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摻雜 Cr 及 V 對 AZO 透明導電膜及應用於染料敏化太陽能電池之抗化性研究

林義成

摘要

本研究主要目的在利用不同比例的摻雜 Cr(chromium)及 V(vanadium)元素進入 AZO 薄膜之中，探討添加不同比例之 Cr 及 V 兩種元素對 AZO 薄膜之光電特性影響；以及摻雜之 AZO 薄膜對蝕刻製程中化學穩定性之影響。首先藉由調變脈衝直流濺鍍功率、工作壓力、脈衝反轉時間、通氧量與偏壓等參數以得最佳之 AZO 薄膜製備條件;其次，以 Cr 及 V 金屬薄片置放於 AZO 靶材上並調變位置以改變摻雜量，並以所製得薄膜使用酸鹼溶液蝕刻與電化學腐蝕分析,探討摻雜對化學穩定性的影響，最後將實驗中製備之最佳化 AZO 薄膜應用於染料敏化太陽能電池上。研究中利用薄膜段差測試儀量測薄膜沉積厚度與蝕刻速率、X-ray 繞射儀分析薄膜結晶性、四點探針及霍爾量測儀量測薄膜電性、紫外/可見光光譜儀量測薄膜於可見光穿透率、原子力顯微鏡量測薄膜表面粗糙度、掃描式電子顯微鏡觀察薄膜表面、X 光能量分散光譜進行薄膜成份分析、高解析電子能譜儀觀察薄膜表面元素的化學性質及成分比例、二次離子質譜儀觀察薄膜內載子縱深分佈、

日光模擬光源及電池效率量測系統量測 DSSCs 之能量轉換效率。

關鍵字:AZO 薄膜;摻雜;化學穩定性;電化學腐蝕分析;DSSCs

Study on the Chemical Stability of AZO TCO Thin Film Within Cr and V Dopants and Its Application on DSSCs

林義成

Abstract

The purpose of this study is to investigate the effect of dopping different weight percent of chromium and vanadium in AZO films. That focuses on optical and electronic properties and chemical stability of doped AZO films. Sputtering parameters were adjusted by sputtering power, working pressure, reverse-time, bias voltage and oxygen flow ratio to obtain an optimum sputtering conditions. Cr and V sheets were used for dopping by changing their positions on the AZO target. Then the effects of optical and electronic properties and chemical stability of films after acid and alkali solution etching and potentiostatic. Finally, this study prepare optimal AZO films to apply to dye-sensitized solar cell. The etching rate, deposition rate, electric resistivity, crystalline, surface morphology, root mean square(Rms) roughness, chemical characteristic and componential proportion of surface element and distributive depth of carriers of the AZO film before/after the etching process were measured by α-step, four-point probe, x-ray diffraction(XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM), The composition analysis by EDS, X-ray Photoelectron Spectrometer (XPS), Secondary ion mass spectroscopy (SIMS), respectively. Finally, efficiency of energy at DSSCs were measured by sun simulator and measurement system of solar cell efficiency.

Key words: AZO film;Dopping;Chemical stability;potentiostatic;DSSCs