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Abstract
Zinc oxide (ZnO) thin films with a strong c-axis preferred orientation, obvious piezoelectric and piezo-optical effects, have been used in acoustoelectric and acousto-optical devices. Besides, the surface textured or “cratered” morphology of ZnO films have a potential application in enhanced light trapping in optical devices such as solar cells. The conduction characteristics of ZnO film with typical resistivity of 1-100 Ω-cm. These primarily dominated by electrons due to the oxygen vacancies and Zn interstitial atoms. In order to improve electric conductivity of the ZnO n-type semiconductor, the proper metal of choosing to enhanced carrier concentration is a feasible and effective method.
In this research, we prepared Mo doped ZnO thin films on glass a substrate using co-sputtering to improve the conductivity of ZnO. The incorporated concentration of Mo atoms in ZnO was controlled by adjusting the aperture size of a shutter palaced in front of the Mo target. Textured morphology of ZnO film could be formed by attaching a metallic mask on the substrate. The optoelectric properties and structure of Mo doped ZnO films dependent on process conditions are investigated.
Results show that ZnO film doped with 1.84wt% Mo exhibits the highest concentration and conductivity and the lowest surface roughness. A resistivity of 7.52×10-3Ω-cm can be achieved after an annealing process of the MZO film. This is due to that the crystalline intensity and grain size of MZO film were increased after annealing, leading to reduced lattice scattering and impurity scattering effects. The optical transmittance of the MZO film were also improved by 1~2 %. Surface textures with a thickness of 100nm a diameter of 70μm were formed by attaching a metallic shadow mask to the subst rate. The surface textures could adjust optical path of an in coming light resulting in an optical transmittances reduction of 5%. This indicates the surface textured MZO films could enhance light diffusion efficiency. We also observed that the optical transmittance of MZO films decreases as the incident angle of light increases. Increase of thickness would enhance this angle effect to the optical transmittance. So that at high angle of incident the light diffusion refractive effect is more prominent.
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