

金屬空氣液流電池組與關鍵元件開發計畫

執行單位

聯合大學 能源中心

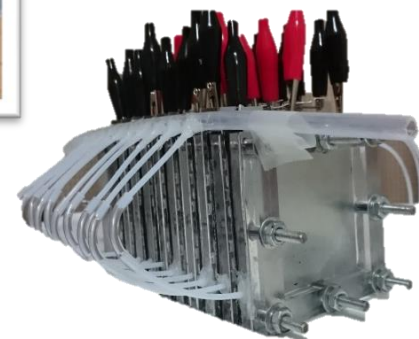
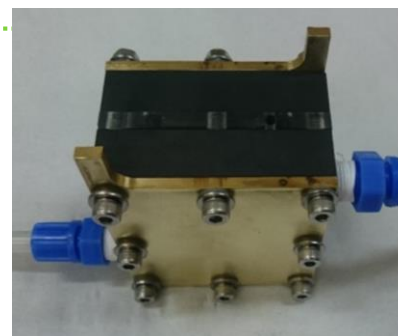
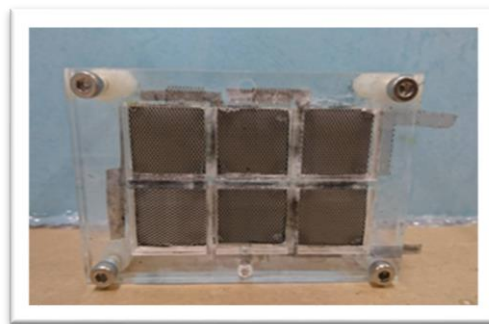
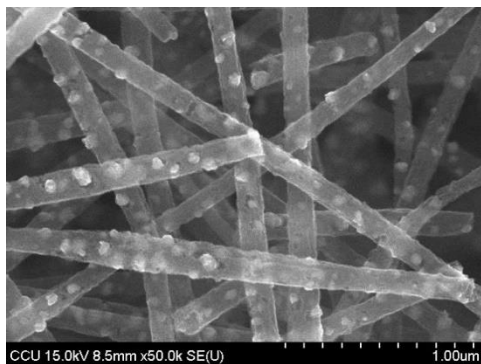
計畫主持人

薛康琳

- 計畫開發二次金屬空氣電池所需之關鍵元件。已開發新穎攜帶方便之**名片型緊急救援電力**並驗證可驅動小型電子產品。研發**新型空氣電極觸媒**經驗證具雙功能、高效率、安定特性，循環週期超過**70**小時。新製程產出之**氣體擴散層**具高透氣性，有助於電池效能之提昇。**陽極電極**以添加流場方式有效抑制枝狀晶產生。**新四元電解液**提高鋅電極之庫倫效率，降低腐蝕速率。

專利名稱：含觸媒及奈米碳管之多孔洞的奈米碳纖維及其製造方法

專利號碼：201706468



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● 技術介紹

1. 在電池設計中，利用空氣的對流設計，可提高空氣電極效率。
2. 開發的鐵摻雜之鈷鎳系尖晶石氧化物觸媒，在充放電cycle life超過70 h。
3. 首創電紡製成之疏水性PS高分子纖維膜，透氣性比商用PTFE membrane好。
4. 開發以控制電解質流場方式改良鋅電極之電化學性質，並抑制枝狀晶產生。
5. 開發四元電解液添加劑，提高鋅電極之庫倫效率，降低腐蝕速率。

● 目前發展情形

- 已商業化的鋅空氣電池，目前仍以一次鋅空氣電池為主。目前已有鋅泥式的一次鋅空氣液流電池。其最大功率密度約在300~500mW cm⁻²之間。
- 鋅空氣二次電池目前以開發雙功能觸媒與可饒式型電池為主；鋅空氣二次液流電池目前仍在實驗階段，
- 目前研究鋅空氣電池的國家主要為美國與大陸，且專利近20年的發表情況已從每年兩篇到提升至每年15篇。

Development of Metal-Air Flow Battery and Key Components

Execution Unit

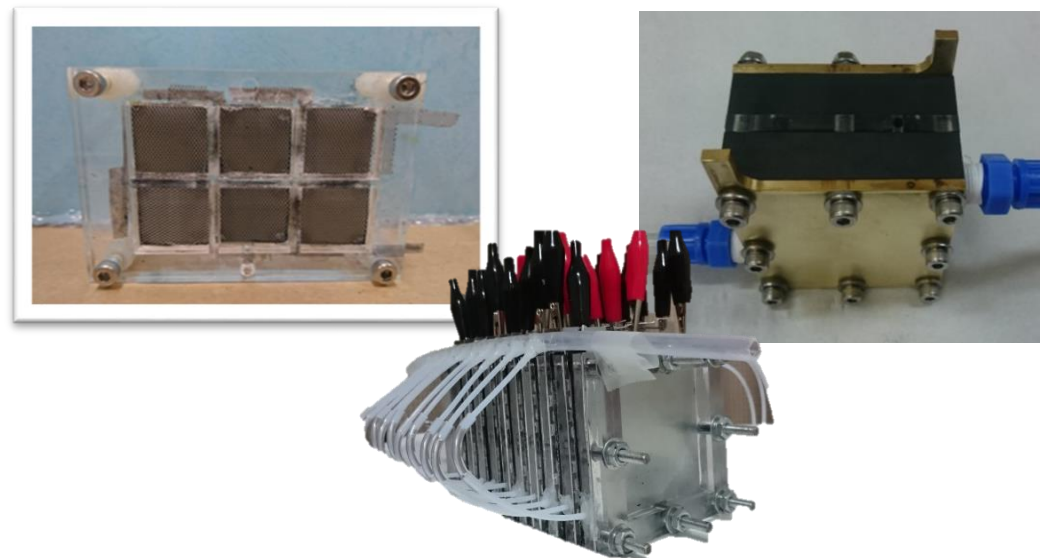
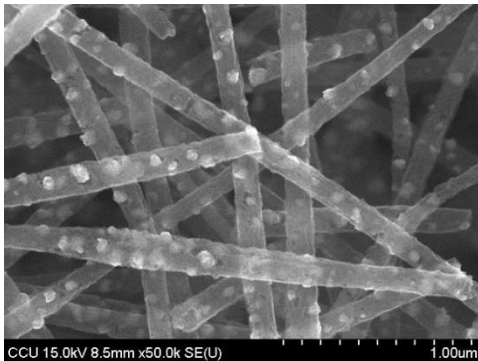
National United University/Energy Research Center

Project Director

Kan-Lin Hsueh

- Project aims to develop the key components for secondary metal-air batteries. A new **business card size zinc-air battery** has been developed as emergency power. It is capable of driving small electronic products. A **new catalyst** has been developed for air electrode. It is proven to have dual-function, high efficiency, and chemically stable. Catalyst cycle life is greater than 70 hours. A highly air permeable **gas diffusion layer** is produced by a novel process. It improves the battery performance. The **anode electrode** under flow field can effectively suppresses dendrite formation. New **quaternary electrolyte** can improve the coulomb efficiency of zinc electrode and reduce the corrosion rate.

Patent : Containing catalyst porous nano-carbon fiber and its manufacturing method
201706468



Development of Metal-Air Flow Battery and Key Components

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● Technology

1. The battery design adopt force convection on the air side. It improves battery performance.
2. Developing iron-doped cobalt-nickel spinel oxide catalyst. The charge-discharge cycle life is greater than 70 h.
3. Hydrophobic PS polymer fiber membrane made by electrospinning technique. The permeability of this membrane is much better than the commercial PTFE membrane.
4. Zinc electrode under controlled electrolyte flow field improve its electrochemical deposition property and inhibits dendrite formation.
5. Developing quaternary electrolyte additives. It improve the coulombic efficiency of zinc electrodes and reduce the corrosion rate.

● Current status

- Commercialized zinc-air batteries are still for primary battery applications. Zinc-air flow battery is found in the literature. Its maximum power density reaches $300 \sim 500\text{mW cm}^{-2}$.
- Secondary zinc-air batteries development is focus on dual-function catalyst and flexible battery. Secondary zinc-air flow battery is at its laboratory development stage.
- At present, zinc-air batteries are mainly studied in United States and China. Patent issued in the past two decades has been raised from 2 to 15 per year.