

賴臆升 許嘉丹

高效能光催化產氫之太陽能電池原件

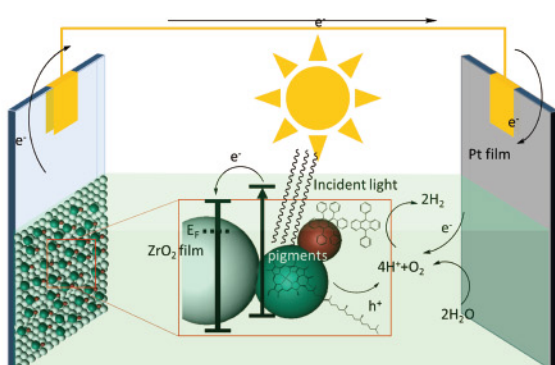
在我們的研究設計當中，使用無毒氧化鋯做為水分解元件之基材，其所具備的高能階可大幅提高水分解的效率，但缺點也是因為能階過高，導致於基態的電子不易吸收日光而躍遷至激發態。研究人員往往會添加光敏化劑來吸收太陽光，以產生受激發的電子並傳送給氧化鋯的導帶，進而隨著電子迴路注入電解液當中進行水的分解。但我們選擇使用天然的葉綠素做為吸收太陽光的敏化劑。透過使用天然的葉綠素可以大幅降低因使用人造合成分子而產生的環境危害(合成過程中產生的毒物、大量有機溶劑的使用與研發過程中因失敗而產生的化學廢棄物)!!

The device is made up of non-toxic zirconia, which serves as a substrate for water decomposition. Non-toxic zirconia possesses a high energy level that can greatly increase the efficiency of water decomposition within a solar cell. However, since the energy level is too high to absorb the sunlight, the ground state electron can easily transit into an excited state. To tackle the problem, natural chlorophyll is used to act as a photosensitizer in the design. Compared to the traditional photosensitizer, natural chlorophyll is more eco-friendly that can considerably reduce the impact on the environment.

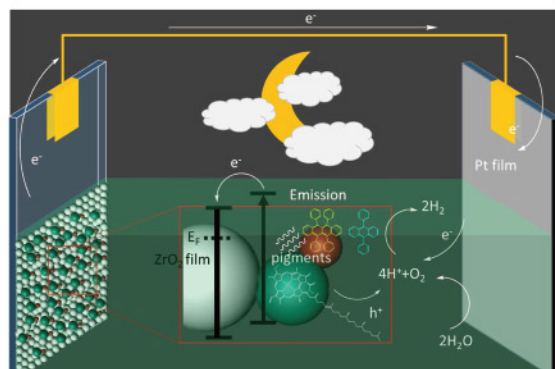
賴聰升 高效能光催化產氫之太陽能電池原件

環境污染、能源危機以及生態失衡的現象一直是需要被立即解決的困境，發展綠能電池原件並將綠能的概念教導給更多人，讓環境污染、能源危機以及生態失衡等問題都能從簡易的綠能原件得到解決。高效能之分解水產氫的太陽能電池原件主要是由高折射率且高硬度之氧化鋯薄膜結合純天然之葉綠素製備。天然之葉綠素可以吸收太陽光之能量使其電子從基態激發至激發態，接著激發的電子躍入氧化鋯之導帶能階當中隨著迴路來到白金電極並注入電解液，進而還原電解液中的氫離子而形成氫氣。目前世界上分解水產氫的太陽能電池原件僅有5%，且使用的材料大部分是有毒的重金屬。然而在本設計研究當中，皆是無毒且天然的萃取物，效率可達3%，若結合一些生活廢棄物的使用，其最高效率可達12%。利用這樣分解水產氫的太陽能電池原件，在未來的生活中，大家可以用更加有效的方式分解生活或工廠廢水，且選用來種植植物來萃取葉綠素更可有效降低生態失衡的現象。

The environmental pollution, energy crisis and ecological imbalance is the most serious issues for us, which is needed to be resolved immediately. Developing and teaching people the green energy technology would be the solution. During this topic the high performance water splitting solar cells are made of zirconium dioxide (ZrO_2) corresponding with the nature chlorophyll. ZrO_2 is the wide band gap metal oxide semiconductor with hard and high reflective index. The nature chlorophyll which is extracted from the leaves acts as the photosensitizer of ZrO_2 for absorbing the solar energy and exciting the electrons from ground state. The excited electrons will migrate into the conduction band of ZrO_2 than transport into the Pt films by the circuit. As the excited electrons transport into the Pt films, the electrons will inject into the electrolyte and reduction the H^+ ions into the H_2 gases. At present the world's demonstration the water splitting solar cells with the highest efficiency is 5%, which is made of the heavy metal and toxic organic photosensitizer. However, in this design study, we demonstration the water splitting solar cells with 3%, if combined with the use of a domestic waste, the maximum efficiency of up to 12%. Thus, in the future life, we can use a more effective way to decompose living or factory wastewater, and the number of exotic plants can be control more effectively.



天然之葉綠素可以吸收太陽光之能量使其電子從基態激發至激發態，接著激發的電子躍入氧化鋯之導帶能階當中隨著迴路來到白金電極並注入電解液，進而還原電解液中的氫離子而形成氫氣。



當晚上沒有日光時，使用過的螢光棒中的螢光素便可發揮作用，在製作原件時重新添加催化劑便能使天然之葉綠素吸收螢光素發出之螢光，直接轉換成激發態的電子，使電子躍入氧化鋯之導帶能階當中隨著迴路來到白金電極並注入電解液，進而還原電解液中的氫離子而形成氫氣。

未來可以利用家庭或工業廢水做為電解液，以外來種植物作為葉綠素之來源，便可同時做到廢水處理、外來種植物數量之控制且低碳節能之環境規劃。

2017 環境關懷跨領域設計競賽 ▶ 佳作



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