Abstract

The surface morphology and field emission properties of laser irradiated Stainless Steel-304 (SS) have been investigated. For this purpose, Nd: YAG laser (1064 nm, 10 Hz, 10 ns) has been employed as an irradiation source. The irradiation has been performed in air at atmospheric pressure for various fluences ranging from 4.3 J/cm^2 to 15.2 J/cm^2. Scanning Electron Microscope (SEM) analysis revealed the formation of micro and nano scale surface features such as grains, bubbles and holes. Field emission parameters such as turn-on field (E_o), geometrical field enhancement factor (β) and maximum current density (J_m) of the irradiated SS samples are also measured by recording their I-V characteristics in a diode configuration under UHV condition. The negative slope of the linear Fowler-Nordheim (F-N) plots confirms the quantum mechanical tunneling of field emitted electrons. The values of field emission properties such as turn-on field, field enhancement factor beta and maximum current density come out to be 7.5 V/μm, 41 and 29.14μA/cm^2 respectively for untreated SS samples. Whereas, a significant enhancement in field emission properties of laser treated samples is observed and variation from 4.5 V/μm to 3 V/μm for E_o, 227 to 780 for β and 45.14μA/cm^2 to 79.8μA/cm^2 for J_m is revealed for samples treated at various fluences ranging from 4.3 J/cm^2 to 15.2 J/cm^2. The SS sample irradiated at a fluence of 10.6 J/cm^2, illustrates the formation of bubbles and holes at the surface and corresponds to the minimum turn-on field of 3 V/μm and the maximum field enhancement factor of 780.