4Cp06

高速度カメラを用いた車載式水プラズマにおけるアーク変動解析
Arc Fluctuation Analysis of Water Plasma Installed on Vehicle by High-Speed Camera

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1 Introduction

Water plasma is in favor of generation of a large amount of H, O, and OH radicals. These radicals play important roles on control of by-products formation.

An water plasma has been scaled up into a mobile system in a vehicle with direct-current generator. This innovative in-vehicle plasma has great advantage to reduce the risk and cost caused by the transportation of harmful wastes.

Recent studies have revealed the arc fluctuation and temperature field of the water plasma by high-speed visualization [1]. However, these fundamental phenomena in in-vehicle water plasma has not been investigated in spite of their importance. In this study, the observation of arc fluctuation and the measurement of the arc temperature were conducted by employing the high-speed camera system. Furthermore, the effect of arc fluctuation on waste treatment was discussed.

2 Experimental

The arc was generated between a cathode inside a nozzle and a disk-shaped anode as shown in **Fig. 1**. The water as plasma source was introduced from cathode nozzle to discharge area. The copper or iron as anode material rotates to reduce anode erosion. The input power was changed in the range from 100 to 250 kW to clarify their effect on arc fluctuation.

A high-speed camera with an appropriate band-pass filter system was used to visualize the arc fluctuation and the temperature field as shown in **Fig. 2**. The wavelengths of the filters were 656 nm and 486 nm for H_α and H_β, respectively. Typical framerates were $1x10^5$fps for arc observation and 1×10^4fps for temperature measurement.

3 Result and discussion

The temperature distributions of the water plasma at different input powers are shown in **Fig. 3**. Arc temperature in most of the arc region was higher than 10,000 K at both conditions. Highest temperature was over than 15,000 K. These results revealed that the arc temperature of in-vehicle water plasma was sufficiently high to decompose any organic and inorganic compounds.

4 Conclusions

Temperature measurement on microsecond timescale was achieved by the high-speed camera system with appropriate band-pass filters. Measured temperatures were sufficiently high for complete decomposition of harmful wastes. Obtained understandings enable to apply this system to waste treatment.

References

[1] Y. Ozeki *et al.*, J. Fluid Sci. Technol. **12**(3), JFST0022 (2017).

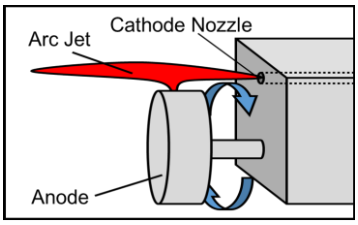

Fig. 1 Schematic diagram of water plasma system.

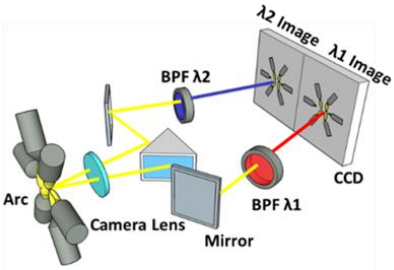

Fig. 2 Schematic diagram of observation system.

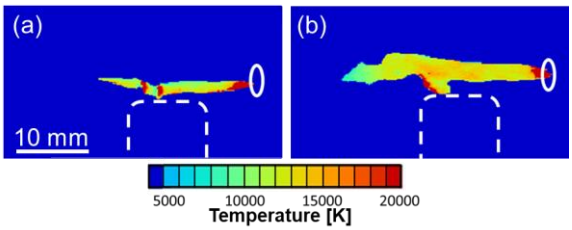

Fig. 3 Temperature distributions of water plasma with input power of (a) 102 kW and (b) 244 kW.