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Influence of post-deposition annealing on structural, morphological and optical properties of copper (II) acetylacetonate thin films

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Abstract

In this study, the effect of thermal annealing under vacuum conditions on structural, morphological and optical properties of thermally evaporated copper (II) acetylacetonate, $cu(acac)_2$, thin films were investigated. The copper (II) acetylacetonate thin films were deposited using thermal evaporation technique at vacuum pressure ~1×10^{-5} mbar. The deposited films were thermally annealed at 323, 373, 423, and 473K for two h in vacuum. The thermogravimetric analysis of $cu(acac)_2$ powder indicated a thermal stability of $cu(acac)_2$ up to 423K. The effects of thermal annealing on the structural properties of $cu(acac)_2$ were evaluated employing X-ray diffraction method and the analysis showed a polycrystalline nature of the as-deposited and annealed films with a preferred orientation in $[\bar{1}01]$ direction. Fourier transformation infrared (FTIR) technique was used to negate the decomposition of copper (II) acetylacetonate during preparation or/and annealing up to 423K. The surface morphology of the prepared films was characterized by means of field emission scanning electron microscopy (FESEM). A significant enhancement of the morphological properties of $cu(acac)_2$ thin films was obtained till the annealing temperature reaches 423K. The variation of optical constants that estimated from spectrophotometric measurements of the prepared thin films was investigated as a function of annealing temperature. The annealing process presented significantly impacted the nonlinear optical properties such as third-order optical susceptibility $\chi^{(3)}$ and nonlinear refractive index n_2 of $cu(acac)_2$ thin films.

Keywords: Copper (II) acetylacetonate – XRD – FESEM – Dispersion relation – Nonlinear optical parameters.

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