

以熱化學/電化學作動催化之高安全性與高性能鋰離子電池技術開發計畫

執行單位

國立臺灣科技大學應用科技研究所

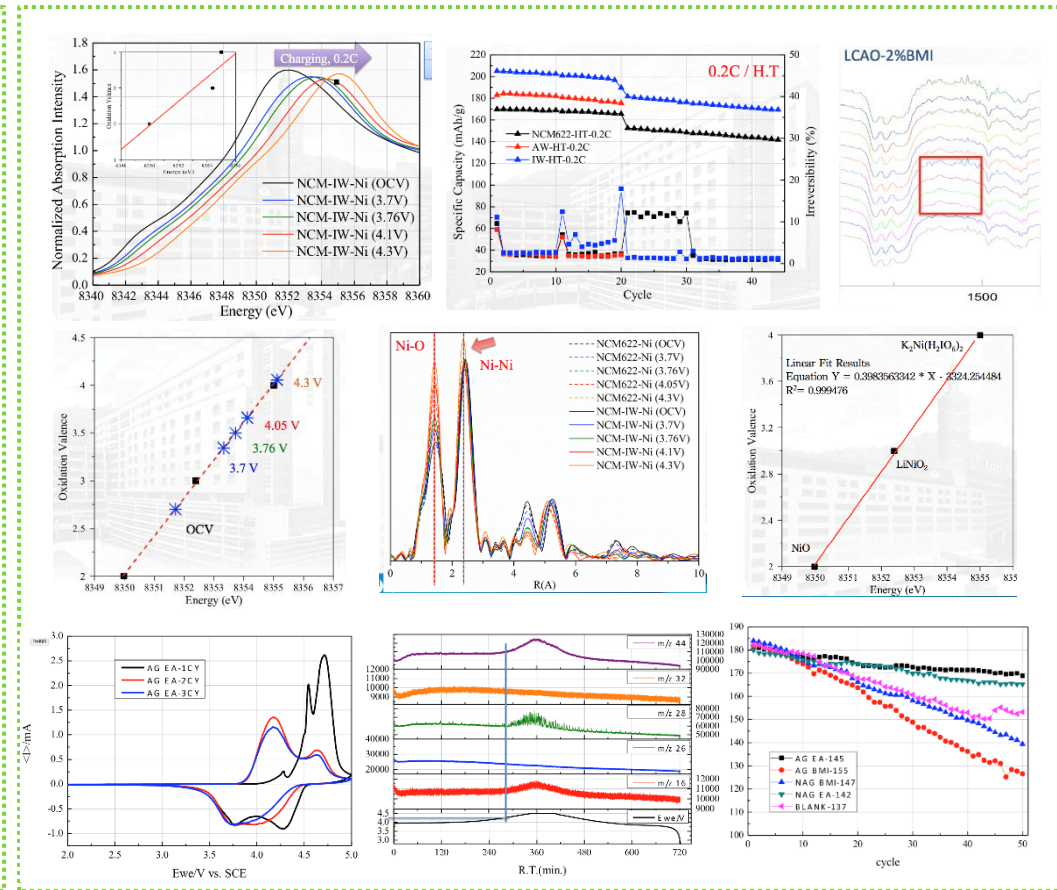
計畫主持人

王復民

開發高可靠度及具高度專利性的下一代LIVING@高安全性添加劑為本計畫最終目標。鋰離子電池用添加劑除了具有高安全性之外，也需具備良好熱/電化學選擇性，並兼顧高庫倫可逆效率與循環壽命。

專利

1. OLIGOMER-POLYMER AND LITHIUM BATTERY, Fu-Ming Wang*, Bing-Joe Hwang, Chong-Shyan Chern, Jung-Mu Hsu, Jing-Pin Pan, Chang-Rung Yang, PHAM QUOC THAI, R. O. C. Apply No. 105136149; P. R. C Apply No. 201710384206.2; U. S. A. Apply No. 15/619061
2. OLIGOMER ADDITIVE AND LITHIUM BATTERY, Fu-Ming Wang*, Bing-Joe Hwang, Chong-Shyan Chern, Jung-Mu Hsu, Jing-Pin Pan, Chang-Rung Yang, R. O. C. Patent No. I608646; P. R. C Apply No.201610153038.1; U. S. A. Apply No. 15/081,810
3. OLIGOMER-POLYMER AND LITHIUM BATTERY, Fu-Ming Wang*, Chong-Shyan Chern, Jung-Mu Hsu, R. O. C. Patent No. I602849; P. R. C Apply No. 201710251814.6; U. S. A. Apply No. 15/591,897
4. OLIGOMER-POLYMER AND LITHIUM BATTERY, Fu-Ming Wang*, Chong-Shyan Chern, R. O. C. Patent No. I602857; P. R. C Apply No. 201611036226.2; U. S. A. Apply No. 15/406,398
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- ✓在高能量密度與高鎳含量的高溫(60°C)測試下，電池內電極材料的能量密度可達170mAh/g以上，50圈循環壽命測試超越無任何添加的Blank系統。
- ✓由臨場電化學-X光吸收光譜的結果指出在高鎳含量的三元正極材料系統中，高安全性添加劑可以有效提升鎳離子的氧化反應，並促成較佳的電池性能。
- ✓LIVING@結構匹配性→建立寡聚物分歧結構與電池性能/安全特性的資料庫關係。
- ✓高鎳含量高電壓陰極應用技術→導入622NMC與LCOA電極材料。
- ✓高答應反應速率→提升安全性能。
- ✓臨場電化學氣相層析質譜儀、紅外光譜分析儀、X光繞射儀與同步輻射分析技術。

FY106技術指標	達成情形	LIVING@
循環壽命>170 mAh/g @ 50 cycles (0.2C) (Ni rich cathode)	可逆電容量 (mAh/g)	168-172 (0.5C)
反應速率>1*10 ⁶ 1/s	反應速率 (1/s)	3.55*10 ⁶
商用電池產業應用性 (>10Ah)	商用產業應用性 (Ah)	15-40

Thermochemical/ electrochemical initialized high safety and high performance lithium ion battery

Execution Unit

Graduate Institute of Applied Science and Technology

Project Director

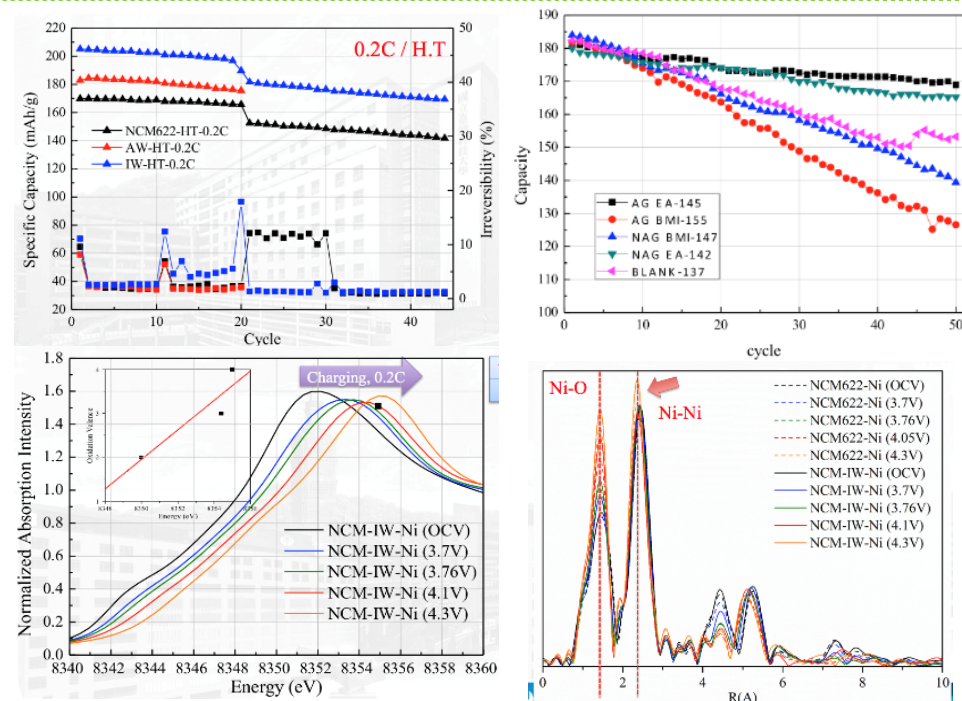
Fu-Ming Wang

Content

Patent

1. OLIGOMER-POLYMER AND LITHIUM BATTERY, Fu-Ming Wang*, Bing-Joe Hwang, Chong-Shyan Chern, Jung-Mu Hsu, Jing-Pin Pan, Chang-Rung Yang, PHAM QUOC THAI, R. O. C. Apply No. 105136149; P. R. C Apply No. 201710384206.2; U. S. A. Apply No. 15/619061
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Developing high reliability and highly patentability safety additive (LIVING@) is the final propose of this project. This novel safety additive provides excellent safety, thermo/ electrochemical selectivity, and high reversibility/ cycle life.



✓At high temperature (60°C), the energy density of cathode material achieves 170 mAh/g with **LIVING@**. After 50 cycles, the cycle life of battery with **LIVING@** excels that the battery without any additive.

✓From in-situ EC/XAS results, the **LIVING@** significantly enhances the valence change of Ni ion during the oxidation reaction and improves the battery performance.

✓**LIVING@ in cathode electrodes** → The database of hyper branch oligomer and battery performance/safety.

✓**Ni-rich high voltage cathode applications** → In 622NMC and LCOA active materials ◦

✓**High response reaction rate** → Improve safety ◦

✓**In-situ/ In-operando electrochemical** GCMS, FTIR, XRD, and Synchrotron radiation.

FY106 target	Status	LIVING@
Cycle life >170 mAh/g @ 50 cycles (0.2C) (Ni rich cathode)	Energy density (mAh/g)	168-172 (0.5C)
Reaction rate > 1*10 ⁶ 1/s	Reaction rate (1/s)	3.55*10 ⁶
Battery capacity (>10Ah)	Battery capacity (Ah)	15~40