Abstract:

In this study, molybdenum (Mo) was exposed to Nd: YAG laser (1064 nm, 10 Hz, 10 ns) at a fixed fluence of 76 J/cm2 under He gas environment at various pressures ranging from 10 torr to 200 torr. The structural and morphological properties along with work function of the laser irradiated Mo were investigated using XRD analysis, optical microscopy, Scanning Electron Microscopy (SEM) and Scanning Kelvin Probe(SKP) respectively. XRD patterns revealed no new phase formation. However, higher angular peak shifting is observed in Mo (110) plane due to compressive stresses. The initially increasing and then decreasing trends in crystallite size and dislocation line density are attributed to plasma-induced annealing and defect generation respectively. The Harris analyses was used to identify the preferred orientation along with evaluation of texture coefficient with the variation of He gas pressures. SEM analysis shows the formation of pin holes, cavities, ridges, spongy structures, re-solidified channels, voids, melt pools, multiple ablative layers and bumps. To examine the Field Emission (FE) characteristics of the laser irradiated Mo targets, experiments were conducted under ultra-high vacuum (UHV) environment by plotting I-V characteristics and Fowler-Nordheim (F-N) curves. The field emission parameters, including the turn-on field (E_o), maximum current density (J_{max}), and field enhancement factor (β) vary from 2 V/μm to 3.3 V/μm, from740 nA/cm2 to 2215 nA/cm2, and from 2601 to 8377, correspondingly. Theses variations in FE properties are strongly correlated with density and geometrical shapes of morphological features.

Key words: Laser ablation; Surface morphological features. Field emission properties. Work function. Emission sites