Abstract

ecimens of $Pd_{80}Ni_{20}$ alloy were irradiated in air with 70, 80, 90, and 100 laser shots using a Q-witched Nd-YAG laser of 1064 nm wavelength with pulse duration 10 ns, energy 50 mJ, and epetition rate 10 Hz. Surface morphology of the specimens was studied with the help ofa canning Electron Microscope. The x-ray diffraction patterns of un-irradiated and irradiated pecimens were analyzed using Williamson-Hall method to evaluate crystallite size and lattice train. Surface hardness was measured using a Micro & Macro Vickers Hardness Tester. It was found that surface morphology of laser irradiated specimens include bumps, cone-like structures, flakes, fissures, cracks, cavities, and wave-like structures or ripples, etc. The peak intensity of (111), (200), (220), (311) and (222) planes increases linearly with laser shots, which shows that the concentration of point defects (i.e. vacancies) is progressively decreased on increasing the number of laser shots due to the annealing processes. The increase in peak intensity per laser shot is maximum for (111) plane and minimum for (222) plane. The average surface hardness of the $Pd_{80}Ni_{20}$specimen decreases on irradiation with 70 laser shots, and later on increases linearly with increase in laser shots up to 100. An inverse Hall-Petch relationship is observed in $Pd_{80}Ni_{20}$ specimens with crystallite size in the range 19 to 27 nm. As crystallite size decreases from 27 nm to 19 nm, volume fraction of amorphous phase increases progressively. The amorphous phase being softer than crystalline phase due to increased atomic spacing leads to reduction in surface hardness of the material.