW, before transitioning to equilibrium regime. This study investigates the characteristics of a 20-kW reverse vortex flow GAD (figure 1).

2. Methods

Transition from equilibrium to non-equilibrium regime in GAD can be experimentally observed as an abrupt change in electric field, as found as dV/dL derivate of voltage dependence on arc channel length. These measurements, initially done for flat plate GAD, are in good agreement with spectroscopic measurements done before and after transition [2]. In this study changes occurring to electric field is investigated as a function of arc length (flow rate) to determine characteristics such as equilibrium and non-equilibrium regimes and determine average plasma gas temperature present in the 20-kW reverse vortex flow GAD.

3. Results and Discussion

Preliminary results show that at higher power levels of up to 20 kW, GAD work as a heat source producing plasma streams with temperature up to 2000° K (figure 2), which together with a simple design and no water-cooled electrodes could be beneficial in large scale industrial processes.

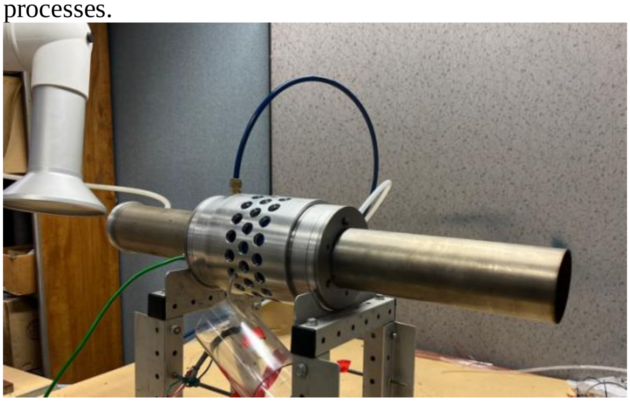

Figure 1: 20 kW Gliding Arc Discharge

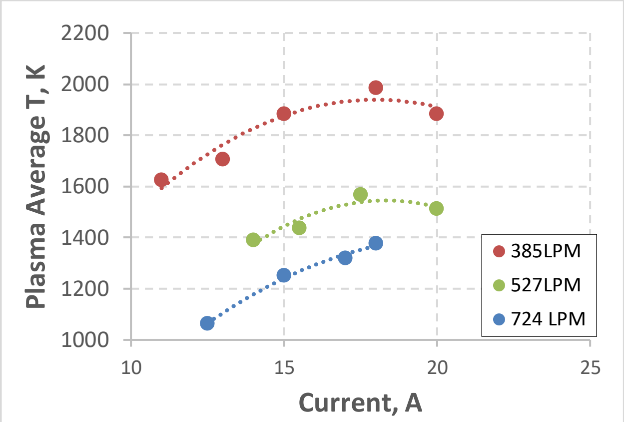

Figure 2: Average plasma temperatures at different flow rates in the 20 kW GAD.

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References

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