

YANG SHAO-HORN

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Professor Shao-Horn is W.M. Keck Professor of Energy at the Massachusetts Institute of Technology (M.I.T.), as well as, a Professor of Mechanical Engineering, and Materials Science and Engineering. Professor Shao-Horn earned her B.S. degree from Beijing University of Technology and her Ph.D. degree from Michigan Technological University both in Metallurgical and Materials Engineering. She joined the M.I.T. faculty in 2002.

Professor Shao-Horn's research programs are centered on exploiting chemical/materials physics and physical/materials chemistry principles to understand charge transfer at the solid-gas and solid-liquid interface, which is used to design materials/processes and control the kinetics of (electro)chemical reactions, critical to enable the deployment of clean air and clean energy technologies. Professor Shao-Horn and coworkers have pioneered the use of electronic structure to develop universal guiding principles, and design interfaces with activity, reactivity and stability to enhance function/performance across a number of applications spanning from oxidation of air pollutants, making of sustainable or solar fuels via water splitting, CO₂ reduction or nitrogen reduction (Hwang et al., *Science* 2017), to charge transfer at the electrode/electrolyte interface of rechargeable lithium-ion and lithium-air batteries. Research programs include experimental and computational components including synthesis, (electro)chemical measurements, synchrotron X-ray diffraction and spectroscopy, electron- and light-based imaging and spectroscopy, and Density Functional Theory computation. Professor Shao-Horn and coworkers are highly interdisciplinary and collaborating closely with other leading labs and private sectors in chemical, automotive, and energy industry. Select research results from the past few years are described in detail below.

Professor Shao-Horn and her coworkers have tuned the oxide electronic structure to develop active and non-precious-metal-containing catalysts to promote oxygen reduction and evolution kinetics (accounting for ~75% of total energy loss), which is central to achieve high efficiencies of water-splitting devices, fuel cells, and metal-air batteries. The oxide electronic structure features, more specifically the energy levels of metal d and O p density of states (DOS), dictate the filling of antibonding orbitals on metal and oxygen sites, metal-oxygen covalency, and the binding strength with reaction intermediates, which influences the reaction energetic barrier for the rate-limiting step and thus reaction kinetics. Also, Shao-Horn and her collaborators have shown that the antibonding orbital filling ("e_g" 3d electron) of surface transition-metal cations controls the catalytic activity of oxides for oxygen reduction (Suntivich et al. *Nature Chemistry* 2011) and oxygen evolution (Suntivich et al. *Science* 2011) in a volcano-shaped dependence over several orders of magnitude. Applying this principle to design new oxide chemistry has led to intrinsic oxygen evolution activity greater than start-of-the-art IrO₂ (Suntivich et al. *Science* 2011) and record intrinsic oxygen reduction activity for non-precious-metal-based catalysts known to date (Stoerzinger et al. *JPCL* 2015). Recently, Shao-Horn and her coworkers have established criteria to obtain high stability and activity of most active catalysts for oxygen evolution, where increasing the metal-oxygen covalency (smaller energy gap between metal d and O 2p states) enhances activity but beyond an optimal value reduces oxide stability (May et al. *JPCL* 2012 and Grimaud et al. *Nature Comm* 2013). Exploiting this concept to examine a series of oxides not only sets record catalytic activity but also establishes a new reaction mechanism for the most active oxides, where both metal and oxygen sites can catalyze oxygen evolution (Grimaud et al. *Nature Chemistry* 2017) and deprotonation from oxide surface can be rate-limiting (Hong et al. *EES*

2017) – contrary to long-standing belief. Therefore, tuning metal-covalency points to a new direction to increase oxide activity and stability. Recently, such concepts have been applied in the design of surfaces to suppress the dehydrogenation of electrolytes to enhance the lifetime and safety of high-energy Li-ion batteries (Giordano et al. JPCL 2017).

Professor Shao-Horn and her coworkers have made notable contributions to advance the development of fuel cells for consumer vehicles. Her work on the mechanism of Pt catalyst loss in fuel cells in collaboration with GM has contributed to prolonging the lifetime of fuel cells from hundreds to thousands of hours and to the first commercialization of fuel-cell-powered vehicle, Mirai, by Toyota in 2015. In addition, Shao-Horn and her coworkers have established the degradation mechanisms of Pt and Pt alloy nanoparticles in fuel cells (Ferreira et al. JES 2005 and Chen et al. JES 2010). Recent work has demonstrated record ORR activity for Pt alloy catalysts in fuel cells exceeding the target set by US Department of Energy for 2017 by teaming up with GM and Johnson Matthey (EES 2015).

Professor Shao-Horn is a member of National Academy of Engineering, and is among the World's Most Influential Scientific Minds and *Highly Cited Researchers* (Thomson Reuters) based on ~300 archival journal papers and ~300 invited, keynote and plenary lectures in academia (e.g. Marvel Lecture 2017), at industrial events (e.g., BASF Energy Symposium in 2015) and high-level strategic meetings (e.g., Ideaslab of World Economic Forum in Davos 2017). She has advised ~90 students and postdoctoral associates at MIT, now pursuing successful careers in industry, national research laboratories, and in academia (~25) including faculty positions at University of Michigan, MIT and Cornell, as well as, academic positions in Europe and Asia.

Professor Shao-Horn's leadership and service contributions include: MIT Energy Council, Co-Director for Center for Energy Storage at MIT; Energy Area Head, MIT Mechanical Engineering; National Science Foundation Interdisciplinary Leader and MIT Presidential Energy Research Council. In addition, she has been serving on the advisory boards of private/public organizations and leading journals in energy science and physical chemistry including American Chemical Society Journal of Physical Chemistry, Royal Society of Chemistry Energy and Environmental Science, Wiley Advanced Energy Materials, Materials Today, and Cell Press Chem and Joule. Moreover, Professor Shao-Horn has received honors including the Charles Tobias Young Investigator Award and the Battery Division Research Award from the Electrochemical Society, the Tajima Prize from the International Society of Electrochemistry, the Research Award by the International Battery Association, the Faraday Medal from Royal Society of Chemistry, and has been elected as a Fellow from the American Association for the Advancement of Science, the Royal Society of Chemistry, International Society of Electrochemistry, and the Electrochemical Society.

Representative Publications of Yang Shao-Horn

1. Hopkins, B.J., Y. Shao-Horn, and D. P. Hart, Suppressing Corrosion In Primary Aluminum–Air Batteries Via Oil Displacement, *Science*, 362, 658-661 November 2018.
2. Yu, Y., P. Karayaylali, Y. Katayama, L. Giordano, M. Gauthier, F. Maglia, R. Jung, I. Lund, and Y. Shao-Horn, Decomposition and Carbonate Dehydrogenation Enhanced by Highly Covalent Metal Oxides in High-Energy Li-Ion Batteries, *Journal of Physical Chemistry C*, DOI 10.1021/acs.jpcc.8b07848 October 2018.
3. Kuznetsov, D., B. Han, Y. Yu, R.R. Rao, J. Hwang, Y. Román-Leshkov, and Y. Shao-Horn, Tuning of redox transitions via inductive effect in transition metal complexes and oxides and implications in catalyzing oxygen reduction and oxygen evolution, *Joule*, 2, 1-20 February 2018.
4. Hwang, J., R.R. Rao, L. Giordano, Y. Katayama, Y. Yu, and Y. Shao-Horn, Perovskites in Catalysis and Electrocatalysis, *Science*, 358, 751-756 November 2017.
5. Rao, R.R., M.J. Kolb, N.B. Halck, A.F. Pedersen, A. Mehta, H. You, K.A. Stoerzinger, Z. Feng, H.A. Hansen, H. Zhou, L. Giordano, J. Rossmeisl, T. Vegge, I. Chorkendorff, I.E.L. Stephens, and Y. Shao-Horn, Towards identifying the active sites on RuO₂(110) in catalyzing oxygen evolution, *Energy & Environmental Science*, 10, 2626-2637 December 2017.
6. Feng, S., M. Chen, L. Giordano, M. Huang, W. Zhang, C.V. Amanchukwu, R. Anandakathir, Y. Shao-Horn, and J.A. Johnson, Mapping a stable solvent structure landscape for aprotic Li–air battery organic electrolytes, *Journal of Materials Chemistry A*, 5, 23987-23998 November 2017.
7. Hong, W., K.A. Stoerzinger, Y-L. Lee, L. Giordano, A.J.L. Grimaud, A.M. Johnson, J. Hwang, E. Crumlin, W. Yang, Y. Shao-Horn, Charge-transfer-energy-dependent oxygen evolution reaction mechanisms for perovskite oxides, *Energy & Environmental Science*, 10, 2190-2200 October 2017.
8. Tulodziecki, M., G.M. Leverick, C.V. Amanchukwu, Y. Katayama, D.G. Kwabi, F. Bardé, P.T. Hammond and Y. Shao-Horn, The role of iodide in the formation of lithium hydroxide in lithium-oxygen batteries, *Energy & Environmental Science*, 10, 1828-1842 August 2017.
9. Hong, W., K.A. Stoerzinger, Y-L. Lee, L. Giordano, A.J.L. Grimaud, A.M. Johnson, J. Hwang, E. Crumlin, W. Yang, Y. Shao-Horn, Charge-transfer-energy-dependent oxygen evolution reaction mechanisms for perovskite oxides, *Energy & Environmental Science*, 10, 2190-2200 October 2017.
10. Giordano, L., P. Karayaylali, Y. Yu, Y. Katayama, F. Maglia, S. Lux, and Y. Shao-Horn, Chemical Reactivity Descriptor for the Oxide-Electrolyte Interface in Li-Ion Batteries, *Journal of Physical Chemistry Letters*, 8, 3881-3887 August 2017.
11. Risch, M., K. A. Stoerzinger, B. Han, T.Z. Regier, D. Peak, S. Y. Sayed, C. Wei, Z. Xu, and Y. Shao-Horn, Redox Processes of Manganese Oxide in Catalyzing Oxygen Evolution and Reduction: An in Situ Soft X-ray Absorption Spectroscopy Study, *Journal of Physical Chemistry C*, 121, 17682-17692 August 2017.
12. Grimaud, A., O. Diaz-morales, B.H. Han, W. T. Hong, Y.L. Lee, L. Giordano, K. A. Stoerzinger, M.T.M. Koper, Y. Shao-Horn, Activating lattice oxygen redox reactions in metal oxides to catalyze oxygen evolution, *Nature Chemistry*, 9, 457-465 May 2017.
13. Han, B., K.A. Stoerzinger, V. Tileli, A.D. Gamalski, E.A. Stach, and Y. Shao-Horn, Nanoscale Structural Oscillations in Perovskite Oxides Induced by Oxygen Evolution, *Nature Materials*, 16, 121-126 January 2017.
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- Lupart, P. Lamp, L. Giordano and Y. Shao-Horn, Inorganic Solid-State Electrolytes for Lithium Batteries: Mechanisms and Properties Governing Ion Conduction, *Chemical Reviews*, 116, 140-162 January 2016.
15. Kwabi, D., V.S. Bryantsev, T.P. Batcho, D. Itkis, C.V. Thompson and Y. Shao-Horn, Experimental and Computational Analysis of the Solvent-Dependent $O_2/Li^+-O_2^-$ Redox Couple: Standard Potentials, Coupling Strength and Implications for Lithium-Oxygen Batteries, *Angewandte Chemie International Edition*, 128, 3181-3186 February 2016.
 16. Gauthier, M., T.J. Carney, A. Grimaud, L. Giordano, N. Pour, H.-H. Chang, D.P. Fenning, S.F. Lux, O. Paschos, C. Bauer, F. Maglia, S. Lupart, P. Lamp, and Y. Shao-Horn, The Electrode-Electrolyte Interface in Li-ion Batteries: Current Understanding and New Insights, *Journal of Physical Chemistry Letters*, 6, 4653-4672 October 2015.
 17. Hong, W.T., M. Risch, K.A. Stoerzinger, A. Grimaud, J. Suntivich, and Y. Shao-Horn, Toward the Rational Design of Non-precious Transition Metal Oxides for Oxygen Electrocatalysis, *Energy & Environmental Science*, 8, 1404-1427 2015.
 18. Stoerzinger, K.A., W.T. Hong, G. Azimi, L. Giordano, Y.L. Lee, E.J. Crumlin, M.D. Biegalski, H. Bluhm, K.K. Varanasi, and Y. Shao-Horn, Reactivity of Perovskites with Water: Role of Hydroxylation in Wetting and Implications for Oxygen Electrocatalysis, *Journal of Physical Chemistry C*, 119, 18504-18512 2015.
 19. Hong, W.T., K.A. Stoerzinger, B. Mortiz, T.P. Devereaux, W. Yang, and Y. Shao-Horn, Probing $LaMO_3$ Metal and Oxygen Partial Density of States Using X-ray Emission, Absorption, and Photoelectron Spectroscopy, *Journal of Physical Chemistry C*, 119, 2063-2072 2015.
 20. Han, B., C.E. Carlton, A. Kongkanand, R.S. Kukreja, B.R.C. Theobald, L. Gan, R. O'Malley, P. Strasser, F.T. Wagner, and Y. Shao-Horn, Record Activity and Stability of Dealloyed Bimetallic Catalysts for Proton Exchange Membrane Fuel Cells, *Energy & Environmental Science*, 8, 258-266 2015.
 21. Elias, J., S., M. Risch, L. Giordano, A.N. Mansour, and Y. Shao-Horn, Structure, Bonding and Catalytic Activity of Monodisperse, Transition-Metal-Substituted CeO_2 Nanoparticles, *Journal of the American Chemical Society*, 136, 17193-17200 2014.
 22. Feng, Z., Y. Yacoby, M.J. Gadre, Y.L. Lee, W.T. Hong, H. Zhou, M.D. Biegalski, H.M. Christen, S.B. Adler, D. Morgan, and Y. Shao-Horn, Anomalous Interface and Surface Strontium Segregation in $(La_{1-y}Sr_y)_2CoO_{4\pm\delta}/La_{1-x}Sr_xCoO_{3-\delta}$ Heterostructured Thin Films, *Journal of Physical Chemistry Letters*, 5, 1027-1034 2014.
 23. Grimaud, A., K.J. May, C.E. Carlton, Y.L. Lee, M. Risch, W. Hong, J. Zhou and Y. Shao-Horn, Double Perovskite as a Family of Highly Active Catalysts for Oxygen Evolution in Alkaline Solution, *Nature Communications*, 4, 2439 2013.
 24. Suntivich, J., Z. Xu, C.E. Carlton, J. Kim, B. Han, S.W. Lee, N. Bonnet, N. Marzari, L.F. Allard, H.A. Gasteiger, K. Hamad-Schifferli, Y. Shao-Horn, Surface Composition Tuning of Au-Pt Bimetallic Nanoparticles for Enhanced Carbon Monoxide and Methanol Electro-oxidation, *Journal of the American Chemical Society*, 135, 7985-7991 2013.
 25. Mutoro, E., E.J. Crumlin, H. Pöpke, B. Luerssem, M. Amati, M. K. Abyaneh, M.D. Biegalski, H. M. Christen, L. Gregoratti, J. Janek and Y. Shao-Horn, Reversible Compositional Control of Oxide Surfaces by Electrochemical Potentials, *Journal of Physical Chemistry Letters*, 3, 40 - 44 2012.
 26. Suntivich, J., H.A. Gasteiger, N. Yabuuchi, H. Nakanishi, J.B. Goodenough and Y. Shao-Horn, Design Principles for Oxygen Reduction Activity on Perovskite Oxide Catalysts for Fuel Cells and Metal-Air Batteries, *Nature Chemistry*, 3, 546-550 2011.
 27. Suntivich, J., K.J. May, H.A. Gasteiger, J.B. Goodenough and Y. Shao-Horn, A Perovskite Oxide Optimized for Oxygen Evolution Catalysis from Molecular Orbital Principles, *Science*,

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28. Lee, Y. L., J. Kleis, J. Rossmeisl, Y. Shao-Horn and D. Morgan, Prediction of Solid Oxide Fuel Cell Cathode Activity with First-Principles Descriptors, *Energy & Environmental Science*, 4, 3966-3970 2011.
 29. Crumlin, E.J, E. Mutoro, S.J. Ahn, G.J. la O', D. N. Leonard, A. Borisevic, M. D. Biegalski, H. M. Christen, Y. Shao-Horn, Oxygen Reduction Kinetics Enhancement on a Hetero-Structured Oxide Surface for Solid Oxide Fuel Cells, *Journal of Physical Chemistry Letters*, 1, 3149–3155 2010.
 30. Lee, S.W., N. Yabuuchi, G.M. Gallant, S. Chen, B.S. Kim, P.T. Hammond and Y. Shao-Horn, High-Power Lithium Batteries from Functionalized Carbon-Nanotube Electrodes, *Nature Nanotechnology*, 5, 531–537 2010.
 31. Chen, S., W.C. Sheng, N. Yabuuchi, P.J. Ferreira, L.F. Allard and Y. Shao-Horn, The Origin of Oxygen Reduction Activity of “Pt₃Co” Nanoparticles: Atomically Resolved Chemical Compositions and Structures, *Journal of Physical Chemistry C*, 113, 1109–1125 2009.
 32. Ferreira, P.J., G.J. la O', Y. Shao-Horn, D. Morgan, R. Makharia, S. Kocha and H. Gasteiger, Instability of Pt/C Electrocatalysts in Proton Exchange Membrane Fuel Cells: A Mechanistic Investigation, *Journal of the Electrochemical Society*, 152, A2256–A2271 2005.

Selected Recent Lectures of Yang Shao-Horn

Professor Shao-Horn has given ~300 invited, keynote and plenary lectures at university seminars, national and international conferences and events.

1. July 2019, A Universal Descriptor for Ion Conductivity? **Plenary**, Nano Korea 2019, Korea.
2. March 2019, Oxygen redox in metal oxides, **Plenary**, IBA, San Diego, CA.
3. October 2018, “Electrified Interface: Challenges and Opportunities”, **Current Challenges in Catalysis**, The Royal Danish Academy of Sciences and Letters, Copenhagen, Denmark.
4. September 2018, “Electrocatalysis for Storing Electrons”, **RSC Faraday Medal Address**, Manchester, UK.
5. May 2018, “Energy Outlook 2050”, **Stanford Energy Seminar**, Stanford University, Palo Alto, CA.
6. October 2017, “Electrochemistry Outlook 2050”, **Nanqiang Lecture**, Xiamen University, Xiamen, China.
7. September 2017, “The Future of Electrochemistry”, **Marvel Lecture**, EPFL, Lausanne, Switzerland.
8. January 2017, “A Grand Challenge: Energy Storage”, **IdeasLab**, World Economics Forum, Davos, Switzerland.
9. August 2016, “Oxygen electrochemistry for Chemical Storage”, **Keynote**, Inauguration of Villum Center for Sustainable Fuels and Chemicals, Denmark.
10. October 2015, “Activating Oxygen Chemistry of Energy Storage”, **BASF Lectureship**, UC Berkeley, CA.
11. March 2015, Oxygen Electrochemistry and Design of Oxides for Clean Energy and Clean Environment, **Keynote**, BASF Energy Symposium for 150 Year Celebration, Ludwigshafen, Germany.
12. January 2015, “Enabling Oxides for Oxygen Electrocatalysis,” **Faculty Distinguished Lecture**, Chinese University of Hong Kong, Hong Kong, China.
13. August 2014, “Enabling Oxides for Oxygen Electrocatalysis,” **Plenary**, International Society of Electrochemistry, Lausanne Switzerland.
14. July 2014, Design Principles of Oxides for Oxygen Electrocatalysis, **Keynote**, Nano2014, Moscow, Russia.
15. June 2014, “The Solvation Influence on the Oxygen Redox for Rechargeable Li-air Batteries”, **Plenary**, IMLB 2014, Como, Italy.
16. February 2013, Oxygen Electrolysis on Oxides for Clean Energy Applications, **Plenary**, Zing Conference on Electrochemistry, Canary Islands, Spain.
17. May 2012, “Challenges in Oxygen Electrocatalysis for Electrochemical Storage and Conversion,” EMC² Seminar, Cornell University, Ithaca, NY.
18. February 2012, “Design Principles for Oxygen Reduction and Evolution on Oxide Catalysts,” **Plenary**, APS March National Meeting, Boston, MA.

Full Publications of Yang Shao-Horn

Professor Shao-Horn and coworkers have published ~300 peer-reviewed archival journal publications and is a co-inventor on a number of issued and pending Patents. Professor Shao-Horn has advised ~90 M.S. and Ph.D. students, and postdoctoral researchers.

1. Hopkins, B.J., Y. Shao-Horn, and D. P. Hart, Suppressing Corrosion In Primary Aluminum–Air Batteries Via Oil Displacement, *Science*, **362**, 658-661 November 2018.
2. Yu, Y., P. Karayaylali, Y. Katayama, L. Giordano, M. Gauthier, F. Maglia, R. Jung, I. Lund, and Y. Shao-Horn, Decomposition and Carbonate Dehydrogenation Enhanced by Highly Covalent Metal Oxides in High-Energy Li-Ion Batteries, *Journal of Physical Chemistry C*, DOI 10.1021/acs.jpcc.8b07848 October 2018.
3. R. Tatara, P. Karayaylali, Y. Yu, Y. Zhang, L. Giordano, F. Maglia, R. Jung, J. P. Schmidt, I. Lund, and Y. Shao-Horn, The Effect of Electrode-Electrolyte Interface on the Electrochemical Impedance Spectra for Positive Electrode in Li-Ion Battery, *JECS* 2019, 166(3), A5090-A5098.
4. D. Lee, J. Zhou, G. Chen, and Y. Shao-Horn, Enhanced Thermoelectric Properties for PEDOT:PSS/Undoped Ge Thin, ÅFilm Bilayered Heterostructures, *Advanced Electronic Materials* DOI: 10.1002/aelm.201800624.
5. Stoerzinger, K. A., X. R. Wang, J. Hwang, R. R. Rao, W. T. Hong, C. M. Rouleau, D. Lee, Y. Yu, E. J. Crumlin, Y. Shao-Horn, Speciation and Electronic Structure of $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ During Oxygen Electrolysis, *Topics in Catalysis*, DOI 10.1007/s11244-018-1070-7 October 2018.
6. Shibuya, Y., R. Tatara, Y. Jiang, Y. Shao-Horn, and J. A. Johnson, Brush-First ROMP Of Poly(Ethylene Oxide) Macromonomers Of Varied Length: Impact Of Polymer Architecture On Thermal Behavior And Li^+ Conductivity, *Journal of Polymer Science, Part A*, DOI: 10.1002/pola.29242 October 2018.
7. Kong, W., H. Li, K. Qiao, Y. Kim, K. Lee, Y. Nie, D. Lee, T. Osadchy, R. J. Molnar, D. K. Gaskill, R. L. Myers-Ward, K. M. Daniels, Y. Zhang, S. Sundram, Y. Yu, S. Bae, S. Rajan, Y. Shao-Horn, K. Cho, A. Ougazzaden, J. C. Grossman, and J. Kim, Polarity Governs Atomic Interaction Through Two-Dimensional Materials, *Nature Materials*, **17**, 999-1004 October 2018.
8. Krauskopf, T., S. Muy, S. P. Culver, S. Ohno, O. Delaire, Y. Shao-Horn, and W. G. Zeier, Comparing The Descriptors For Investigating The Influence Of Lattice Dynamics On Ionic Transport Using The Superionic Conductor $\text{Na}_3\text{PS}_{4-x}\text{Se}_x$, **140**, 14464-14473 October 2018.
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10. Wang, X., X. Zhang, L. Sun, D. Lee, S. Lee, M. Wang, J. Zhao, Y. Shao-Horn, M. Dinca, T. Palacios, and K. K. Gleason, High Electrical Conductivity And Carrier Mobility In Ocvd PEDOT Thin Films By Engineered Crystallization And Acid Treatment, *Science Advances*, **4**, DOI: 10.1126/sciadv.aat5780 September 2018.
11. Perego, D., J. S. T. Henga, X. Wang, Y. Shao-Horn and C. V. Thompson, High-Performance Polycrystalline RuO_x Cathodes For Thin Film Li-Ion Batteries, *Electrochimica Acta*, **283**, 228-233 September 2018.
12. Feng, S., J. R. Lunger, J. A. Johnson, and Y. Shao-Horn, Hot Lithium-Oxygen Batteries Charge Ahead, *Science*, **361**, 758 August 2018.

13. Zhang, W., M. Huang, S. Al Abdullatif, M. Chen, Y. Shao-Horn, and J. A. Johnson, Reduction of (Meth)acrylate-Based Block Copolymers Provides Access to Self-Assembled Materials with Ultrasmall Domains, *Macromolecule*, 51, 6757–6763 August 2018.
14. Sebastian, P., M. Tulodziecki, M. del Pilar Bernicola, V. Climent, E. Gomez, Y. Shao-Horn, and J. M. Feliu, The Use of CO as Cleaning Tool of Highly Active Surfaces in Contact with Ionic Liquids. Ni Deposition on Pt(111) Surfaces in IL, *ACS Applied Energy Materials*, 1, 4617–4625, August 2018.
15. Hwang, J., R. R. Rao, Y. Katayama, D. Lee, X. R. Wang, E. Crumlin, T. Venkatesan, H. N. Lee, and Y. Shao-Horn, Reactivity on Cobalt-Based Perovskites, *Journal of Physical Chemistry C*, 122, 20391–20401 August 2018.
16. Roy, C., R. R. Rao, K. A. Stoerzinger, J. Hwang, J. Rossmeisl, I. Chorkendorff, Y. Shao-Horn and I. E. L. Stephens, Trends in Activity and Dissolution on RuO₂ under Oxygen Evolution Conditions: Particles versus Well-Defined Extended Surfaces, *ACS Energy Letters*, 3, 2045–2051 August 2018.
17. Muy, S., J.C. Bachman, H.-H. Chang, L. Giordano, F. Maglia, S. Lupart, P. Lamp, W.G. Zeier, and Y. Shao-Horn, Lithium Conductivity and Meyer-Neldel Rule in Li₃PO₄–Li₃VO₄–Li₄GeO₄ Lithium Superionic Conductors, *Chemistry of Materials*, 30, 5573–5582 July 2018.
18. Tatara, R., G. M. Leverick, S. Feng, S. Wan, S. Terada, K. Dokko, M. Watanabe, and Y. Shao-Horn, Tuning NaO₂ Cube Sizes by Controlling Na⁺ and Solvent Activity in Na-O₂ Batteries, *Journal of Physical Chemistry C*, 122, 18316–18328 July 2018.
19. Han, B., M. Risch, S. Belden, S. Lee, D. Bayer, E. Mutoro and Y. Shao-Horn, Screening Oxide Support Materials for OER Catalysts in Acid, *Journal of The Electrochemical Society*, 165, F813–F820 July 2018.
20. Phillips, K. R., Y. Katayama, J. Hwang, and Y. Shao-Horn, Sulfide-Derived Copper for Electrochemical Conversion of CO₂ to Formic Acid, *Journal of Physical Chemistry Letters*, 9, 4407–4412 July 2018.
21. Qiao, B., G. M. Leverick, W. Zhao, A. H. Flood, J. A. Johnson, and Y. Shao-Horn, Supramolecular Regulation of Anions Enhances Conductivity and Transference Number of Lithium in Liquid Electrolytes, *Journal of the American Chemical Society*, 140, 10923–10936 July 2018.
22. Rao, R.R., M. J. Kolb, J. Hwang, A. F. Pedersen, A. Mehta, H. You, K. A. Stoerzinger, Z. Feng, H. Zhou, H. Bluhm, L. Giordano, I. E. L. Stephens, and Y. Shao-Horn, Surface Orientation Dependent Water Dissociation on Rutile Ruthenium Dioxide, *Journal of Physical Chemistry C*, 122, 17802–17811 July 2018.
23. A. Chaudhuri, L. Mandal, X. Chi, M. Yang, M. C. Scott, M. Motapothula, X. J. Yu, P. Yang, Y. Shao-Horn, T. Venkatesan, A. T. S. Wee, and A. Rusydi, Direct Observation Of Anisotropic Small-Hole Polarons In An Orthorhombic Structure Of Bivo₄ Films, *Physical Review B*, 97, 195150–195158 May 2018.
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25. Gauthier, M., P. Karayaylali, L. Giordano, S. Feng, S. F. Lux, F. Maglia, P. Lamp, and Y. Shao-Horn, Probing Surface Chemistry Changes Using LiCoO₂-only Electrodes in Li-Ion Batteries, *Journal of The Electrochemical Society*, 165, A1388–A1387 May 2018.
26. Østergaard, T. M., L. Giordano, I. E. Castelli, F. Maglia, B. K. Antonopoulos, Y. Shao-Horn, and J. Rossmeisl, Oxidation of Ethylene Carbonate on Li Metal Oxide Surfaces, *Journal of Physical Chemistry C*, 122, 10442–10449 April 2018.

27. Huang, B., S. Muy, S. Feng, Y. Katayama, Y.-C. Lu, G. Chen, and Y. Shao-Horn, Non-Covalent Interactions In Electrochemical Reactions And Implications For Clean Energy Applications, *Physical Chemistry Chemical Physics*, 20, 15680-15686 April 2018.
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