Multi arc roots would occur in a magnetically rotating arc plasma generator, which is thought to lower the electrode ablating. Multi arc roots arise from either parallel arcs or an arc shunting. It’s well known that parallel arcs at atmospheric pressure are unstable. In a magnetically rotating arc plasma generator, however, a series of images of parallel arcs at atmospheric pressure were captured by a hi-speed CCD camera. The parallel double arcs may continue steadily up to 8 milliseconds.

In this paper, characteristics of parallel double arcs, such as their voltage and currents, their configuration and luminosity and etc. in the progress of their generation, evolution and extinguishment are discussed. Complications affecting parallel arcs generation and stabilization are discussed. Main causes of parallel arcs coexisting were understood. Parallel arcs originate from partially contracted of dispersed arc plasma, which arises from plasma instabilities. Generally, the parallel arcs evolving will go through such three different states: the parallel arcs igniting and the voltage descending; stable progress of parallel arcs accompanied by the arc voltage slowly increasing and the arc current transferring between, and the parallel arcs come to the end and the voltage rises rapidly.

The coexisting and homeostasis of parallel arcs is assured by positive rising rate of arc voltage to arc currents ((dV/dt)/dI>0), which arises from arc column being elongated due to the influence of Lorentz force with arc currents increasing. When currents in one arc channel increase, its voltage would rise more rapidly and exceed the other, currents will transfer reversely. Consequently parallel arcs keep stable.

To our study, the stable parallel arcs appear more preferentially under such experimental conditions: arc currents $I > 200A$, the axially magnetic field $B < 300GS$, and $37500A\cdot GS < I*B < 60000 A\cdot GS$ at the gas flow $G = 3NM3/h$.

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