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Laser trapped single fine particle as a probe of plasma parameters
DAISUKE YAMASHITA, MASAHIRO SOEJIMA, TEPPEI ITO, HYUNWOONG SEO, NAHO ITAGAKI, KAZUNORI KOGA, MASAHARU SHIRATANI, Kyushu University — Here we report evaluation of electron density and temperature using optically trapped single fine particle. Experiments were carried out with a radio frequency low pressure plasma reactor, where we set two quartz windows as top and bottom flanges to irradiate an infrared laser light of 1064 nm wavelength from the bottom side [1]. Ar plasmas were generated between a powered ring-electrode set at the bottom of the reactor and a grounded mesh placed at the center of the reactor at 100 Pa by applying 13.56MHz voltage. The particles injected into the plasmas were monodisperse methyl methacrylate-polymer spheres of 10 μm in diameter. A negatively charged particle, which is suspended plasma sheath boundary, was trapped at the focal point of the irradiated laser light due to the transfer of momentum from the scattering of incident photons. At the beginning of the trapping, particle of 10 μm in size was trapped above 505 μm from the bottom window. After 230 min, the size and position were 9.56 μm and 520 μm, respectively. From the results, the electron density and temperature are deduced to be 1.7x10^9 cm^{-3} and 1.9 eV.

[1] T. Ito, et al., J. Phys.: Conf. Ser. 518(2014)012014.

Daisuke Yamashita
Kyushu University

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