

# 分散式儲能系統及控制技術(2/3)

執行單位

工研院/綠能所

計畫主持人

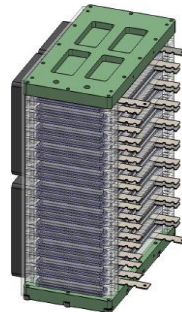
楊昌中

- 再生能源如太陽能與風力發電亟需分散式儲能系統提供穩定電網，本計畫投入研發前瞻高功率鋁電池及高能量金屬空氣二次液流電池，採用低成本且蘊藏豐富的金屬材料為基礎，達成**0.025 USD/kWh/cycle**的長程成本目標。

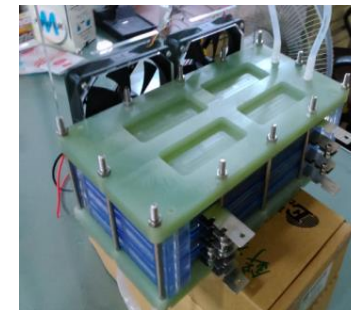
- ✓ 鋁電池專利全面佈局逾50件，使臺灣具備發展鋁電池產業的堅實根基。
- ✓ 高效率長壽命空氣電極開發結合千瓦級電池設計，將有利於下世代儲能技術發展。
- ✓ 已布局空氣電極專利2案4件(取得中華民國專利I482660)，並將申請電池組設計專利



可高速充放電鋁電池連續兩年榮獲國際大獎，研發技術快速由實驗室放大至試量產階段，成果快速與產業化接軌



三單電池組圖



千瓦鋅空氣電池組設計組合

# 鋁電池

- 2016榮獲全球百大科技研發獎(R&D 100 Awards)、2017榮獲愛迪生發明大獎(Edison Awards)
- -成功開發可高速充電之發泡石墨電極，小電池充電速度125C-rate，循環壽命30,000次，衰退率<10%，庫倫效率>99%。2V/1Ah方型電芯採用圖案化電極結構，提高石墨電容量至102mAh/g，循環壽命1,000次。
- 高容量陰極材料開發技術，高可靠度電解質材料改質技術
- 高耐用性電池芯、電池模組與系統整合技術
- 鋁電池專利全面佈局逾50件，使臺灣具備發展鋁電池產業的堅實根基

# 鋅空氣電池

- 高效率/高比表面積複合式 $\text{MnO}_2$ 可有效提升放電電壓至1.30V、充電電壓~1.73 @20 mA/cm<sup>2</sup>，充放電效率可達~75%；電沉積法製作空氣電極，電極壽命>3000 cycles，庫倫效率超過80%。
- 完成千瓦級鋅金屬液流二次電池模組設計，3-cell短電池組之組裝目前正進行密封檢測，後將繼續進行電池性能測試，確認可行後將進行放大製程。
- 高效率長壽命空氣電極開發結合千瓦級電池設計，將有利於下世代儲能技術發展。
- 已布局空氣電極專利2案4件(取得中華民國專利I482660)，並將申請電池組設計專利

# Distributed Energy Storage System and Management Technology

Execution Unit

ITRI/Green Energy and Environment Research Laboratories

Project Director

Chang-Chung Yang

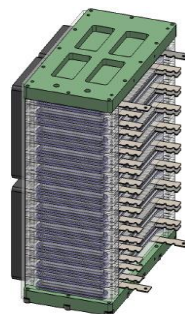
## ● Content

Distributed energy storage system is an important advanced technology for the integration of future various renewable energy sources and the smart grids. This project developed advanced aluminum ion battery with high power density and metal-air flow battery with high power energy density to achieve long-term cost target of 0.025 USD / kWh / cycle.

- ✓ More than 50 patents of Al-ion batteries reveal the strong foundation of battery research in Taiwan.
- ✓ The kW-scale Zinc-air battery modules with high efficiency and good cycle life contribute to the development of next-generation energy storage technology.
- ✓ The Zinc-air battery electrode was patented. (R.O.C. patent I482660) The Zinc-air battery module design will also apply for patent.



The ultrafast rechargeable Al-ion battery has won the international awards for two years. Trial production is undergoing and commercialized target will soon be achieved.



kWh Zinc-air battery module

## Al-ion battery

- R&D 100 Awards (2016) & Edison Awards (2017).
- Graphitic foam electrode was successfully developed for ultrafast rechargeable battery: 125C-rate for a single cell, cycle life ~ 30,000 cycles, capacity fading <10%, coulombic efficiency >99%.  
2V/1Ah battery with pattern-structure electrode: enhance the graphite capacity to 102mAh/g, cycle life ~ 1,000 cycles.
- Development of high capacity cathode materials & material modification techniques for high reliable electrolytes.
- High durability cells, battery modules and system integration techniques.
- More than 50 patents of Al-ion batteries reveal the strong foundation of battery research in Taiwan.

## Zinc-air battery

- High efficiency/high specific surface area complex  $\text{MnO}_2$  has enhanced discharge voltage to 1.30V, charge voltage~1.73 @20 mA/cm<sup>2</sup>, efficiency~75% ; Air electrode fabricated via electrodeposition method: cycle life>3000 cycles, coulombic efficiency >80%.
- Accomplish the module design of kWh Zinc metal flow secondary battery. Short cell (3 cell) pack is undergoing the sealing test. The following steps are battery performance test and pilot production.
- The kWh Zinc-air battery modules with high efficiency and good cycle life contribute to the development of next-generation energy storage technology.
- The Zinc-air battery electrode was patented (R.O.C. patent I482660), and it's module design will also apply for patent.