Abstract The effects of the Carbon (C) ions irradiation on the compositional, structural, morphological and Field Emission (FE) properties of Molybdenum (Mo) have been reported by using two ion sources i.e Pelletron Linear Accelerator and Laser Induced Plasma (LIP). The irradiation of Mo from both ion sources is performed independently. In the case of Pelletron linear accelerator the polycrystalline Mo (99.999%) samples were exposed to C ions at constant ion dose of 2.8 10_{13} ions/cm_2 and at different ion energies ranges from 400 keV to 800 keV. While, in the second case an Nd: YAG laser (532nm, 6ns, 10Hz) of irradiance 16 TW/cm_2 was used to generate the graphite plasma that contains the C ions. Faraday Cup (FC) Time Of Flight (TOF) technique was employed to measure the fluence and energy of laser induced C plasma ions. The fluence of C ions varies from 5.1 10_{15} ions/cm_2 to 1.5 10_{16} ions/cm_2 by increasing the laser shots from 3000 to 9000 and value of energy was estimated to 6.4 keV. To explore the damage profile in both cases a SRIM program was used that predicts the ion range (R), electronic energy loss (S_e), nuclear energy loss (S_n) and the vacancies generated by C ions. From the XRD patterns no new phase is identified in both cases. However, a significant lower angular peak shifting of preferred orientated Mo (110) plane is observed at higher ion energies that strongly support the variation in Stacking Fault Probability (SFP) and it confirms the ion induced lattice distortion and stresses. Whereas, in the case of C plasma ions irradiation a higher angle peak shifting of Mo planes is observed for all fluence values. Anomalous trends in the peak intensity, crystallite size, dislocation line density and stress were also obtained after the C ions irradiation. FTIR spectra of laser induced C plasma ion irradiated Mo targets exhibit the stretching functional group of carbide which is a strong evidence of presence of C ions in Mo. The optical and Scanning Electron Microscopes (SEM) were used to explore the growth of different surface features on ions irradiated Mo. The irradiated surfaces exhibit the formation of ion tracks, melted channels, cracks, melt pools, clusters, agglomers, cavities and hillocks at various C ion energies of accelerator. Whereas, the features like pores, particulates, hillocks, particle clusters and agglomers are observed at different ion fluences of C plasma ions. These features are explained on the basis of Coulomb explosion, thermal spike and Bradley Harper instability models. Field Emission (FE) parameters of ion structured Mo targets in both cases are also investigated under UHV circumstances by evaluating I-V characteristics and accompanying Fowler-Nordheim (FN) plotting curves between current density (J) and applied electric field (E). In the case of xiv irradiation through pelletron linear accelerator, the improved FE parameters i.e E_o, J_{max} and β come out to be in the range of 2 V/μm to 20 V/μm, 98 to 3250 and 19 nA/cm_2 to 33970 nA/cm_2 respectively. Whereas, various ion fluences of laser generated plasma ions give improvement in the E_o, J_{max} and β from 11 V/μm to 2 V/μm, 140 nA/cm_2 to 99080 nA/cm_2 and 41 to 9436 respectively. These improved characteristics are strongly correlated to the densification and nature of the morphological features. (Ctrl)