新穎染敏太陽電池組成結構與電化學特性分析

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摘 要

本研究分為兩部份，第一部分探討以不同鹽類(LiI、NaI、KI)與溶劑Propylene carbonate(PC)、3-Methoxypropiontrile(MPN)以及膠態高分子(polyacrylonitrile ,PAN)組成之電解質系統，以循環伏安(cyclic voltammogram，CV)法及交流阻抗(AC Impedance)等進行電化學特性探討；以此作為染料敏化太陽電池(Dye-Sensitized Solar Cell, DSSC)的電解質系統，量測其光電轉化效率，探討各種電解質系統對於元件光伏特性之影響。

本研究第二部分主要針對工作電極，以旋轉塗佈將配好的TiO2溶液塗佈於ITO玻璃上後燒結做為工作電極，並以不同厚度、異質結構觀察其對光電轉換效率的影響。電解質則以ELM-026(0.26 M LiI+0.05M I2+MPN)、EKM-034(0.34 M KI+0.01M I2+MPN)觀察其I-V的表現。

研究結果發現TiO2工作電極膜厚與旋塗次數成正比，而當工作電極膜厚達到9.1?愠時(六層)，具有最佳的光電轉換效率(??，當工作電極膜厚再次增加時，光電轉換效率不再增加，但是短路電流Jsc略降。

電化學分析結果顯示：溶劑MPN系統中，其Jlim大小為NaI > LiI > KI，溶劑PC系統中，其Jlim大小為LiI > NaI > KI。溶劑PC/EC=3:2時，其離子導電度最高可達8.22×10-2 S/m。

綜合以上結論，可知本研究之最佳製程參數：TiO2膜厚9.1?愠，電解質則以ELM-026，可得最大光電轉換效率， η =6.74%。其中結構(1)，TCO/P25-TiO2(9.1?愠)光伏測試結果如下；VOC=0.740V、JSC=14.11 mA/cm2、FF=0.56、 η =5.93%；結構(2)，TCO/Sol-Gel TiO2 underlayer/ P25-TiO2(9.1?愠) 光伏測試結果如下；VOC=0.723V、JSC=15.01 mA/cm2、FF=0.57、 η =6.14%；結構(3)，TCO/SnO2/ Sol-Gel TiO2 underlayer / P25-TiO2(9.1?愠)，光伏測試結果如下；VOC=0.75V、JSC=15.22 mA/cm2、FF=0.58、 η =6.74%。

關鍵詞 : 染料敏化太陽電池、循環伏安法、交流阻抗法、膠態高分子電解質

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