Abstract

Nanosecond pulsed laser ablation phenomena of single crystal Ge (100) has been investigated by employing photoacoustic deflection as well as SEM analysis techniques. Nd: YAG laser (1064nm, 10 nsec, 1-10 Hz) at various laser fluences ranging from 0.2 to 11 Jcm^{-2} has been employed as pump beam to ablate Ge target. In order to evaluate in-situ ablation threshold fluence of Ge by photoacoustic deflection technique, CW He-Ne laser (632nm, power 10 mW) was employed as a probe beam, while passing parallel to the target surface at a distance of 3mm. This probe beam passes through Ge plasma plume and causes deflection due to density gradient of acoustic waves. The deflected signal was detected by photodiode. The threshold fluence of Ge, the velocity of ablated species and the amplitude of the deflected signal were evaluated. The threshold fluence of Ge was 0.5 Jcm^{-2} and was comparable with the analytical. In order to compare the estimated value of threshold with ex-situ measurements, the quantitative analysis of laser irradiated Ge was performed by using SEM analysis. For this purpose Ge was exposed to single and multiple shots of 5, 10, 50 and 100 at various laser fluences ranging from 0.2 to 11 Jcm^{-2}. The threshold fluence for single and multiple shots as well as incubation co-efficient were evaluated. It was observed that the value of incubation co-efficient was decreased with increasing number of pulses and is therefore responsible for lowering the threshold fluence of Ge. SEM analysis also revealed the growth of various features such as porous structures, non-uniform ripples and blisters on the laser irradiated Ge. The laser fluence as well as number of shots played a significant role for the growth of these structures.