

Dr. Seongmin Bak

Chemistry Associate (staff)
Chemistry Division, Brookhaven National Laboratory
Bldg. 555, Upton, NY 11973
Phone: 631-977-1807 (cell) 631-344-4142 (office)
E-mail: smbak@bnl.gov

EDUCATION

Ph.D., Material Science and Engineering, Yonsei University, Seoul, Korea, 2013

Advisor: Prof. Kwang-Bum Kim

Thesis title: A Structural Study on the Thermal Decomposition Mechanism of Nickel-based Lithium Transition Metal Oxides

B.S, Metallurgical Engineering, Yonsei University, Seoul, Korea, 2007

Military Service (Sep. 2002 - Oct. 2004, Republic of Korea Army)

RESEARCH INTEREST

- Synchrotron-based X-ray characterization (spectroscopy/scattering/imaging), Electrochemical energy storage/conversion materials (batteries, catalysts).

RESEARCH EXPERIENCE

Chemistry Associate (staff position)

Sep. 2016-present

Chemistry Division, Brookhaven National Lab, New York

Group leader: Dr. Xiao-Qing Yang

- Carry out ““Battery500 Consortium”, The Office of Vehicle Technologies, EE&RE, U.S. Department of Energy (DOE)
- Carry out “Advanced in situ Diagnostic Techniques for Battery Materials”, Advanced Battery Materials Research (BMR) project (**Co-Principle Investigator**), The Office of Vehicle Technologies, EE&RE, U.S. Department of Energy (DOE)
- Characterization of high-energy battery materials (Ni-rich cathode, Li-metal, Li-S system) by synchrotron-based ex/in-situ X-ray techniques

Research Associate (postdoctoral position)

Dec. 2013-Sep.2016

Chemistry Department, Brookhaven National Lab, New York

Group leader: Dr. Xiao-Qing Yang

- Carry out “Advanced in situ Diagnostic Techniques for Battery Materials”, Advanced Battery Materials Research (BMR) project, The Office of Vehicle Technologies, EE&RE, U.S. Department of Energy (DOE)
- Characterization of Li/Na-ion battery cathode materials by synchrotron-based ex/in-situ X-ray diffraction and absorption spectroscopy

Visiting student

Nov.2010 ~ Dec.2012

Chemistry Department, Brookhaven National Lab, New York

Co-Advisor: Dr. Kyung Yoon Chung (KIST, Korea) and Dr. Xiao-Qing Yang (BNL, US)

- Carry out “A Study on the Abuse Tolerable/High Capacity Electrode Materials for Lithium Secondary Batteries using Synchrotron based X-ray Analysis Techniques”, Global Research Laboratory (GRL) Program, Ministry of Education, Science and Technology, Korea
- Develop the combined time-resolved X-ray diffraction and mass spectroscopy (TR-XRD/MS) technique that allows simultaneous observation of the structural changes and gas species which are involved during thermal decomposition of charged cathode materials
- Investigated and demonstrated that thermal decomposition mechanism of charged cathode materials used in Li-ion batteries

Graduate student

Sep.2007 ~ Aug.2013

Department of Material Science and Engineering, Yonsei University, Seoul, Korea

Advisor: Prof. Kwang-Bum Kim

- Carry out “Synthesis and Characterization of Metal Oxide/Graphene Nano-hybrid Electrode Materials for Non-Aqueous Hybrid Capacitor”, SAMSUNG ELECTRO-MECHANICS, Korea. (2009 ~ 2012)
- Carry out “Synthesis of Porous Carbon/Metal Oxide Composite Electroactive Materials for Supercapacitor Applications”, National Research Laboratory Program, Ministry of Education, Science and Technology, Korea. (2007 ~ 2012)

SELECTED PUBLICATIONS

1. Z. Shadike, H.-S. Lee, C. Tian, K. Sun, L. Song, E. Hu, I. Waluyo, A. Hunt, S. Ghose, Y. Hu, J. Zhou, J. Wang, P. Northrup, **S.-M. Bak***, X.-Q. Yang*, “Design and synthesis of a new organodisulfide and its characterization as cathode materials for high performance lithium batteries” *Adv. Energy Mater.* **2019**, 1900705.
2. Q.-Q. Qiu, Q.-C. Wang, X.-Y. Yue, X.-L. Li, S.-S. Yuan, X.-J. Wu, Z. Shadike, **S.-M. Bak***, X.-Q. Yang*, Y.-N. Zhou*, “Improve the electrochemical performance and structure stability of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ cathode material at high voltage charging through Ti substitution”, *ACS Appl. Mater. Interfaces*, **2019**, 11 (26), 23213-23221.
3. S. Yun⁺, **S.-M. Bak⁺**, S. Kim, J.S. Yeon, M.K. Kim, X.-Q. Yang, P.V. Braun, H.S. Park, “Rational Design of Hierarchically Open-Porous Spherical Hybrid Architectures for Lithium-Ion Batteries”, *Adv. Energy Mater.* **2019**, 9 (6), 1802816.
4. E. Hu, X. Yu, R. Lin, J. Lu, **S. Bak**, K.-W. Nam, H.L. Xin, C. Jaye, D.A. Fischer, K. Amine, X.-Q. Yang, “Evolution of redox couples in Li-and Mn-rich cathode materials and mitigation of voltage fade by reducing oxygen release”, *Nature Energy*, **2018**, 3, 690-698.
5. **S.-M. Bak⁺***, Z. Shadike⁺, R. Lin, X. Yu*, X.-Q. Yang*, “In situ/Operando Synchrotron Based X-ray Techniques for Lithium Ion Battery Research”, *NPG Asia Mater.* **2018**, 10, 563-580.
6. Q.-C. Wang, E. Hu, Y. Pan, N. Xiao, F. Hong, Z. Fu, X.-J. Wu, **S.-M. Bak***, X.-Q. Yang*, Y.-N. Zhou*, “Utilizing $\text{Co}^{2+}/\text{Co}^{3+}$ Redox Couple in P2-Layered $\text{Na}_{0.66}\text{Co}_{0.22}\text{Mn}_{0.44}\text{Ti}_{0.34}\text{O}_2$ Cathode for Sodium-Ion Batteries”, *Adv. Sci.* **2017**, 4(11), 1700219.
7. **S.-M. Bak⁺**, R. Qiao⁺, W. Yang, S. Lee, X. Yu, B. Anasori, H. Li, Y. Gogotsi, and X.-Q. Yang, “Na-Ion Intercalation and Charge Storage Mechanism in Two-Dimensional Vanadium Carbide”, *Adv. Energy Mater.* **2017**, 7(20), 1700959.
8. H.-K. Kim, **S.-M. Bak**, S. W. Lee, M.-S. Kim, B. Park, S. C. Lee, Y. J. Choi, S. C. Jun, J. T. Han, K.-W. Nam, K. Y. Chung, J. Wang, J. Zhou, X.-Q. Yang, K. C. Roh, and K.-B. Kim, “Scalable Fabrication of Micron-Scale Graphene Nanomeshes for High-Performance Supercapacitor Applications”, *Energ. Environ. Sci.* **2016**, 9, 1270-1281. (selected as back cover)
9. M. R. Lukatskaya⁺, **S.-M. Bak⁺**, X. Yu, X.-Q. Yang, and Y. Gogotsi, “Probing the Mechanism of High Capacitance in Two-dimensional Titanium Carbide using in-situ X-ray Absorption Spectroscopy”, *Adv. Energy Mater.* **2015**, 5, 1500589.
10. H.-C. Youn⁺, **S.-M. Bak⁺**, M.-S. Kim⁺, C. Jaye, D. A. Fischer, C.-W. Lee, X.-Q. Yang, K. C. Roh, and K.-B. Kim, “High-Surface-Area Nitrogen-Doped Reduced Graphene Oxide for the Electric Double-Layer Capacitors”, *ChemSusChem* **2015**, 8, 1875-1884. (selected as inside cover).
11. **S.-M. Bak**, E. Hu, Y. Zhou, X. Yu, S.D. Senanayake, S.-J. Cho, K.-B. Kim, K.Y. Chung, X.-Q. Yang and K.-W. Nam, “Structural Changes and Thermal Stability of Charged $\text{LiNi}_x\text{Mn}_y\text{Co}_z\text{O}_2$ Cathode Materials for Li-ion Batteries Studied by Combined Time-resolved XRD and Mass Spectroscopy”, *ACS Appl. Mater. Interfaces* **2014**, 6 (24), 22594-22601.
12. **S.-M. Bak**, K.-W. Nam, W. Chang, X. Yu, E. Hu, S.-Y. Hwang, E.A. Stach, K.-B. Kim, K.Y. Chung and X.-Q. Yang, “Correlating Structural Changes and Gas Evolution during the Thermal Decomposition of Charged $\text{Li}_x\text{Ni}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ Cathode Materials”, *Chem. Mater.* **2013**, 25 (3), 337-351.
13. K.-W. Nam, **S.-M. Bak**, E. Hu, X. Yu, Y. Zhou, X. Wang, L. Wu, Y. Zhu, K.-Y. Chung and X.-Q.

Yang, “Combining in situ synchrotron X-ray diffraction and absorption techniques with transmission electron microscopy to study the origin of thermal instability in overcharged cathode materials for lithium-ion batteries”, *Adv. Funct. Materials* **2013**, 23, 1046-1063. (selected as frontispiece)

Book chapter

- **S.-M. Bak**, H.K. Kim, S.H. Park, K.B. Kim, “Reduced Graphene Oxide-Based Hybrid Materials for High-Rate Lithium Ion Batteries”, *Nanomaterials for Lithium Ion Batteries: Fundamentals and Applications*, Pan Stanford Publishing (2013), Chapter 10, pp.337-362.