工作電極之修飾及其對於染敏太陽電池光電轉換效率之影響

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摘 要

本研究以溶膠凝膠TiO2 製備染料敏化太陽電池之工作電極，研究製程參數對太陽電池光電轉換效率之影響，主要製程變因包括：寬能隙半導體工作電極的製備、染料系統篩選、對電極製備與太陽電池封裝等。?米孔隙的TiO2溶液經由燒結容易形成緻密結構的薄膜電極，如何調控其孔隙度使成為多孔性薄膜結構，是製備良好染料敏化太陽電池結構的重要技術。多孔性薄膜工作電極具兩種相互牽制的效應：孔隙度越大，TiO2 薄膜電極有效照光面積越小，染料分子披覆數量越少；反之，大的孔洞有助於電解質離子之擴散，因而減少質傳阻力，有助光電流之提升。為了達到最佳之效果，必須由製程條件調整膜厚與孔隙度大小。

本研究能隙阻障TiO2 工作電極製備條件進?研究。實驗方法以旋轉塗佈法(Spin coating)於已鍍有氧化銦錫 (Indium Tin Oxide, ITO) 之導電玻璃上塗佈奈米級之TiO2當工作電極SnO2與SiO2當修飾電極，這參數是將TiO2 添加不同比例PEG、不同燒結溫度、不同轉速等條件下，及注入最佳濃度的電解液，來研究對色素增感型太陽能電池光電特性之影響。加入不同比例的PEG可以調孔隙度大小，增加電解質離子之擴散,效能提升；在不同高溫燒結度下，所產生TiO2 的晶相不同，對光的吸收光譜也有所不同，所產生效率也有所不同。

研究結果發現：染料敏化太陽能電池製作需要高度技巧，經由適當製程調控，整體的最佳值之開路電壓VOC=0.7V，短路電流密度JSC=10 mA/cm2，FF=63%， η ?l 4.05%。此外染料的選用攸關光電流與電池效率。目前效率最佳的Ru-complex dye價格高昂，含有稀有貴金屬，多少會影響此一新穎太陽電池結構的發展，因此如何使用ruthenium complex染料，達到合理的效率，是今後需要努力克服的障礙。

關鍵詞 : 染敏太陽電池、溶膠凝膠、二氧化鈦、二氧化錫

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