中文摘要

近年來由於溫室效應的影響，造成地球的平均溫度逐漸上升，相對也帶來空調負荷過重的問題。因此，利用電致色變窗戶改變陽光穿透率，減少光照，而節省冷氣用電的研究逐漸受到重視。本研究利用射頻磁控濺鍍系統製備氧化鎢薄膜，並探討各種濺鍍條件及熱處理溫度對薄膜晶體結構、微組織及電致色變性質之影響，接著將研究延伸至全固態電致色變元件並搭配光控制電路，使此元件能藉由光與電分別控制。電致色變元件封裝方式則分別採有機與無機兩種不同製程進行，並針對各項特性分析與比較。
研究結果顯示，在氧氣流量 1~5 sccm 中，所得氧化鎢薄膜結構均爲非晶質結構。當氧氣流量爲 3 sccm 時所製備的氧化鎢薄膜具有最佳的電致色變效果，其在波長爲 550 nm 處的穿透度變化率 ΔT550 nm = 77.5%，變色響應時間爲 60 秒，薄膜之著色效率 CE=20.4 cm2/C。氧化鎢薄膜經 500℃熱處理兩小時後，仍爲非晶質結構；當溫度提升至 600℃以上時，氧化鎢薄膜轉變成結晶結構。在熱處理溫度 700℃時，其穿透度的變化率 ΔT550 nm = 17.6%，變色響應時間超過 300 秒。
將最佳參數濺鍍之氧化鎢薄膜，以有機及無機電解質封裝成全固態電致色變元件。在有機電解質元件方面，其穿透度的變化率 ΔT550 nm = 69.9%，著色去色之響應時間爲 61 秒。而無機電解質元件之穿透度的變化率 ΔT550 nm =19.3%，顯示利用有機電解質進行封裝具有較佳的變色效果。最後爲使其達實用，本研究利用光控制電路系統驅動有機電致色變元件，經系統設計將其應用在節能窗上。

英文摘要

The Greenhouse Effect has made the average temperature of earth rise in recent years and this incurs a big problem on air-condition strain. Therefore, using electrochromic device to control the transmittance of window is becoming an important topic recently. There are two parts of this study. First, deposition of WO_3 films on ITO/glass by R.F. magnetron sputtering. The effect of sputtering parameters and heat treatment temperature on crystalline structure, surface morphology and the properties of electrochromic properties were studied. The All-Solid-State Electrochromic device with a light controller circuit was made for a light controlled or electricity controlled system. The electrolyte for electrochromic device could be either organic or inorganic materials. The difference between the two electrolyte materials was also studied. Experimental results indicated that the WO_3 crystal structure was amorphous at the oxygen flow rate from 1~5 sccm. The optimum condition occurred with the oxygen flow rate of 3sccm. The transmittance change of 550 nm wavelength ($\Delta T_{550\ nm}$) was 77.5% between colored and bleached states , the response time was 60s, and the coloration efficiency of the film was 20.4 cm^2/C. The WO_3 structure was still amorphous after 500℃ heat treatment for 2 hours. When raising the temperature was raised to 600℃, the structure became crystalline. The transmittance change was $\Delta T_{550\ nm}$ =17.6% and the response time was over 300s when WO_3 film was heat treated at 700℃.
All-Solid-State Electrochromic device was fabricated with the optimum sputter parameters. With an organic electrolyte, the $\Delta T_{550\ nm}$ was 69.89% and the devices response time was 61 seconds. With an inorganic electrolyte, the $\Delta T_{550\ nm}$ was 19.3%. This shows that the device has excellent coloration efficiency with inorganic electrolytes. For practical applications, a light controller circuit was designed to control the electrochromic device for smart window applications.