

Abstract:

The effect of transverse magnetic field (TMF) of strength 0.5 T has been explored on spatially resolved brass plasma generated by Nd:YAG laser (6 ns, 532 nm, 230 mJ) irradiation at an irradiance of 25 TWcm^{-2} . Self designed and fabricated Langmuir probe was employed to diagnose brass plasma at different biasing voltages ranging from 3V to 100V as well as at various probe to target distances of 1.5cm, 2cm, 2.5cm, 3cm and 3.5cm. All the measurements were taken in existence and absence of TMF. The electron number density (n_e) electron temperature (T_e) and ion number density (n_i) of brass plasma have been evaluated from the I-V characteristic curves. All three plasma parameters i.e. T_e , n_e & n_i show decreasing trend with increasing the probe to target distance. The values of T_e vary from 21.5 eV to 11.7 eV, n_e varies from $10.5 \times 10^{11} \text{ cm}^{-3}$ to $7.2 \times 10^{11} \text{ cm}^{-3}$ and n_i varies from $11.5 \times 10^{12} \text{ cm}^{-3}$ to $7.2 \times 10^{12} \text{ cm}^{-3}$ in the absence of TMF. Whereas, in presence of TMF the variation in T_e is from 36.5 eV to 15.4 eV, n_e varies from $17.6 \times 10^{11} \text{ cm}^{-3}$ to $7.41 \times 10^{11} \text{ cm}^{-3}$ and n_i varies from $61.3 \times 10^{12} \text{ cm}^{-3}$ to $5.7 \times 10^{12} \text{ cm}^{-3}$. All the values of plasma parameters are significantly higher in the presence of TMF in case of shorter probe to target distances and show no significant differences at larger distance of probe to target. It is due to deflection of charge species in employed TMF which is proved through evaluation of the angular distribution of electrons and ions flux by using Faraday cups. In order to confirm the formation of double layer plasma and charge separation the self-generated electric field (SGEF) of laser induced brass plasma has also been evaluated with electric probe. In the absence of TMF, the measured values of SGEF varies from 0.7 V/cm to 0.2 V/cm and in case of TMF, due to confinement effect on brass plasma smaller charge separation occurs which is responsible for smaller values of electric field varying from 0.5 V/cm to 0.11 V/cm with increasing the distance of electric probe from the target.