Abstract

In this study, microlasma irradiation in mesh configuration is used to induce surface morphological, structural, electrical and field emission modifications of brass for different exposure times ranging from 6 minutes to 14 minutes. The ablation spot depth and diameter evaluated by optical microscopy analysis vary from 100 μm to 140 μm and 213 μm to 1098 μm respectively. Scanning Electron Microscope (SEM) analysis reveals the generation of microscale holes, blisters, loop and fibrous network like structures which are explained on the basis of collisional sputtering and bursting of gaseous bubbles. From X-Ray Diffraction (XRD) analysis, it is found that microplasma irradiation of brass did not introduce any new compositional or structural phase. However, irradiation induced heating, melting and recrystallization cause variation in the peak intensities, crystallite size, dislocation line density and strain. Microplasma irradiation induced alterations in the work function are investigated by using the Scanning Kelvin Probe (SKP) Technique which falls within the range of 4.17 eV —4.92 eV. The potential of microplasma treated brass to be used as field emission cathode is explored by taking the I-V characteristics. The field enhancement factor (β), turn on field (E_o) and current density (J) are observed to fall within the range of 969—10532, 2 V/μm —11.5 V/μm and 131 μA/cm^2 —2864 μA/cm^2 respectively. The structured brass shows significantly improved values of field emission parameters well correlated with the structural density and electrical conductivity measurements and hence are attributed to the geometrical field enhancement, increased number of emission sites offered by the grown structures and enhanced charge transport properties. The maximum current density corresponds to the maximum electrical conductivity explored by four probe method.