

## Abstract

Effects of laser irradiations on the structure and hardness of Al 5086 alloy has been investigated in air as well as in vacuum ( $10^{-3}$  torr) by using Excimer laser. The numbers of shots were varied from 100 to 500. Williamson-Hall analysis was used to evaluate the crystallite size and lattice strain. When the specimens were irradiated in air, the crystallite size and lattice strain increases with the number of laser shots, except for 400 laser shots. When the specimens were irradiated in vacuum, the crystallite size and lattice strain also increases by increasing the number of laser shots except for 500 laser shots. It has been observed that the crystallite size of the specimens irradiated in vacuum is higher than those were irradiated in air. Inverse Hall-Petch relation is observed in the case of specimens laser-treated in air and classical Hall-Petch relation is observed in case of specimens laser-treated in vacuum not only for the surface hardness but also for hardness measured at 0.5 mm and 1.0 mm depth below the surface. It has been observed that cross over from classical Hall-Petch region to inverse Hall-Petch region takes place at about 55 nm on plotting combined data for laser-treated specimens in air as well as in vacuum. Classical Hall-Petch relation ( $D = 26 \text{ nm} - 36 \text{ nm}$ ) has been observed for Al 5086 alloy specimens treated with proton beam in vacuum same behavior was observed in case of Al 5086 specimens laser-treated in vacuum ( $D = 30 \text{ nm to } 99 \text{ nm}$ ).