

BARIS KEY

Argonne National Laboratory, 9700 South Cass Avenue, Bldg. 200 C185, Argonne, IL, 60439

Office: 1-630-252-7351

bkey@anl.gov

EDUCATION

Stony Brook University, Stony Brook, NY

Ph.D. in Chemistry

2010

Dissertation: "Solid State NMR and Pair Distribution Function Studies of Silicon Electrodes for Lithium-Ion Batteries"

Advisor: Prof. Clare P. Grey

Bogazici University, Istanbul, TURKEY

M.S. in Chemistry

2005

Dissertation: "Ancient Copper-Antimony Alloys: Preparation Methods and Properties"

Bogazici University, Istanbul, TURKEY

B.S. in Chemistry

2003

AWARDS AND GRANTS

Chemistry Award for Outstanding Doctoral Student, Stony Brook University **2010**

Chemistry Award for First-Year Teaching Assistant, Stony Brook University **2006**

DOE BES Joint Center for Energy Storage Research (JCESR) Energy Innovation Hub, Principal Investigator, \$500K/year **2013-present**

DOE VTO Applied Battery Research (ABR) Program: "Silicon Anode Consortium Project", Principal Investigator, \$150K/year **2016-present**

DOE VTO Applied Battery Research (ABR) Program: "Voltage Fade in LMR-NMC Materials", Principal Investigator, \$75K/year **2012-2014**

Battery Division Student Travel Grant, 216th Electrochemical Society Meeting **2009**

Speaker Travel Grant, Advanced Photon Source, Argonne National Laboratory **2009**

Battery Division Student Travel Grant, 214th Electrochemical Society Meeting **2008**

SELECTED HIGH IMPACT STUDIES OUT OF 34 PEER REVIEWED JOURNAL ARTICLES – **2626 CITATIONS & H-INDEX 20** AS OF 8-20-2018 (VIA GOOGLE SCHOLAR)

1. Pieremanuele Canepa, Shou-Hang Bo, Gopalakrishnan Sai Gautam, **Baris Key**, William D Richards, Tan Shi, Yaosen Tian, Yan Wang, Juchuan Li, Gerbrand Ceder, "High magnesium mobility in ternary spinel chalcogenides", **2017, *Nature Communications***, 8 (1), 1759
2. Chunjoong Kim, Patrick J Phillips, **Baris Key**, Tanghong Yi, Dennis Nordlund, Young-Sang Yu, Ryan D Bayliss, Sang-Don Han, Meinan He, Zhengcheng Zhang, Anthony K Burrell, Robert F Klie, Jordi Cabana, "Direct observation of reversible magnesium ion intercalation into a spinel oxide host", **2015, *Advanced Materials***, 27 (22), 3377-3384, **73 total citations**
3. Fulya Dogan, Brandon R Long, Jason R Croy, Kevin G Gallagher, Hakim Iddir, John T Russell, Mahalingam Balasubramanian, **Baris Key**, "Re-entrant Lithium Local Environments and Defect Driven Electrochemistry of Li-and Mn-Rich Li-Ion Battery Cathodes", **2015, *Journal of the American Chemical Society***, 137 (6), 2328-2335, **64 total citations**
4. Feng Wang, Rosa Robert, Natasha A Chernova, Nathalie Pereira, Fredrick Omenya, Fadwa Badway, Xiao Hua, Michael Ruotolo, Ruigang Zhang, Lijun Wu, Vyacheslav Volkov, Dong Su, **Baris Key**, M Stanley Whittingham, Clare P Grey, Glenn G Amatucci, Yimei Zhu, Jason Graetz,

- "Conversion Reaction Mechanisms in Lithium Ion Batteries: Study of the Binary Metal Fluoride Electrodes", **2011, *Journal of the American Chemical Society*, 133(46), 18828-36., 315 total citations**
5. **Baris Key**, Mathieu Morcrette, Jean-Marie Tarascon, Clare P Grey, "Pair Distribution Function Analysis and Solid State NMR Studies of Silicon Electrodes for Lithium Ion Batteries: Understanding the (De)lithiation Mechanisms", **2011, *Journal of the American Chemical Society*, 133, 503-512, 245 total citations**
 6. Rangeet Bhattacharyya, **Baris Key**, Hailong Chen, Adam S Best, Anthony F Hollenkamp, Clare P Grey, "*In situ* NMR Observation of the Formation of Metallic Microstructures in Lithium Batteries", **2010, *Nature Materials*, 9, 504-510, 376 total citations**
 7. Meng Jiang, **Baris Key**, Ying S Meng, Clare P Grey, "Electrochemical and Structural Study of the Layered, "Li-Excess" Lithium-Ion Battery Electrode Material $\text{Li}[\text{Li}_{1/9}\text{Ni}_{1/3}\text{Mn}_{5/9}]\text{O}_2$ ", **2009, *Chemistry of Materials*, 21(13), 2733-2745, 246 total citations**
 8. Naoko Yamakawa, Meng Jiang, **Baris Key**, Clare P Grey, "Identifying the Local Structures Formed during Lithiation of the Conversion Material, Iron Fluoride, in a Li Ion battery: A Solid State NMR, X-ray Diffraction, and Pair Distribution Function Analysis Study", 2009, ***Journal of the American Chemical Society*, 131, 10525-10536, 208 total citations**
 9. **Baris Key**, Rangeet Bhattacharyya, Mathieu Morcrette, Vincent Seznec, Jean-Marie Tarascon, Clare P Grey, "Real-Time NMR Investigations of Structural Changes in Silicon Electrodes for Lithium-Ion Batteries", **2009, *Journal of the American Chemical Society*, 131, 9239-9249, Journal Cover and C&EN Highlighted Paper, 483 total citations**

SELECTED INTERNATIONAL COMMUNICATIONS

1. **Plenary Speaker: B. Key**, "Solid State NMR Applications on Rechargeable Battery Chemistries" EMSL Integration Meeting, Fall 2015
2. **Guest Lecturer:** UIC Class LAS 493 Energy Storage for the Grid and Transportation: **Baris Key**, "Next Generation Battery Systems: Survey of New Chemistries with Potential", November 2015
3. **Invited Speaker: B. Key**, "Active Particle Studies" 2018 Vehicle Technologies Office Annual Merit Review, Washington DC, June 18-21, 2018
4. **Invited Speaker: B. Key**, "Experimental Observations of Structure-Activity Relationships in Magnesium-Ion Cathodes via Solid State NMR Spectroscopy", 1st International Symposium on Magnesium Batteries, 2016 (This trip was cancelled days before the meeting due to German Visa issues)
5. **Guest Lecturer:** UIC Class LAS 493 Energy Storage for the Grid and Transportation: **Baris Key**, "Next Generation Battery Systems: Survey of New Chemistries with Potential", November 2016
6. **Invited Speaker: B. Key**, F. Dogan, B. R. Long, J. R. Croy, M. Balasubramanian, M. D. Slater, H. Iddir, R. Benedek, M. Bettge, C. Johnson, J. T. Vaughey "Solid State NMR Studies of Li-Rich NMC Cathodes: Investigating Structure Change and Its Effect on Voltage Fade Phenomenon" DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review, Washington, DC, June 16-20, 2014
7. **Invited Speaker: B. Key**, "Pair Distribution Function Analysis and Solid State NMR Studies of Silicon Electrodes for Lithium Ion Batteries: Understanding the (De)lithiation Mechanisms", March Meeting of American Physical Society, Boston, 2012
8. **Invited Speaker: B. Key**, "Solid State NMR and Pair Distribution Function Studies to Investigate the Changes in Short Range order in Silicon Anodes", Advanced Photon Source Users Meeting, Argonne National Laboratory, IL, 2009

WORK EXPERIENCE

- **Assistant Chemist**, CSE Division Staff Scientist, Argonne National Laboratory **2014-present**
 - **Postdoctoral Researcher**, CSE Division, Argonne National Laboratory **2011-2013**
 - **Research Assistant**, Stony Brook University **2006-2010**
 - **Teaching Assistant**, General Chemistry Laboratory, Stony Brook University **2005-2006**
 - **Teaching Assistant**, Organic Chemistry Laboratory, Bogazici University **2003-2005**
 - **Internships**, Roche Pharmaceutical Company, Istanbul **2002**
 - **Internships**, Meges Paints and Chemistry Ltd., Istanbul **2001**
 - **Internships**, Turkkan Dye and Textile Company, Bursa **2000**
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RESEARCH EXPERIENCE

- **Expertise in Lithium-ion Batteries, 2005 to present**
 - Major contributions to fundamental understanding and characterization of High Energy Anodes Chemistries; Si and Lithium metal
 - Co-precipitation Synthesis and Characterization of High Energy Cathodes; Li-rich LTMO's (NM, NMC)
 - Sol-gel and Solid State Synthesis and Characterization of Solid Li-ion and Mg-ion conductor ceramics (LATP, LLTO, LLZO, Mg-spinel chalcogenides)
 - Adaptation and development of cell designs for in-situ characterization techniques; prototype plastic bag-cells for NMR and Synchrotron X-rays
 - Cell fabrication and electrochemistry
 - **Expertise in Multivalent-ion Batteries**
 - Development of New Battery Chemistries; Characterization of Na-ion, Mg and other Multivalent-ion chemistries (Zn, Al, Ca)
 - **Expertise in Solid State NMR**
 - NMR of battery materials: ^1H , ^2H , $^{6,7}\text{Li}$, ^{13}C , ^{19}F , ^{23}Na , ^{25}Mg , ^{27}Al , ^{29}Si , ^{31}P , ^{67}Zn , ^{43}Ca MAS/static
 - NMR of paramagnetic battery materials (Mg, Zn, Ca, and Li-rich NiMn and NiMnCo type)
 - NMR of diamagnetic battery materials (Li-ion battery electrolyte, Li-ion conducting ceramics)
 - NMR of metallic battery materials and zintl-phases (Lithium silicides, Lithium metal, LiCoO_2)
 - Development of in-situ static NMR techniques for batteries (1st successful adaptation in Grey Group, 2008)
 - Development of in-situ MAS NMR techniques for batteries
 - Development of in-situ/ex-situ MRI techniques for batteries
 - Solution NMR of battery electrolytes and soluble Li-sulfur compounds
 - NMR probe design, modification and repair
 - NMR system maintenance and repair; Varian, Bruker and Chemmagnetics
 - **Considerable Experience in Synchrotron X-ray and Neutron Techniques**
 - Ex-situ and in-situ X-ray diffraction
 - Ex-situ and in-situ X-ray Pair Distribution Function (PDF)
 - Ex-situ and in-situ X-ray Absorption Spectroscopy (XAS)
 - Neutron Diffraction and PDF
 - Atomic Absorption Spectroscopy
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INTERNATIONAL JOURNAL REVIEWING ASSIGNMENTS

NPG: Scientific Reports

ACS: Journal of the American Chemical Society, Chemistry of Materials, Journal of Physical Chemistry, ACS Applied Materials & Interfaces, Inorganic Chemistry

ECS: Journal of the Electrochemical Society

Springer: Ionics

Elsevier: Journal of Power Sources, Journal of Solid State Chemistry

PROFESSIONAL ORGANIZATION MEMBERSHIPS

- The Electrochemical Society
- The American Chemical Society