ABSTRACT

The present work deals with the investigation of the microplasma irradiation induced surface morphological, structural, compositional, electrical and field emission properties of Mg alloy. The irradiation effects are studied for various exposure times ranging from 2 minutes to 10 minutes at the fixed Ar flow rate of 10 L/m and applied DC voltage of 5 kV. The surface morphological analyses were performed by using by Optical Microscopy and Scanning Electron Microscopy (SEM) techniques. They reveal the formation of flower like patterns comprising of particulates, micro-bumps, and agglomers. These structures are explained on the basis of thermal spike model, Columb explosion, stress relaxation, sputtering and recrystallization processes. X-Ray Diffraction (XRD) analysis demonstrates the absence of any new phase formation. However, a substantial variation in peak intensities, crystallite size, dislocation line density, stresses and strain with exposure time is attributed to the structural variation employed by microplasma irradiation induced heating, melting, recrystallization, generation and annihilation of defects. Fourier Transformation Infrared (FTIR) spectroscopy reveals the characteristics of stretching vibrations of (OH-) group. The work function and electrical conductivity were measured by using Scanning Kelvin Probe (SKP) and four probe techniques respectively. The enhanced field emission parameters of plasma irradiated Mg alloy such as maximum current density J_{max} (304 to 2770 nA/cm2), turn-on field (2.6 to 3.3 V/μm), and field enhancement factor β (3015 to 7091) are well correlated with morphological features and structural parameters.