Deposition of Al-doped Zn films by magnetron sputtering and its application in dye-sensitized solar cells

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ABSTRACT

In this study, deposition of Al-doped ZnO(AZO) films by magnetron sputtering system, and applied to dye sensitized solar cells (DSSC). It can be divided into two parts. The first part is mainly to explore the process parameters of magnetron sputtering system to deposit AZO thin film. Using FE-SEM, XRD, Hall-effect, UV-VIS to analyze the optical and electrical properties of AZO thin films. The experimental results show: when working pressure in 2×10-3torr、subtract temperature in 325℃,the resitivity is 2.9401 ×10-4(Ω． cm), and concentration is 3.2599×1021(cm-3), and mobility is 6.4682 (cm2． V-1． S-1). It can further enhance the electric conductivity of AZO, when it in 550 ℃ under an Ar/H2 (6%) atmosphere of annealing for one hour.The resitivity is 2.0176 ×10-4(Ω． cm), and concentration is 2.7939×1021(cm-3), and mobility is 11.08518 (cm2． V-1． S-1). After deposited AZO thin films, we using hydrochloric acid to etch the surface of AZO thin films. Using UV-VIS, Four-Point Probe, Haze meter, FE-SEM, to analyze the electrical and optical properties of AZO thin films. The second part ,we use AZO transparent conductive glass substrate in the first part, and it will be applying to DSSC. Using Degussa P25 TiO2 to spin coating(8.6 μ m) under AZO thin film for the photo-electrode, then we sinter the photo-electrode in 450℃. Our DSSC uses D719 dyes, EL-100 electrolytes and Pt counter-electrode. We measured the photovoltaic conversion efficiency(simulated AM 1.5 sunlight), and the result shows: Voc=0.8519 V、Jsc=4.460 mA/cm2、FF=0.53、 η =2.009%.

Keywords : magnetron sputtering system、AZO、Dye-Sensitized Solar Cell

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