2013 中技社科技研究獎學金
CTCI Science and Technology Research Scholarship

石墨烯光觸媒分解水之研究
Graphene-Based Materials as Photocatalysts for Water Splitting

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研究重點

Solar fuel generation from water and carbon dioxide has significant potential to satisfy global energy demands in a most environmentally sustainable fashion. Different from conventional photovoltaics, powdered photocatalytic water splitting does not require electrodes or wires. Instead, a catalyst material is dispersed in water and upon solar illumination will produce hydrogen and oxygen. Common photocatalytic materials are composed of rare materials and rely on high-temperature synthesis and energy-consuming fabrication processes. These requirements negate the scalability and ease of the described energy cycle. Graphene oxide (GO), a polymer-like graphitic semiconductor made of only carbon, oxygen and hydrogen, has a large exposed area and can extensively disperse in water to molecular scale. These structural features, in both chemical and physical aspects, suggest that GO can be served as a stable photocatalyst for H_2 evolution from water under solar light irradiation. One of the major advantages of GO is its tunable electronic structure and band gap that vary with the quantity and type of functionalities located on the graphene sheets.

研究成果

(1) *Adv. Mater.* **2013**, under consideration. **(2)** *J. Phys. Chem. C* **2013**, 117, 6516. **(3)** *J. Phys. Chem. C* **2011**, 115, 22587. (4) *Adv. Funct. Mater.* **2010**, 20, 2255.

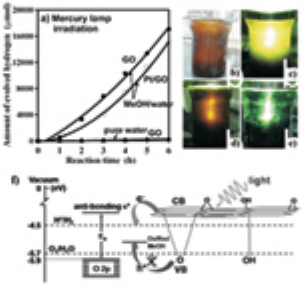

Figure 1. a) Time course of H_2 evolution methonal solution. b) Color variation of GO suspension during irradiation. c) Schematic energy-level diagram of GO.

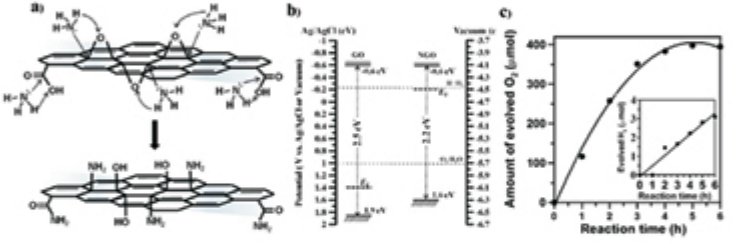

Figure 3. a) Mechanistic shcematics of ammonia interacting with GO. b) Schematic of energy level diagrams of GO and NGO. c) Time course of O_2 evolution from aqueous $AgNO_3$ solution over NGO.

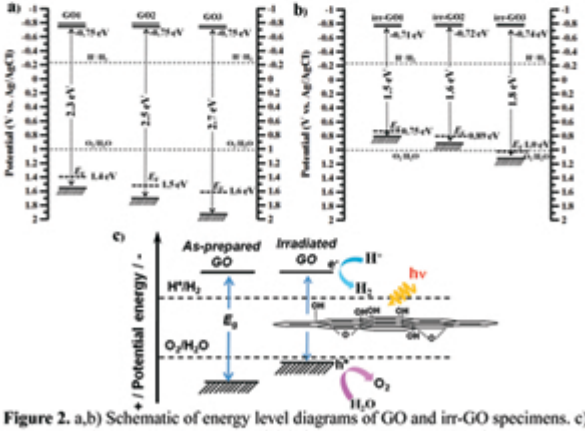

Figure 2. a,b) Schematic of energy level diagrams of GO and irr-GO specimens. c) Schematic of energy level diagram of GO for H_2 and O_2 evolutions from water.

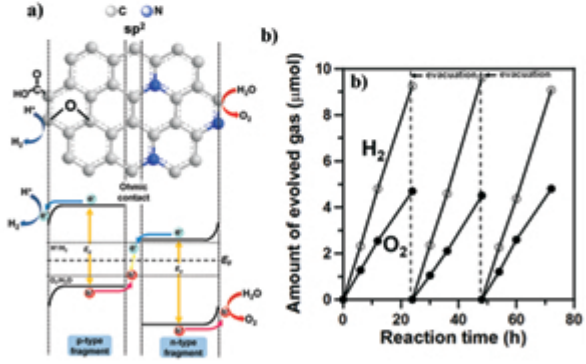

Figure 4. a) The configuration and energy diagram for the NGO-QD photochemical diode. b) Time course of gas production over NGO-QDs suspended in water under visible-light (420 nm < λ < 800 nm) irradiation.

研究生活及心得

學生現為成大化工系博士班三年級，在碩士班就進入鄧熙聖老師實驗室直到現在。研究領域主要集中在石墨烯材料的開發，並將其應用至光觸媒分解水與光電化學領域。非常感謝中技社科技獎學金評審委員的肯定，讓我能夠獲得這份巨大的殊榮。非常感謝家人以及鄧熙聖老師細心的栽培與指導，在我研究遇到瓶頸時給我鼓勵和建議。未來我將更專注於學術研究，將研究成果與其他能源和環境等相關領域整合。希望此結果可幫助解決目前地球上所面臨到的能源及環境問題，替目前社會對於乾淨能源的發展及台灣的學術研究盡一份心力。

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