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$Li_2Si_2O_5$ 供給中の多相交流アークにおける Li 原子の励起光を用いた温度計測
Temperature Measurement Using Excitation Light of Li Atoms in Multiphase AC Arc during $Li_2Si_2O_5$ Supply

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1. Introduction

A multiphase AC arc has higher energy efficiency, larger plasma volume, and slower velocity compared with conventional thermal plasmas such as DC arc. The multiphase AC arc is expected to be applied to mass production process of nanomaterials. In spite of a large number of experimental and numerical efforts [1], nanoparticle formation mechanism in thermal plasmas has been insufficiently understood.

The purpose of this study is to visualize the behavior of metal vapor in the reaction field and measure the temperature.

2. Experimental setup

The multiphase AC arc was generated among 6 electrodes by applying sinusoidal voltages with different phases to multiple electrodes. Micron-scale powder of $Li_2Si_2O_5$ was injected into the multiphase arc at 0.2 g/min.

The emission was captured by a high-speed camera and two band-pass filters were combined for visualization of Li vapor.

3. Results and discussion

The emission spectra obtained at 10 mm from electrode during $Li_2Si_2O_5$ feeding are shown in **Fig. 1 (a)**. The line emissions from atomic Li was confirmed at 460 nm and 610 nm. Band-pass filters with transmission wavelengths of 460±5 nm and 610±5 nm were selected for high-speed imaging.

The excitation temperature of atomic Li was estimated from the relative intensity ratio method as shown in **Fig. 1(b)**. **Figure 2** shows the high-speed camera images and temperature distributions at different pressures. The temperature in the downstream increases with an increase of pressure. This is due to different arc current densities at different pressures. Higher pressure leads to arc constriction, resulting in higher current density. As a result, the temperature increases with pressrue increase.

4. Conclusion

Visualization of metal vapor in the multiphase AC arc and temperature measurement of metal vapors were conducted. The obtained findings enable to elucidate the nanoparticle formation mechanism.

References

[1] M. Shigeta and A. B. Murphy., J. Phys. D., **44**, 17, 174025

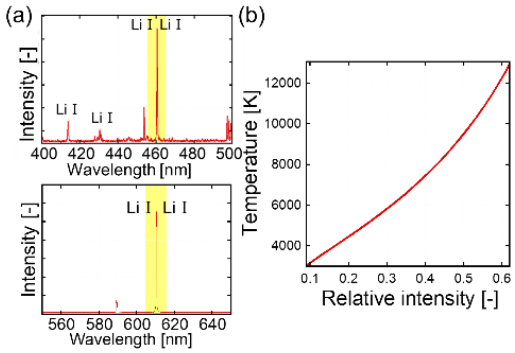

Fig. 1 (a) Emission spectra measured for the center wavelength of 460 nm and 610 nm and (b) theoretical curve calculated by the relative intensity ratio method.

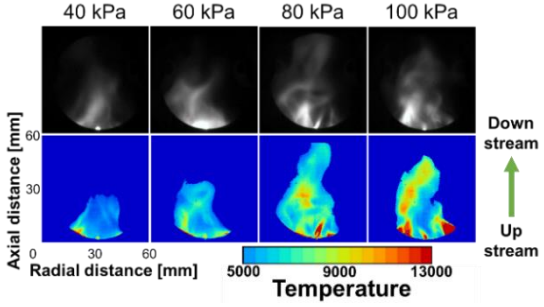

Fig. 2 Representative snapshots of the multiphase AC arc and the temperature distributions at different pressure.