Temperature Distribution of Diode Laser Sustained Plasma by Emission Spectroscopy

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Thermal plasma is widely applied to arc welding, heat source of thermal plasma coating for high melting material such as ceramic, EUV light sources, generation of functional materials, disposal of industrial waste and simulating atmospheric entry. Generally, arc discharge was used to generate thermal plasma. In addition to high pressure operation up to 10 MPa, it has advantage of simple structure, long operational time and ease of maintenance. However, in case of active gases operation, erosion of the electrodes causes severe flow contamination and unstable operation. So laser sustained plasma (LSP) is expected as one of the promising methods for high pressure plasma generation to overcome above problems [(1)]. Recently, our research group successfully generated LSP using 1 kW class diode laser. Fig. 1 shows photo of the LSP which incident laser power is 1000 W. The laser beam was focused on seed plasma generated by arc discharge in a xenon lump which is filled with 1 MPa xenon gas. The plasma emission was measured by a high speed camera and a photo detector. The emission region increased with the laser power and its shape expanded and contracted in the axial direction. As a result of FFT analysis, the fluctuation frequency was around 22 Hz as shown in Fig. 2. In this study, temperature distribution of the plasma is measured by emission spectroscopy.

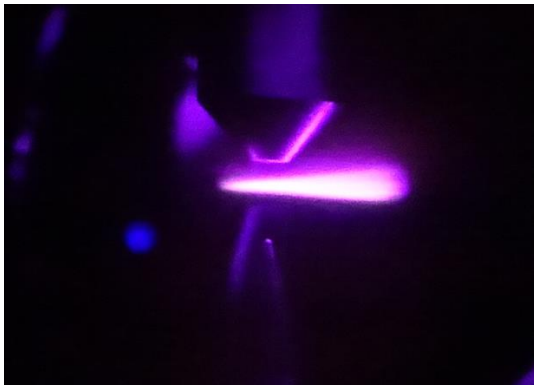

Fig. 1 Photo of LSP

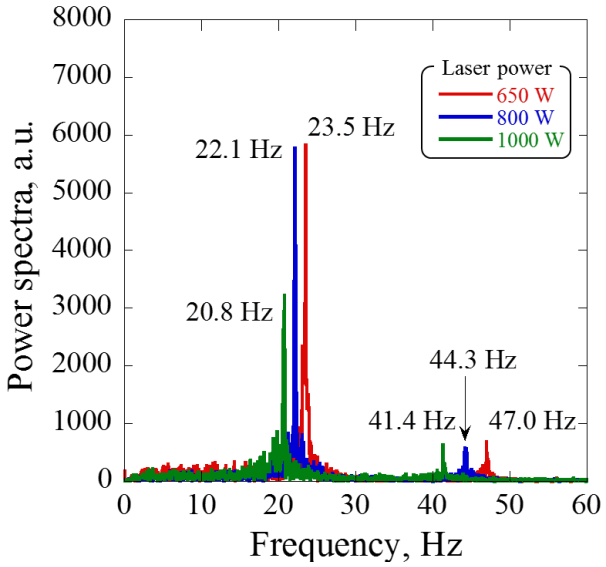

Fig. 2 Power spectra as a function of laser power.

Reference

(1) M. Matsui, K. Tanaka, S. Nomura, K. Komurasaki, Y, Yamagiwa, and Y. Arakawa, J.Appl. Phys. 112, 033301 (2012)