Abstract

Nd: YAG laser (1064 nm, 10 ns) is employed to generate laser induced Cobalt (Co) plasma at various laser irradiances under ultra-high vacuum condition. The parameters of laser induced Co plasma have been determined using LIBS analysis for various laser irradiances. The plasma parameters increase with the increase of laser irradiance in the first regime, decreases with the increase of irradiance in the second regime and showed an alternating increasing and decreasing trend in the third regime. For the irradiance ranging from 2.7×10^{8} to 5.41×0^{8} Wcm^{-2} two Co plasma parameters electron temperature $(T)_e$ and electron density (n_e) of Co plasma are evaluated. The T_e varies from 7.83×10^{3} to 9.30×10^{3} K and n_e varies from 6.58×10^{17} to 7.63×10^{17} cm^{-3}. Self-generated Electric and Magnetic fields (SGEMFs) with known parameters have been estimated as a function of irradiances using electric and magnetic probes. The measured values of Self-Generated Electric Field (SGEF) varies from 72 Vm^{-1} to 300 Vm^{-1} and Self-Generated Magnetic Field (SGMF) varies from 15.30 T to 36.90 T at laser irradiances ranging from 2.7×10^{8} to 5.4×10^{8} Wcm^{-2}. The enhancements in electric field is attributed to increase in electric dipole formation, whereas magnetic field is enhanced due to more electric currents and temperature gradient. Surface morphology of laser irradiated Co target is characterized by Scanning Electron Microscope (SEM). SEM analysis reveals the formation of various structures like grains, pores, cavities, holes and crakes. It was observed that the growth of all these structures is strongly related to the laser irradiance along with plasma parameters. With the better control on laser irradiance various structures can be controlled along with self-generated electric and magnetic fields of plasmas.