Abstract

Langmuir probe characterization is used to diagnose laser induced Iron plasma generated by Nd:YAG laser (532nm, 6ns) pulses. The targets were exposed to laser irradiances ranging from 3.3 $GWcm^{-2}$ to 10 $GWcm^{-2}$ under vacuum condition. The Iron plasma is spatially confined by placing a metallic blocker. It is observed that plasma parameters of Iron are strongly dependent upon laser irradiance as well as spatial confinement. Increasing laser irradiance, the electron temperature of Iron plasma varies from 13.0 eV to 24.3 eV whereas, slight increase in electron temperature is observed with the variation from 14.7 eV to 27.0 eV, when Iron plasma is spatially confined with blocker. Similarly the electron number density increases from 1.92×10^{15} cm^{-3} to 2.56×10^{15} cm^{-3} in the blocker free case, but spatial confinement increases this value from 2.18×10^{15} cm^{-3} to 4.60×10^{15} cm^{-3}. It is revealed that the spatial confinement plays a significant role for the enhancement of both electron temperature and electron number density. The processes which are responsible for enhancement of Iron plasma are collisional excitation, confinement and compression due to reflection of shockwaves. To explore the surface structures of laser ablated Iron, the Scanning Electron Microscope analysis was performed. It reveals the formation of various features such as ripples, ridges and cones. The confinement of plasma in the presence of blocker helps for the growth of distinct and well defined structures as compared to blocker free case. The growth of ripples is attributed to Kelvin Helmholtz instabilities. The other role of spatial confinement is the growth of fine ripples as compared to blocker free case. The higher laser irradiances are responsible for the growth of well-defined and clean ripples.