Abstract

Lithium Niobate nanostructure ($LiNbO_3$) thin film was prepared and deposited on the quartz substrate by using pulse laser deposition (PLD) technique for the optical waveguide application. The effect of different preparation conditions which are: substrate temperature (250 and 300) °C, laser wavelength (1064 and 532) nm and annealing process on the structural, morphological and optical properties were studied. $LiNbO_3$ films are characterized and analyzed by using various techniques which are: X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM), Atomic Force Microscopy (AFM) and Ultra-Violet (UV-Vis) spectrophotometer. XRD measurements indicated that the films were more crystalline at the substrate temperature of 250°C and the films appeared high crystallization with higher laser wavelength (1064nm) before the annealing process at both substrate temperature and after the annealing process at the substrate temperature of 300°C only while, the structure of these films after the annealing process is much better than its structure before this process due to the increasing in the peaks intensity. SEM measurements explained that at the substrate temperature of 300°C the presence of pores and conglomerates were noted in high proportions on the films surface and the films prepared at low laser wavelength (532nm) were more homogeneous, smoother and better distribution compared to the films which prepared at high laser wavelength (1064nm). The results showed also an importance of the annealing process that indicate that the films structure starts to crystallize as well as the porosity and conglomerates on the films surface were reduced after this process. AFM measurements found that the annealing process led to increase the values of roughness average, RMS roughness and decrease the values of average diameter of grain size while the increase in substrate temperature leds to increase in all these values unlike that the increase in the laser wavelength leds to a decrease in all these values. UV-Vis measurements showed that the increase in the substrate temperature led to decrease the values of transmission (T%) and energy band gap (Eg) and

increases the values of absorbance (A), reflection (R%) and refractive index (n), while the increasing in the laser wavelength did not significantly affect the values of A, Eg and n, but it had little effect on the values of T% and R%. Whereas the annealing process led to an increase the values of all optical characteristics except T% values.