

國防大學理工學院應用化學及材料科學系教師個人資料表

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ECMF Lab.

ELECTRO CHEMICAL MICRO FABRICATION LAB.

A Research team of **Magnesium Alloy, Polymer Synthesis & Functional Carbon Composite**

儲能電池材料及功能性碳材研究

研究主題

高效能無陽極鋅二次電池開發

改良型鉛碳電池電極材料研製

高穩定儲能電池電解質開發

功能性碳材料開發及儲能電池應用

可充電鋅金屬電池

Rechargeable Zn metal batteries

Organic/inorganic liquid electrolytes (dangerous or expensive)
Aqueous electrolytes (safe)

Challenges

- Dendrite growth
- Corrosion
- Side reactions
- Structural stability
- Hydrogen evolution
- Electrolyte degradation

Rechargeable Zn-air batteries
Aqueous Zn-ion battery

改良型鉛碳電池

Pb/Carbon batteries

Pb/C Battery (Lead-Carbon)
Advanced Pb/C electrodes

Hybrid system

Separator
PbO₂ Pb/C

Power storage System

產學合作：中鋼/中碳/希世比能源科技/陽明交大

研究合作

Research cooperation

先進鋰離子電池

Advanced Li-ion batteries

Organic
Salts
modification

研究合作：中科院/國家同步輻射中心/臺灣科大

Department of Materials Science and Engineering
National Tsing Hua University, Taiwan
Ceramic/Carbon & Energy Materials Lab

陽明交大 **NYCU** **Energy Storage and Green Chemistry Lab**
儲能與綠色化學實驗室

TAIWAN TECH 永續能源發展中心
Sustainable Energy Development Center

NSRRC 國家同步輻射研究中心
National Synchrotron Radiation Research Center

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一、個人學歷：

學校名稱	國別	主修學門系所	學位	起訖年月(西元年/月)
國防大學 中正理工學院	中華民國	機械工程科	副學士	自 2000 / 7 至 2002 / 7
國防大學 理工學院	中華民國	兵器系統工程研究所	碩士	自 2006 / 8 至 2008 / 6
臺灣科技大學	中華民國	化學工程研究所	博士	自 2012 / 9 至 2016 / 7

二、個人經歷：

服務機構	服務部門 / 系所	職稱	起訖年月(西元年/月)
國防大學理工學院	化學及材料工程學系	副教授	2021/8 至 2021/8
國防大學理工學院	化學及材料工程學系	助理教授	2016/7 至 2021/7
國防大學理工學院	學員生大隊	中隊長	2011/1 至 2012/9
國防大學理工學院	教學支援中心	教育行政官	2008 /10 至 2011/1
國防大學理工學院	學員生大隊	行政官	2006/7 至 2008/10
國防大學中正理工學院	教務分處	訓練官	2005/4 至 2006/8
國防大學中正理工學院	勤務連	排長	2002/11 至 2005/4
國防大學中正理工學院	機械系	技術官	2002/7 至 2002/11

三、研究領域：

1.金屬二次電池電池	2.鋰離子電池	3.改良型鉛碳電池	4.臨場電化學分析技術
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四、教授課程：

1. 化工熱力學	2.電極動力學	3.創/儲能電池專題實作	4.儲能材料
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五、教學與研究績效

(一)授課科目

學年度	上下 學期	班別	學分/小時	科目	教學回饋 評量成績
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111	下	化材系	3/3	材料實驗(交大合授)	
111	下	化材系	3/3	創/儲能電池專題實作(交大合授)	
111	下	化工系	0/2	導師輔導	
111	上	化材系	3/3	化工熱力學	
111	上	化工碩 材料碩	3/3	儲能材料	
111	上	化材系	3/3	創/儲能電池專題實作(交大合授)	
111	上	化工系	0/2	導師輔導	

(二)指導學生論文及專題

項次	年度	班別	姓名	題 目
1	111~	碩 112	黃順昇	硫酸鋇添加劑特徵對鉛碳電池負極性能影響研究
2	111~	碩 112	李品勳	過氯酸鋅電解液結合二甲基亞砷添加劑對改善鋅離子電池負極反應穩定性及循環性能之影響研究
3	110~111	碩 111	翁浩容	氯化膽鹼/乙二醇為基底之深共晶溶劑電解質對鋅二次電池鋅金屬負極反應穩定性影響研究
4	109~110	碩 110	王柏元	不同結構形貌之活性炭添加劑對鉛碳電池負極性能影響研究
5	108~109	碩 109	黃鈞偉	鉛碳電池負極石墨烯/無定形碳複合添加劑研製及電化學效能改善機制分析
6	107~108	碩 108	呂家欣	探討 AZ31 鎂合金微弧氧化層表面結構對披覆鎳磷金屬層特性之影響
7	111~112	大 112	歐陽永承 黃柏勳	探討分析混合碳添加劑對鉛碳電極性能的影響
		大 112	吳柏毅 陳婕妤 李宥誼 謝雯郁	鋅二次電池電解液研製及電化學性能分析實作 製備深共晶電解液應用於鋅金屬電池負極高溫腐蝕 衰變抑(科技部大專生計畫)
8	110~111	大 111	羅竣中	探討不同鉛活物配方對鉛碳電極的影響
			呂俊諺	
9	109~110	大 110	戴伯軒	高效能鋁金屬一次電池之電極性能分析及全電池模組研製(科技部大專生計畫)
			黃俊諺	鋅空氣電池電解液優化策略開發及備援電能系統設

			王嚴閭	計
10	108~109	大 109	趙少楓	高效能鋁金屬一次電池之電極性能分析及全電池模組研製
		大 109	陳苟安	
		大 109	張加霓	
		大 109	王聖博	
11	107~108	大 108	鄭百翔	鋅空氣二次電池負極沉積行為之觀測與分析
		大 108	陳振樺	
		大 108	黃柏舜	

(三)參與之研究計畫

項次	計畫名稱	計畫內擔任工作	起迄日期	預算金額	補助機構
1	鋅-空氣二次電池鋅負極衰變與抑制機制分析及 X 光臨場顯影解析技術之導入應用 (MOST106-2218-E-606-002 -MY2)	計畫主持人	2017/4 ~ 2019/3	2,000,000	科技部
2	積層製造工件之表面粗糙度優化技術開發之研究	協同主持人	2019/3~ 2020/12	2,000,000	中科院
3	鋅空氣二次電池之複合型電解質添加劑修飾優化及鋅負極結構演變臨場顯微分析 (108-2221-E-606-011)	計畫主持人	2019/8~ 2020/7	1,136,000	科技部
4	優化之深共熔溶劑電解質開發及探析對二次鋅電池鋅負極電化學效能與介面反應機制影響 (109-2221-E-606-010)	計畫主持人	2020/8~ 2021/7	1,090,000	科技部
5	活性碳性質對鉛碳電池負極之電化學效能影響研究 09T6D0024	計畫主持人	2020/9~ 2021/6	850,000	中鋼公司
6	活性碳改質對鉛碳電池效能影響研究	計畫主持人	2022/1~ 2022/10	900,000	中鋼公司
7	鋰電池正極回收技術開發(鈷回收)	計畫主持人	2022/1~ 2022/12	500,000	光洋應用 材料科技 公司
8	二次鋅離子電池之功能型電解質添加劑與電解質改質策略開發及電極反應影響機制研究 (110-2221-E-606 -004)	計畫主持人	2021/8~ 2022/7	975,000	科技部
9	突破式國防科技研發計畫-開發適用不同應用	共同主持人	2022/1~ 2022/12	12,396,000	中科院

	情境的次世代高能量高安全鋰/鋰離子混成電池(1/2)				
10	新式熱電池材料及技術探討(1/3)	共同主持人	2023/1~ 2023/12	1,300,000	中科院
11	突破式國防科技研發計畫-開發適用不同應用情境的次世代高能量高安全鋰/鋰離子混成電池(2/2)	共同主持人	2023/1~ 2023/12	15,859,000	中科院

六、論文著述

1. 期刊論文

- (1) M.-H. Lin, S. Hy, C.-Y. Chen, J.-H. Cheng, J. Rick, N.-W. Pu, W.-N. Su, Y.-C. Lee, B.-J. Hwang, Resilient Yolk-Shell Silicon-Reduced Graphene Oxide/Amorphous Carbon Anode Material from a Synergistic Dual-Coating Process for Lithium-Ion Batteries, *ChemElectroChem*, 3 (2016) 1446-1454.
- (2) A.S. Wotango, W.-N. Su, E.G. Leggesse, A.M. Haregewoin, M.-H. Lin, T.A. Zegeye, J.-H. Cheng, B.-J. Hwang, Improved Interfacial Properties of MCMB Electrode by 1-(Trimethylsilyl)imidazole as New Electrolyte Additive to Suppress LiPF₆ Decomposition, *ACS applied materials & interfaces*, 9 (2016) 2410-2420.
- (3) H.-C. Chen, J. Patra, S.-W. Lee, C.-J. Tseng, T.-Y. Wu, M.-H. Lin, J.-K. Chang, Electrochemical Na⁺ storage properties of SnO₂/graphene anodes in carbonate-based and ionic liquid electrolytes, *Journal of Materials Chemistry A*, 5 (2017) 13776-13784.
- (4) H.-Y. Chen, J. Friedl, C.-J. Pan, A. Haider, R. Al-Oweini, Y.L. Cheah, M.-H. Lin, U. Kort, B.-J. Hwang, M. Srinivasan, U. Stimming, In-situ X-ray Absorption Near Edge Structure Studies and Charge Transfer Kinetics of Na₆[V₁₀O₂₈] Electrodes, *Physical chemistry chemical physics: PCCP*, 19 (2017) 3358-3365.
- (5) J.-h. Cheng, A.A. Assegie, C.-J. Huang, M.-H. Lin, A.M. Tripathi, C.-C. Wang, M.-T. Tang, Y.-F. Song, W.-N. Su, B.-J. Hwang, Visualization of Lithium Dendrite Growth via in Operando Transmission X-ray Microscopy, *J. Phys. Chem. C*, 121 (2017) 7761-7766.
- (6) F. Lee, M.-C. Tsai, M.-H. Lin, Y.L. Ni'mah, S. Hy, C.-Y. Kuo, J.-H. Cheng, J. Rick, W.-N. Su, B.-J. Hwang, Capacity retention of lithium sulfur batteries enhanced with nano-sized TiO₂-embedded polyethylene oxide, *J. Mater. Chem. A*, 5 (2017) 6708-6715.
- (7) M.-H. Lin, J.-H. Cheng, H.-F. Huang, U.F. Chen, C.-M. Huang, H.-W. Hsieh, J.-M. Lee, J.-M. Chen, W.-N. Su, B.-J. Hwang, Revealing the mitigation of intrinsic structure transformation and oxygen evolution in a layered Li_{1.2}Ni_{0.2}Mn_{0.6}O₂ cathode using restricted charging protocols, *Journal of Power Sources*, 359 (2017) 539-548.
- (8) T.A. Zegeye, M.-C. Tsai, J.-H. Cheng, M.-H. Lin, H.-M. Chen, J. Rick, W.-N. Su, C.-F.J. Kuo,

- B.-J. Hwang, Controllable embedding of sulfur in high surface area nitrogen doped three dimensional reduced graphene oxide by solution drop impregnation method for high performance lithium-sulfur batteries, *Journal of Power Sources*, 353 (2017) 298-311.
- (9) T.A. Zegeye, C.F.J. Kuo, H.-M. Chen, A.M. Tripathi, M.-H. Lin, J.-H. Cheng, A.D. Duma, W.-N. Su, B.J. Hwang, Dual-Confined Sulfur in Hybrid Nanostructured Materials for Enhancement of Lithium-Sulfur Battery Cathode Capacity Retention, *ChemElectroChem*, 4 (2017) 636-647.
- (10) C.-H. Wu, N.-W. Pu, Y.-M. Liu, C.-Y. Chen, Y.-Y. Peng, T.-Y. Cheng, M.-H. Lin, M.-D. Ger, Improving rate capability of lithium-ion batteries using holey graphene as the anode material, *Journal of the Taiwan Institute of Chemical Engineers*, 80 (2017) 511-517.
- (11) N.-W. Pu, C.-Y. Chen, H.-X. Qiu, Y.-M. Liu, C.-H. Song, M.-H. Lin, M.-D. Ger, Hydrothermal Synthesis of N-Doped Graphene/Fe₂O₃ Nanocomposite for Supercapacitors, *International Journal of Electrochemical Science*, (2018) 6812-6823.
- (12) A.S. Wotango, W.-N. Su, A.M. Haregewoin, H.-M. Chen, J.-H. Cheng, M.-H. Lin, C.-H. Wang, B.-J. Hwang, Designed synergetic effect of electrolyte additives to improve interfacial chemistry of MCMB electrode in propylene carbonate-based electrolyte for enhanced low and room temperature performance, *ACS applied materials & interfaces*, 10 (2018) 25252-25262.
- (13) C. Li, J. Patra, J. Li, P. C. Rath, M.-H. Lin, and J. K. Chang, A Novel Moisture-Insensitive and Low-Corrosivity Ionic Liquid Electrolyte for Rechargeable Aluminum Batteries, *Advanced Functional Materials*, 30 (2020), 1909565.
- (14) J.-B. Huang, J. Patra, M.-H. Lin, M.-D. Ger, Y.-M. Liu, N. W. Pu, C.-T. Hsieh, M.-J. Youh, Q.-F. Dong and J. K. Chang, A Holey Graphene Additive for Boosting Performance of Electric Double-Layer Supercapacitors, *Polymers*, 12(2020), 765.
- (15) C.-C. Lin, C.-T. Hsu, W. J. Liu, S.-C. Huang, M.-H. Lin, U. K., A.S. Mougharbel, T.-Y. Chen, C.-W. Hu, J. -F. Lee, C.-C. Wang, Y.-F. Liao, L.-J. Li, L.L. Li, S.G. Peng, U. Stimming, and H.-Y. Chen, In Operando X-ray Studies of HighPerformance Lithium-Ion Storage in Keplerate-Type Polyoxometalate Anodes, *ACS Applied Materials & Interfaces*, 12(2020) 40296-40309.
- (16) M.-H. Lin, C.-J. Huang, P.-H. Cheng, J.-H. Cheng and C.-C. Wang. Revealing the effect of polyethylenimine on zinc metal anodes in alkaline electrolyte solution for zinc–air batteries: mechanism studies of dendrite suppression and corrosion inhibition, *Journal of Materials Chemistry A*, 8(2020), 20637-20649.
- (17) T.-Y. Chen, S.-Y. Wang, C.-H. Kuo, S.-C. Huang, M.-H. Lin, C.-H. Li, H.-Y. Tiffany Chen, C.-C. Wang, Y.-F. Liao, C.-C. Lin, Y.-M. Chang, J.-W. Yeh, S.-J. Lin, T.-Y. Chen and H.-Y. Chen, In operando synchrotron X-ray studies of a novel spinel (Ni_{0.2}Co_{0.2}Mn_{0.2}Fe_{0.2}Ti_{0.2})₃O₄ high-entropy oxide for energy storage applications, *Journal of Materials Chemistry A*, 8(2020), 21756-21770.
- (18) C.-J. Huang, J.-H. Cheng, W.-N. Su, P. Partovi-Azar, L.-Y. Kuo, M.-C. Tsai, M.-H. Lin, S. Panahian Jand, T.-S. Chan, N.-L. Wu, P. Kaghazchi, H. Dai, P.M. Bieker, B.-J. Hwang, Origin of shuttle-free sulfurized polyacrylonitrile in lithium-sulfur batteries, *Journal of Power Sources*, (2021), 492.
- (19) Ananya Panda, Jagabandhu Patra, Chien-Te Hsieh, Yang-Chih Huang, Yasser Ashraf Gandomi, Chun-Chieh Fu, Ming-Hsien Lin, Ruey-Shin Juang, Jeng-Kuei Chang (2021, Oct). Improving high-temperature performance of lithium-rich cathode by roll-to-roll atomic layer deposition of titania nanocoating for lithium-ion batteries. *Journal of Energy Storage*, 44, 103348.

- (20) Meng-Jey Youh, Yu-Ren Huang, Cheng-Hsiung Peng, Ming-Hsien Lin, Ting-Yu Chen, Chun-Yu Chen, Yih-Ming Liu, Nen-Wen Pu, Bo-Yi Liu, Chen-Han Chou, Kai-Hsiang Hou, Ming-Der Ger (2021, June). Using Graphene-Based Composite Materials to Boost Anti-Corrosion and Infrared-Stealth Performance of Epoxy Coatings. *Nanomaterials*, 11, 1603.
- (21) Syuan-Yu Wang, Tsung-Yi Chen, Chun-Han Kuo, Chia-Ching Lin, Shao-Chu Huang, Ming-Hsien Lin, Chun-Chieh Wang, Han-Yi Chen (2021, Aug). Operando synchrotron transmission X-ray microscopy study on (Mg, Co, Ni, Cu, Zn)O high-entropy oxide anodes for lithium-ion batteries. *Materials Chemistry and Physics*, 274, 125105.
- (22) Jagabandhu Patra, Bo-Rui Pan, Ming-Hsien Lin, Ching-Yuan Su, Sheng-Wei Lee, Tzi-Yi Wu, Rajendra S. Dhaka, Chien-Te Hsieh, Jeng-Kuei Chang, (2022, Jun). Nitrogen-doped holey graphene additive for high-performance electric double-layer supercapacitors. *Electrochimica Acta*, 425, 140713.
- (23) Sofiannisa Aulia, Kuei-Yuan Chen, Ling-Yu Chang, Yu-Xuan Wang, Mia Rinawati, Ming-Hsien Lin, Kuo-Chuan Ho, Min-Hsin Yeh, (2022, Nov). Designing bifunctional ZIF-67 derivatives decorated N-doped carbon nanotubes as an electrocatalyst for oxygen conversion reaction in rechargeable zinc-air battery. *Journal of the Taiwan Institute of Chemical Engineers*, 141, 104598.
- (24) Sofiannisa Aulia, Yin-Chen Lin, Ling-Yu Chang, Yu-Xuan Wang, Ming-Hsien Lin, Kuo-Chuan Ho, and Min-Hsin Yeh (2022, Jul). Oxygen Plasma-Activated NiFe Prussian Blue Analogues Interconnected N-Doped Carbon Nanotubes as a Bifunctional Electrocatalyst for a Rechargeable Zinc–Air Battery. *ACS Applied Energy Materials*, 5, 9801-9810.
- (25) Tsung-Yi Chen, Ho Viet Thang, Tien-Yu Yi, Shao-Chu Huang, Chia-Ching Lin, Yu-Ming Chang, Pei-Lin Chen, Ming-Hsien Lin, Jyh-Fu Lee, Hsin-Yi Tiffany Chen, Chi-Chang Hu, and Han-Yi Chen (2022, Nov). Operando X-ray Studies of Ni-Containing Heteropolyvanadate Electrode for High-Energy Lithium-Ion Storage Applications. *ACS Applied Material Interfaces*, 14, 52035-52045.
- (26) Wei-Hsiang Lin, Shih-Fu Liu, Sanna Gull, Tzu-Chi Su, Kun-Ju Tsai, Chun-Han Kuo, Chia-Ching Lin, Chun-Chieh Wang, Ming-Hsien Lin, Chia-Liang Sun, Han-Yi Chen, (2022, May) Nanoporous core-shell-structured multi-wall carbon nanotube/graphene oxide nanoribbons as cathodes and protection layer for aqueous zinc-ion capacitors: Mechanism study of zinc dendrite suppression by in-situ transmission X-ray microscopy. *Journal of Power Sources*, 541, 231627.

2. 研討會論文

- (1) J.-S. Yu, P.-H. Cheng, J.-H. Chen, B.-S. Huang, M.-H. Lin., In Operando Observation of Dendritic Zinc Growth during the Electrochemical Cycles for Rechargeable Zinc-Air Batteries, 64th TwIChE Annual Meeting, (2017).
- (2) P.-H. Cheng, J.-H. Syu, J.-W. Huang, C.-C. Wang, M.-H. Lin., In Operando X-ray Imaging Study for Suppression of Dendritic Zinc Electrodeposition in an Alkaline Electrolyte Modified with Polyethylenimine Additive, 65th TwIChE Annual Meeting, (2018).
- (3) S.-F. Chao, S.-P. Wang, S.-A. Chen, J.-N. Zhang, S.-H. Chen, M.-H. Lin, Suppressing Dendrite Growth and Hydrogen Evolution on Zinc Anode of Secondary Alkaline Batteries by Using Polyethylenimine-Based Composite Electrolyte Additives, 66th TwIChE Annual Meeting

(2019).

- (4) J.-W. Huang, B.-H. Dai, Y.-L. Wang, C.-Y. Huang, M.-H. Lin, Effects of Graphene/Active Carbon Composite Additives on Electrochemical Performance of Negative Electrode in Lead-Carbon Battery, 66th TwIChE Annual Meeting (2019).
- (5) C.-W. Huang, B.-Y. Wang, B.-H. Dai, Y.-L. Wang, C.-Y. Huang, H.-R. Weng, M.-H. Lin and M.-D. Ger, Effect of Graphene doping on Enhancing the Sulfation inhibition and Electrochemical Properties in Negative Electrodes of Lead-Carbon Battery, 67th TwIChE Annual Meeting (2020).
- (6) B.-Y. Wang, C.-W. Huang, H.-R. Weng, J.-Z. Lou, J.-Y. Lu, M.-H. Lin and M.-D. Ger, Effects of the Concentration and Structure of Carbon Additives on Structure Evolution and Electrochemical Properties of Negative Electrodes in Lead-Carbon Battery, 67th TwIChE Annual Meeting (2020).
- (7) M.-H. Lin, Revealing the effect of polyethylenimine-based electrolyte additives on zinc metal anodes in alkaline electrolyte solution for zinc-air batteries. 2020 ICGET-Tw. (Invited speaker)
- (8) Hao-Rong Weng, Shao-Feng Chao, Shang-Po Wang, Nen-Wen Pu, Chun-Chieh Wang, Ming-Der Ger and Ming-Hsien Lin (2021, Nov). Visualizing the synergistic effect of PEI and tartaric-acid additives on suppression of dendrite growth and hydrogen evolution for zinc metal anodes in alkaline electrolyte solution via operando transmission X-ray microscopy. Topical Meeting of the ISE.
- (9) Jyun-Wei Huang, Jun-Zhong Lou, Jun-Yan Lu, Po-Hsun Huang, Yung-Cheng Ou-Yang and Ming-Hsien Lin (2022, Jan). Effect of activated carbon surface chemistry on the high-rate partial-state-of-charge performance of lead-carbon batteries. 2021 TwIChE Annual Meeting.
- (10) Bo-Yuan Wang, Shun-Sheng Huang, Pin-Xun Li, Po-I Wu, Wen-Yu Xie, Ming-Der Ger and Ming-Hsien Lin (2022, Jan). Effect of lead particles morphology on electrode formation structure and deep charge/discharge performance of negative electrodes for lead-carbon batteries. 2021 TwIChE Annual Meeting.
- (11) Hao-Rong Weng, Shao-Feng Chao, Shang-Po Wang, Nen-Wen Pu, Chun-Chieh Wang, Ming-Der Ger and Ming-Hsien Lin (2021 Nov) Visualizing the synergistic effect of PEI and tartaric-acid additives on suppression of dendrite growth and hydrogen evolution for zinc metal anodes in alkaline electrolyte solution via operando transmission X-ray microscopy. 30th Topical Meeting of the ISE.
- (12) Hao-Rong Weng, Pin-Xun Li, Jie-Yu Chen, You-Yi Li, Ming-Der Ger and Ming-Hsien Lin (2022, Jan). Improved cyclability and interfacial stability of zinc anodes for zinc-ion batteries using ChCl/EG deep eutectic solvent-based electrolytes. 2021 TwIChE Annual Meeting.
- (13) Pin-Xun Li, Yu-Chun Huang, You-Yi Li, Jie-Yu Chen, Po-I Wu and Ming-Hsien Lin (2022, Dec). Enhanced cyclability and interfacial stability of zinc anodes by use of dimethyl sulfoxide as electrolyte additive. 2022 TwIChE Annual Meeting.
- (14) Jyun-Wei Huang, Shun-Sheng Huang, Po-Hsun Huang, Yung-Cheng Ou-Yang, Hou-cheng Jiang and Ming-Hsien Lin (2022, Dec). Effect of nano-BaSO₄ additive on formed electrode structure and cycling performance of negative electrodes for lead-carbon batteries. 2022 TwIChE Annual Meeting.
- (15) Hao-Rong Weng, Yu-Chun Huang, You-Yi Li, and Ming-Hsien Lin (2022, Nov). In-situ/operando visualizing the effect of ChCl/EG-based deep eutectic solvent electrolytes on dendrite suppression of zinc anode in high-temperature cycling. 2022ICGET-Tw@2022ECS-Tw

Meeting.