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Study of the effect of temperature on optical and topographical properties of RF Magnetron Sputtered ZrO_2 thin films

R Shakouri[1], E Nahvifard[1], S Miri[2], and N Talebani[1]

1. Department of Physics, Faculty of science, Imam Khomeini International University, Qazvin, Iran
2. Iranian National Center for Laser Science and Technology, Tehran, Iran

E-mail: shakouri@sci.ikiu.ac.ir

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Abstract

In this paper, ZrO_2 thin films were grown on glass substrates using RF magnetic sputtering method. In three separate experiments, three samples of ZrO_2 film were prepared at various temperatures. Three temperatures of 25℃ (laboratory temperature), 150℃ and 250℃ were selected for three samples, respectively. Except for temperature, other parameters such as pressure, film growth rate, substrate to target distance and deposition time were the same for all three samples. Optical properties and morphology of the samples were investigated. The morphology of the samples was determined by atomic force microscopy (AFM) images and the transmittance was measured using optical spectroscopy. The optical constants of the films were also calculated using their spectrum. The results show that the effect of temperature is especially evident on the optical properties of the films. As the temperature increases from the ambient temperature to 250℃, the refractive index changes from n = 2.11 to n = 2.18. Moreover, increasing the temperature, causes the absorption of the layer to increase. The morphology of the films also changes slightly by changing temperature. The average roughness of all three samples is less than half a nanometer..

Keywords: thin film ZrO_2, sputtering, morphology film, optical properties

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