

Wu, Nae-Lih (吳乃立)

Professor

B.S. in Chemical Engineering
National Taiwan University, 1980
Ph.D. in Chemical Engineering
Pennsylvania State University, 1987

Research and Professional Interests
Materials processing and characterization
Materials for Electrochemical Energy
Storage (Li-ion batteries, Supercapacitors)

Journal Papers

1. Yu-Ting Weng, Hsiao-An Pan, **Nae-Lih Wu**^{*}, and G. Chen, "Titanium Carbide Nanocube Core Induced Interfacial Growth of Crystalline Polypyrrole/Polyvinyl Alcohol Lamellar Shell for Wide-Temperature Range Supercapacitors," *J. Power Sources*, 274, 1118-1125 (2015). (SCI, EI).
2. Fu-Sheng Li, Yu-Shiang Wu, Jackey Chou, Martin Winter, and **Nae-Lih Wu**^{*}, "A Mechanically Robust and Highly Ion-Conductive Polymer-Blend Coating for High-Power and Long-Life Lithium-Ion Battery Anodes," *Adv. Mater.*, 27, 130-137 (2015). (SCI, EI)
3. Yu-Ting Weng, Tzu-Yang Huang, Chek-Hai Lim, Pei-Sian Shao, Sunny Hy, Chao-Yen Kuo, Ju-Hsiang Cheng, Bing-Joe Hwang, Jyh-Fu Lee and **Nae-Lih Wu**^{*}, "An unexpected large capacity of ultrafine manganese oxide as a sodium-ion battery anode," *Nanoscale* 7, 20075 – 20081 (2015). (SCI, EI)
4. Mara Olivares-Marín, Andrea Sorrentino, Rung-Chuan Lee, Eva Pereiro, **Nae-Lih Wu**, Dino Tonti^{*}, "Spatial distributions of lithium oxides in discharged products of lithium-oxygen batteries revealed by synchrotron transmission microscopy," *Nano Letters*, 15, 6932–6938 (2015). (SCI, EI)
5. Yu-Ting Weng, Hsiao-An Pan, Rung-Chuan Lee, Tzu-Yang Huang, Yun Chu, Jyh-Fu Lee, Hwo-Shuenn Sheu and **Nae-Lih Wu**^{*}, "Spatially Confined MnO₂ Nanostructure Enabling Consecutive Reversible Charge Transfer from Mn(IV) to Mn(II) in Mixed Pseudocapacitor-Battery Electrode," *Adv. Energ. Mater.* 5, 1500772 (2015). (SCI, EI)
6. Nai-Hsuan Yang, Yu-Shiang Wu, Jackey Chou, Hung-Chun Wu, and **Nae-Lih Wu**^{*}, "Silicon Oxide-on-Graphite Planar Composite Synthesized Using A Microwave-Assisted Coating Method for Use as A Fast-Charging Lithium-Ion Battery Anode," *J. Power Sources* 296, 314–317 (20 November, 2015). (SCI, EI)
7. Fu-Sheng Li, Yu-Shiang Wu, Jackey Chou, and **Nae-Lih Wu**^{*}, "A Dimensionally Stable and Fast-Discharging Graphite-Silicon Composite Li-ion Battery Anode Enabled by Electrostatically Self-Assembled Multifunctional Polymer-Blend Coating," *Chem. Commun.* 51, 8429-8431 (2015). (SCI, EI)
8. Hsiao-An Pan, O. Ghodbane, Yu-Ting Weng, Hwo-Shuenn Sheu, Jyh-Fu Lee, F. Favier, and **Nae-Lih Wu**^{*}, "Investigating Mechanisms Underlying Elevated- Temperature-Induced Capacity Fading of Aqueous MnO₂ Polymorph Supercapacitors: Cryptomelane and Birnessite," *J. Electrochem. Soc.* 162, A5106-A5114 (2015). (SCI, EI)
9. Chek-Hai Lim, Tzu-Yang Huang, Pei-Sian Shao, Jen-Hao Chien, Yu-Ting Weng, Hsin-Fu Huang, Bing Joe Hwang and **Nae-Lih Wu**^{*}, "Experimental Study on Sodiation of Amorphous Silicon for Use as Sodium-Ion Battery Anode," *Electrochimica Acta* 211,

265 – 272 (2016). (SCI, EI)

10. Tzu-Yang Huang, Baskar Selvaraj, Hung-Yu Lin, Hwo-Shuenn Sheu, Yen-Fang Song, Chun-Chieh Wang, Bing Joe Hwang, **Nae-Lih Wu**,* “Exploring an Interesting Si Source from Photovoltaic Industry Waste and Engineering It as a Li-Ion Battery High-Capacity Anode,” *ACS Sustainable Chemistry & Engineering* 4, 5769–5775 (2016). (SCI, EI)
11. Che-Tseng Lin, Tzu-Yang Huang, Jau-Jiun Huang, **Nae-Lih Wu*** Man-Kit Leung,* “Multifunctional co-poly(amic acid): a new binder for Si-based micro-composite anode of lithium-ion battery,” *J. Power Sources* 330, 246-252 (2016). (SCI, EI)
12. Jing Luo, Rung-Chuan Lee, Jian-Ting Jin, Yu-Ting Weng, and Chia-Chen Fang, **Nae-Lih Wu**,* “Dual-Functional Polymer Coating on Lithium Anode for Suppressing Dendrite Growth and Polysulfide Shuttling in Li-S Batteries,” *Chem. Comm.*, 53, 963-966 (2017) (2016). (SCI, EI)
13. Weifeng Zhang, Tongbin Lan, Tianli Ding, **Nae-Lih Wu**, Mingdeng Wei, “Carbon coated anatase TiO₂ mesocrystals enabling ultrastable and robust sodium storage,” *J. Power Sources* 359, 64-70 (2017).
14. Tongbin Lan, Tao Wang, Weifeng Zhang, **Nae-Lih Wu**, Mingdeng Wei, “Rutile TiO₂ mesocrystals with tunable subunits as a long-term cycling performance anode for sodium-ion batteries,” *J. Alloys and Compounds* 699, 455-462 (2017).
15. Tongbin Lan, Weifeng Zhang, **Nae-Lih Wu**, and Mingdeng Wei, “Nb-Doped Rutile TiO₂ Mesocrystals with Enhanced Lithium Storage Properties for Lithium Ion Battery,” *Chem. Eur. J.* 23, 5059 – 5065 (2017).
16. Jing Luo, Chia-Chen Fang, **Nae-Lih Wu***, “High Polarity Poly(Vinylidene Difluoride) Thin Coating for Dendrite-Free and High-Performance Lithium Metal Anodes,” *Advanced Energy Materials*, 7, 1701482 (2017).
17. Chek-Hai Lim, Baskar Selvaraj, Yen-Fang Song, Chun-Chieh Wang, Jian-Ting Jin, Sheng-Siang Huang, Chung-Hsien Chuang, Hwo-Shuenn Sheu, Yen-Fa Liao and **Nae-Lih Wu***, “Insight into microstructural and phase transformations in sodiation–desodiation of a bismuth particulate anode,” *J. Mater. Chem. A* 5, 21536 - 21541 (2017).
18. Yonas Beyene Yohannes, Shawn D. Lin* and **Nae-Lih Wu**, “In Situ DRIFTS Analysis of Solid Electrolyte Interphase of Si-Based Anode with and without Fluoroethylene Carbonate Additive,” *J. Electrochem. Soc.* 164, A3641-A3648 (2017).
19. Jing Luo, Chia-Chen Fang, **Nae-Lih Wu***, “High Polarity Poly(Vinylidene Difluoride) Thin Coating for Dendrite-Free and High-Performance Lithium Metal Anodes,” *Advanced Energy Materials*, 8, 1701482 (2018).
20. Chih-Jung Chen, Tatsuhiro Mori, Anirudha Jena, Hung Yu Lin, Nai Hsuan Yang, **Nae-Lih Wu**, Ho Chang, Shu-Fen Hu, Ru-Shi Liu*, “Optimizing the Lithium Phosphorus Oxynitride Protective Layer Thickness on Low-Grade Composite Si-Based Anodes for Lithium-Ion Batteries,” *ChemistrySelect* 3 , 729-735 (2018)
21. Yu-Cheng, **Nae-Lih Wu**, Wei-Ren Liu*, “Electrochemical Properties of Al³⁺/Cl-Doped-0.2Li₂MnO₃·0.8LiNiO₂ Cathode Materials for Lithium-Ion Batteries,” *Journal of Nanoscience and Nanotechnology* 18, 68-74 (2018).

22. Mozaffar Abdollahifar, Sheng-Siang Huang, Yu-Hsiang Lin, Yan-Cheng Lin, Bing-Yi Shih, Hwo-Shuenn Sheu, Yen-Fa Liao, **Nae-Lih Wu***, “ High-Performance Carbon-Coated $ZnMn_2O_4$ Nanocrystallite Supercapacitors with Tailored Microstructures Enabled by a Novel Solution Combustion Method,“ *J. Power Sources* 378, 90–97 (2018).
23. Sheng-Siang Huang, Yu-Hsiang Lin, Wesley Chuang, Pei-Sian Shao, Chung-Hsien Chuang, Jyh-Fu Lee, Meng-Lin Lu, Yu-Ting Weng,* and **Nae-Lih Wu***, “Synthesis of High-Performance Titanium Sub-Oxides for Electrochemical Applications Using Combination of Sol–Gel and Vacuum-Carbothermic Processes,“ *ACS Sustainable Chem. Eng.* 6, 3162–3168 (2018).
24. Baskar Selvaraj, Sheng-Siang Huang, Chang-En Wu, Yu-Hsiang Lin, Chun-Chieh Wang, Yen-Fang Song, Meng-Lin Lu, Hwo-Shuenn Sheu, and **Nae-Lih Wu***, “Micrometer-Sized Nanoporous Sb/C Anode with High Volumetric Capacity and Fast Charging Performance for Sodium-Ion Batteries,“ *ACS Appl. Energy Mater.* 1, 2317–2325 (2018) (DOI: 10.1021/acsaem.8b00416)
25. Jing Luo, Chang-En Wu, Lin-Ya Su, Sheng-Siang Huang, Chia-Chen Fang, Yu-Shiang Wu, Jackey Choue, **Nae-Lih Wu***, “A proof-of-concept graphite anode with a lithium dendrite suppressing polymer coating,“ *J. Power Sources* 406 (2018) 63–69 (DOI:10.1016/j.jpowsour.2018.10.002).
26. Mozaffar Abdollahifar, Sheng-Siang Huang, Yu-Hsiang Lin, Hwo-Shuenn Sheu, Jyh-Fu Lee, Meng-Lin Lu, Yen-Fa Liao, **Nae-Lih Wu***, “Tetragonal $LiMn_2O_4$ as dual-functional pseudocapacitor-battery electrode in aqueous Li-ion electrolytes,“ *J. Power Sources* 412, 545 – 551 (2019).
27. Kun-Lin Liu, Chung-Hsiang Chao, Hsin-Chieh Lee, Cheng-Si Tsao, Jason Fang, **Nae-Lih Wu**, Chi-Yang Chao*, “ A novel non-porous separator based on single-ion conducting triblock copolymer for stable lithium electrodeposition,“ *J. Power Sources* 419, 58–64 (2019).
28. Sheng-Siang Huang, Mai Thanh Tung, Huynh Dang Chinh, Bing-Joe Hwang, Peter Maria Bieker, Chia-Chen Fang, and **Nae-Lih Wu***, “ Engineering Rice Husk into a High-Performance Electrode Material through an Eco-Friendly Process and Assessing Its Application for Lithium-Ion Sulfur Batteries,“ *ACS Sustainable Chem. Eng.* 7, 7851–7861 (2019).
29. Chien-Chung Shih, Yan-Cheng Lin, Mengyao Gao, Mercedes Wu, Hui-Ching Hsieh, **Nae-Lih Wu**, Wen-Chang Chen*, “ A rapid and green method for the fabrication of conductive hydrogels and their applications in stretchable supercapacitors,“ *J. Power Sources* 426, 205-215 (2019).
30. Yonas Beyene Yohannes, Shawn D. Lin*, **Nae-Lih Wu** and Bing-Joe Hwang, “SEI Grown on MCMB-Electrode with Fluoroethylene Carbonate and Vinylene Carbonate Additives as Probed by In Situ DRIFTS,“ *J. Electrochem. Soc.* 166, A2741-A2748 (2019).
31. Yu-Ting Weng, Hao-Wen Liu, Allen Pei, FeiFei Shi, Hansen Wang, Chih-Yuan Lin, Sheng-Siang Huang, Lin-Ya Su, Jyh-Ping Hsu, Chia-Chen Fang, Yi Cui*, and **Nae-Lih Wu***, “ An Ultrathin Ionomer Interphase for High-Efficiency Li Anode in Carbonate-Based Electrolyte“, *Nature Communications* 10, 5824 (2019).
32. Yu-Ting Weng, Hansen Wang, Rung-Chuan Lee, Ching-Yu Huang, Sheng-Siang Huang, Mozaffar Abdollahifar, Li-Ming Kuo, Bing-Joe Hwang, Chin-Lung Kuo, Yi Cui, **Nae-Lih Wu***, “Efficient Synthesis of High-Sulfur-Content Cathodes for

High-Performance Li-S Batteries Based on Solvothermal Polysulfide Chemistry," *Journal of Power Sources*, 450, 227676 (2020).

Conference Papers

1. **Nae-Lih Wu**, International Battery Association Meeting, "Mechanically Robust and Highly Ion-Conductive Polymer-Blend artificial SEI for High-Power and Long-Life Lithium-Ion Battery Anodes," Jan. 5-9, Waikaloa, Hawaii, USA (invited speaker) (2015).
2. **Nae-Lih Wu**, Energy Science and Technology Conference, May 20-23, Karlsruhe, Germany (Conference Vice-Chairman) (2015).
3. **Nae-Lih Wu**, The 8th Asian Conference of Electrochemical Power Sources, "Dimensionally Stable and High Rate Graphite-Silicon Composite Li-ion Battery Anodes," August 21-25, Kumin, China (International Organizing committee; Keynote)
4. **Nae-Lih Wu**, The 66th International Society of Electrochemistry annual meeting, "Research on Polymeric Artificial Solid-Electrolyte-Interphase for Enhanced Performance of Li-ion Battery Anodes," Taipei, 10 4-9, 2015 (Organizing committee, invited speaker).
5. **Nae-Lih Wu**, International Battery Association 2016 Meeting, "High-Rate Capability Enabled by Polysulfide Chemistry for Li-S Batteries," Nantes, France, 3 20-25, 2016 (Keynote Speaker).
6. **Nae-Lih Wu**, 5th International Conference on Advanced Capacitors, "Research Toward High Energy Pseudocapacitive Oxides," Otsu, Japan, 5 23-27, 2016 (Plenary Lecture).
7. **Nae-Lih Wu**, 18th International Meeting on Li Batteries, "Polymeric Electrode Modification for Enhanced Performances of Li-Ion Batteries," Chicago, IL, U.S.A., 6 19-24, 2016 (Invited Speaker).
8. **Nae-Lih Wu**, 4th International Conference on the Advancement of Materials and Nanotechnology, "Progress Toward High Energy Nanocrystalline Oxide Supercapacitors," Langkawi, Malaysia, 11 9-11, 2016 (Keynote Speaker).
9. **Nae-Lih Wu**, Materials Challenges in Alternate and Renewable Energy, "Magnéli Phase Titanium Oxides as A New Class of Supercapacitor Materials," Jeju island, South Korea, 2 20-24, 2017 (invited speaker).
10. **Nae-Lih Wu**, International Battery Association Annual Meeting, "High-Capacity and Cycle-Stable Graphite Based Anodes Enabled by Polymeric Coatings," Nara, Japan, 3 5-10, 2017 (invited speaker)
11. **Nae-Lih Wu**, International Symposium of Enhanced Electrochemical Capacitors, "A New Pseudocapacitive SpinelOxide: $ZnMn_2O_4$," Jena, Germany, 7 10-14, 2017 (International advisory committee; invited speaker)
12. **Nae-Lih Wu**, The 5th International Conference on Nanomaterials and Advanced Energy Storage Systems, "Novel Polymeric Artificial Solid Electrolyte Interphases for Enhancing Performance of Li-Ion Battery Cathodes," Astana, Kazakhstan, 8 9-11, 2017 (invited speaker)

13. **Nae-Lih Wu**, The 9th Asian Conference of Electrochemical Power Sources, “A New Type of Supercapacitor Oxide $ZnMn_2O_4$ Showing Combined Pseudocapacitance and Battery Behaviors,” Gyeongju, South Korea, 8 20-23, 2017 (International advisory committee; invited speaker)
14. **Nae-Lih Wu**, International Battery Association Annual Meeting, “Suppressing dendrite formation with polymeric coatings on Li anodes,” Jeju Island, South Korea, 3 11-16, 2018 (Invited speaker).
15. **Nae-Lih Wu**, The 19th International Meeting of Lithium Batteries, “Suppressing Li Dendrite Formation with Soft Coatings on Li-Ion Battery Anodes,” Kyoto, Japan, 6 17-22, 2017 (Invited speaker).
16. **Nae-Lih Wu**, Advanced Automobile Battery Conference-Europe, “Surface Modifications of Li-Ion Battery Active Materials with Polymers for Improved Performance,” Mainz, Germany, 129-30, 2018 (Invited speaker).
17. **Nae-Lih Wu**, International Battery Association 2018 Meeting, “Suppressing dendrite formation with polymeric coatings on Li anodes,” Jeju Island, Korea, 3 11-16, 2018 (Invited speaker).
18. **Nae-Lih Wu**, CIMTIC The 8th Forum on New Materials, “Cost-Effective and High-Capacity Spinel Pseudocapacitive Oxides,” Perugia, Italy, 6 10-14, 2018 (Invited Speaker).
19. **Nae-Lih Wu**, International Battery Association 2019 Meeting, “Understanding Microstructural Deformation of Alloying Anodes for Li- and Na-Ion Batteries,” San Diego, California, 3 3-8, 2019 (Invited speaker).
20. **Nae-Lih Wu**, 2019 Korea Electrochemical Society (KECS) spring meeting, “Transmission X-ray Microscopy Studies on Li-ion Batteries-understanding by seeing,” Jeju island, Korea, 4 4-5, 2019 (Plenary talk).
21. **Nae-Lih Wu**, 6th International Symposium on Enhanced Electrochemical Capacitors (ISEECap), “On the high-rate performance of oxide pseudocapacitors,” Nantes, France, 5 6-10 (2019) (Keynote speaker).
22. **Nae-Lih Wu**, 7th International Conference on Nanomaterials and Advanced Energy Storage Systems, “Synthesis and Operation of High-Sulfur-Content Cathodes for Li-Sulfur Batteries,” Almaty at Kazakhstan, 8 7-9, 2019 (Invited speaker).
23. **Nae-Lih Wu**, The 6th International Conference on Advanced Capacitors, “Strategies to Enhance Rate Performance of Oxide Pseudocapacitors,” Ueda, Japan, 9 8- 2, 2019 (Invited speaker).
24. **Nae-Lih Wu**, The 12th International Conference on Advanced Lithium Batteries for Automobile Applications (ABAA 12), “Facile Synthesis and Enhanced Performance of High-Sulfur-Content Cathodes for Li-Sulfur Batteries,” Ulm, Germany, 10 6-9, 2019 (Invited speaker).
25. **Nae-Lih Wu**, The 60th Battery Symposium in Japan, “Modifying Electrode-Electrolyte Interfaces with Soft Materials,” Kyoto, Japan, 11 13-15, 2019 (Invited speaker).
26. **Nae-Lih Wu**, The 10th Asian Conference on Electrochemical Power Sources (ACEPS10-2019), Kaohsiung, Taiwan, 11 24-27, 2019 (Conference Chairman).

Honors and Others (2015-2019)

1. 臺灣大學特聘教授(University Distinguished Professor)
2. 黃聖翔同學/指導教授吳乃立教授台灣化學工程學會 63(2016)週年年會壁報論文競賽電化學組優勝
3. 黃聖翔同學/指導教授吳乃立教授獲得科技部 104 年度大專學生研究計畫研究創作獎
4. 2016 第十四屆有庠科技論文獎綠色科技類(Outstanding Paper Award of Green Technology, Far Eastern Y.Z. Hsu Science and Technology Memorial Foundation)
5. 2016 工業技術研究院最佳論文獎(Best Paper Award, Industrial Technology Research Institute)
6. 林彥丞同學/指導教授吳乃立教授獲得科技部 105 年度大專學生研究計畫研究創作獎
7. 林彥丞同學/指導教授吳乃立教授台灣化學工程學會 64(2017)週年年會口頭論文競賽傑出論文獎
8. 莊少儀同學/指導教授吳乃立教授台灣化學工程學會 64(2017)週年年會壁報論文競賽傑出論文獎
9. 博士班 Mozaffar 同學獲得 24th 同步輻射中心用戶會議, 最佳壁報論文獎
10. 2018(合著人:羅婧) 發表論文獲選為 Advanced Energy Materials 期刊內封面
11. 劉浩汶同學/指導教授吳乃立教授台灣化學工程學會 66(2019)週年年會壁報論文競賽優勝
12. 魏詩涵同學/指導教授吳乃立教授台灣化學工程學會 66(2019)週年年會壁報論文競賽優勝
13. 林佳歆同學/指導教授吳乃立教授台灣化學工程學會 66(2019)週年年會壁報論文競賽優勝
14. 翁廷瑋同學/指導教授吳乃立教授台灣化學工程學會 66(2019)週年年會壁報論文競賽優勝

International Cooperation Project

1. Lithium-ion Battery with High Electrochemical Performance and Safety Technologies (LiBEST) (3/3)

高效能及高安全鋰離子電池技術之開發(2/3)
Sponsored by Ministry of Science and Technology
NT\$4,500,000; 2019/10/1-2020/9/30

