色素增感型太陽電池電解質系統之電化學研究

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摘 要

本研究針對工作電極的重要製程參數對DSSC光電轉換效率之影響，作較為詳細探討與解釋。主要參數包括控制TiO2薄膜孔隙度的添加劑(polyethylene glycol, PEG)、影響奈米TiO2晶粒分散情形，以利於成膜的界面活性劑(Triton X-100)以及TiO2薄膜的燒結溫度。此外對於工作電極的電化學特性略加探討，以與文獻中發表結果對照，作為爾後研究之參考依據。結果顯示TiO2薄膜的燒結溫度與開路電壓與短路電流之影響甚為明顯，燒結溫度為450oC時，有最大之開路電壓，Voc=417 mV, 短路電流隨燒結溫度增加而增加，由400oC時Jsc=0.99 mA/cm2, 增為550oC時，Jsc=2.7 mA/cm2, 填充因子FF超過500oC時開始明顯下降，?合以上數據，推論450~500oC為適當之燒結溫度。Triton X-100的添加量，在0.05~0.1 ml/3g of P25內均為適宜。此時Voc=518 mV, Jsc=2.1 mA/cm2, 填充因子FF與Triton X-100的添加量關聯性很低。PEG(polyethylene glycol, MW=6000) 的添加，可以調整TiO2薄膜的孔隙特性，經過多次的樣品製備與量測所得結果顯示：PEG的添加有助於短路電流之提昇，最大值出現於PEG=0.9g/3g of P25，此時Jsc=3.9 mA/cm2, 反之PEG的添加與否，對DSSC的Voc影響很小，不過PEG添加超過0.15g/3g of P25時，填充因子FF因為TiO2薄膜內含有機雜質成份漸增，因而導致FF下降。電化學分析(循環伏安法)得知：在工作電壓範圍內，無明顯氧化-還原峰，顯示本研究製備之TiO2薄膜工作電極具有良好的電化學特性。

關鍵詞 : 奈米TiO2粉體，色素增感型太陽電池，染料，電解質

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