

積體化高效能甲醇重組式複合有機無機磷酸燃料電池系統

執行單位

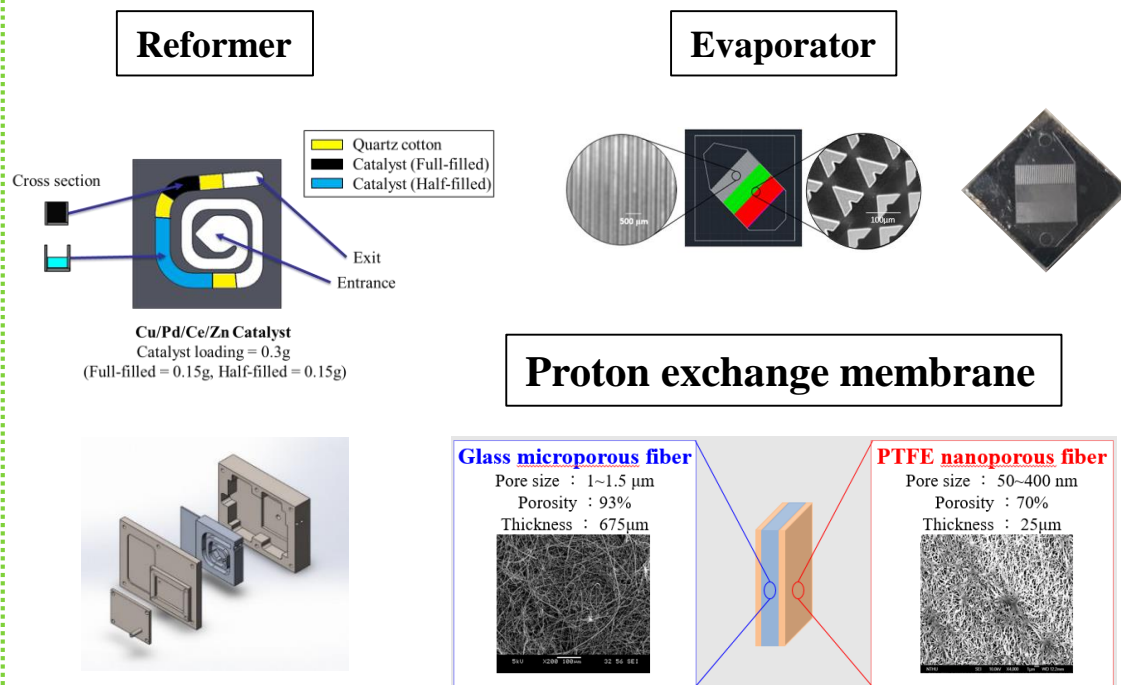
奈微米生醫光機電暨流體系統實驗室

計畫主持人

曾繁根

- 本圖隊整合甲醇蒸發器、甲醇轉化製氫之重組器、高瓦數磷酸燃料電池以及燃燒器，形成一自主產氫、輸氫與發電為一體之甲醇重組式磷酸燃料電池系統，預期應用至車用及備用電源。

- ✓ 反應器及其溫度控制方法 (中華民國發明專利第 592209 號)
- ✓ 被動式燃料電池之進料反應裝置 (中華民國發明專利第 470868 號、U.S. Patent No. 9,048,470)
- ✓ 可氣體及液體分離輸送之電極結構及被動式燃料電池 (中華民國發明專利第 403018 號、U.S. Patent No. 8,802,327)



- 甲醇蒸發器之前半部流道入口端設計採用人字形結構，此結構有助於加強流體之側向分散，形成穩定之均勻分布；在流道後段則是漸擴流道之設計，提高流動沸騰之穩定性。目前此裝置之熱效率可達**63.3%**。
- 甲醇重組器使用CuPdCeZn觸媒，藉由OSRM反應將甲醇轉化為氫氣；而流道之設計採用瑞士捲結構，使熱平均分散。其轉化率於275°C時可達**96.6%**，且CO濃度僅0.8%。
- 本團隊以多孔之玻璃纖維作為基材吸附電解質，在外包覆一層具奈米孔洞之PTFE膜作為防洩漏層，以降低磷酸洩漏程度。單電池測試(H₂、O₂)結果顯示，其效能在140°C時可高達**614mW/cm²**；在長效測試中可知PTFE防洩漏層可有效降低磷酸洩漏程度，提高電池之壽命。
- 本團隊整合蒸發器、重組器及磷酸燃料電池，以重組氣體取代氫氣，其效能可達**280mW/cm²**。

Integrated high-performance methanol recombination type organic-inorganic phosphoric acid fuel cell system

Execution Unit

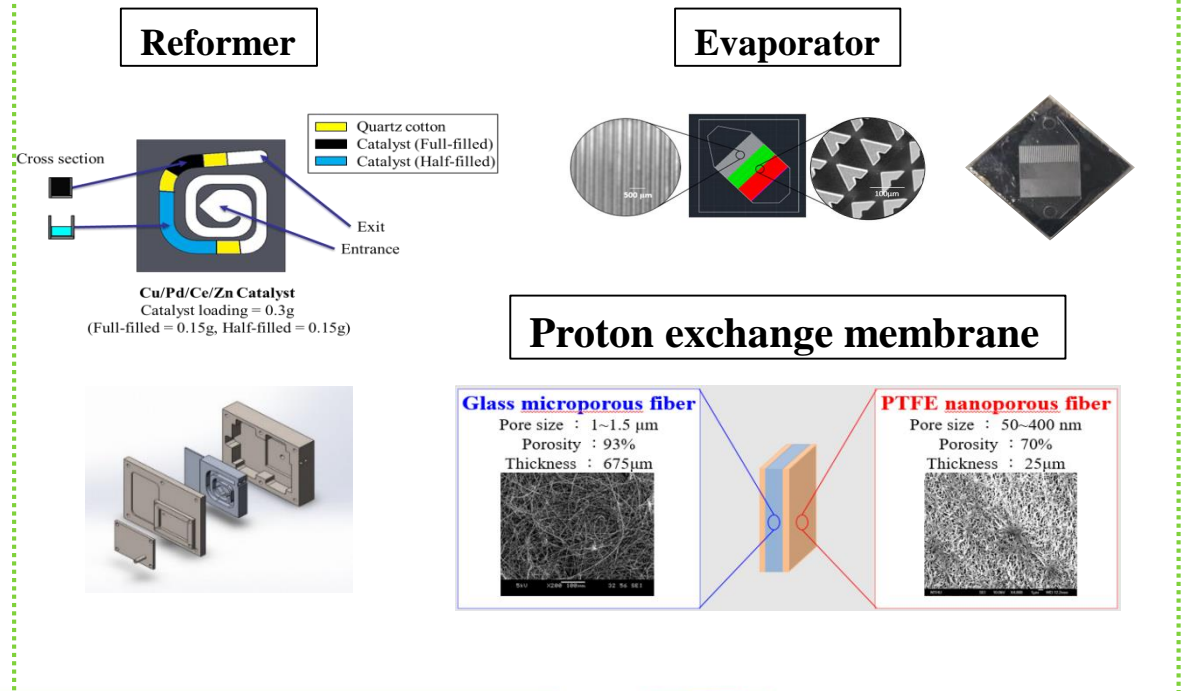
BioNEMS and Nano/Micro Fluidics Lab

Project Director

Fan-Gang Tseng

- We integrated methanol evaporator, methanol reformer, high power phosphoric acid fuel cell and burner into self-sufficient fuel cell system. It is expected to be used as backup power and vehicle power.

- ✓ REACTOR AND TEMPERATURE CONTROLLING METHOD THEREOF (R.O.C. Patent No. I592209)
- ✓ FUEL-FED REACTION DEVICE FOR PASSIVE FUEL CELLS (R.O.C. Patent No. I470868) (U.S. Patent No. 9,048,470)
- ✓ ELECTRODE STRUCTURE CAPABLE OF SEPARATELY DELIVERING GAS AND FLUID AND PASSIVE FUEL CELL USING THE SAME (R.O.C. Patent No. I403018) (U.S. Patent No. 8,802,327)



- A herringbone structure is designed for the inlet end of the first half runner of the methanol evaporator, which helps to strengthen the lateral dispersion of the fluid and form a stable uniform distribution, and the design of the flow channel is designed to improve the stability of flow boiling. At present, the thermal efficiency of this device can reach 63.3%.
- The catalyst used in the methanol reformer is CuPdCeZn. It can do OSRM reaction to produce hydrogen. The flow channel is designed into a swiss-rolle structure to balance the heat distribution. The conversion rate achieves 96.6% at 275°C with only 0.8% of CO concentration.
- Glass microporous fiber covered with PTFE thin film is used as proton exchange membrane. The result shows that its power density can reach 614mW/cm² at 140°C under H₂/O₂ supply. In long-term test, it can be observed that PTFE thin film can reduce the electrolyte leakage effectively.
- The integrated fuel cell system can reach 280mW/cm² at 140°C.