ABSTRACT

In this research work, laser irradiation induced changes in the structural, surface, mechanical and electrochemical corrosion properties of Vanadium are investigated. The Vanadium specimens (1.5 cm × 1.5 cm), were irradiated by ND: YAG laser under different gaseous environment keeping the laser shots fixed. All the specimens were irradiated at constant values of pulse width (6 ns), pulse energy (150 mJ) and repetition rate (10 Hz). Structural properties of pristine and laser irradiated specimens were investigated by using X-ray diffraction analysis. The results revealed the preferred orientation of Vanadium along (200) plane that remain un-affected upon laser irradiation. The crystallite size *D* was monotonically increased with changing the nature of the gas from argon to helium due to its non-reactive nature, and then decreased with nitrogen gas due to its reactive and diffusive nature. The lattice strain ε also increased with the increase in crystallite size. The average diameter of the laser ablated region decreased with the change of gas nature. On contrary, the heat affected area around the ablated region was progressively increased with the changing of gas. The surface morphology of the laser-irradiated Vanadium specimens comprised of micro cones, cavities, cracks, grooves dips, droplets, ripples, bubbles, micro-pillars, and wave-like structures, etc. The surface hardness followed Inverse Hall–Petch relation, i.e., bigger the crystallite size (30 – 62 nm), larger the surface hardness (166 – 184 HV). The electrochemical corrosion results showed that lower the corrosion current density lower will be the corrosion rate and higher will be the polarization resistance.