

David A Cullen, Ph.D.

Senior R&D Staff Scientist
Materials MicroAnalysis Group
Center for Nanophase Materials Sciences
Oak Ridge National Laboratory
[Website](#)

Education:

Ph.D. (2010) Arizona State University, Tempe, AZ
Materials Science and Engineering

B.S. (2005) Brigham Young University, Provo, UT
Applied Physics

Research Expertise:

- >15 Years Research Experience in Electron Microscopy
- Expertise in correlating the atomic structure and chemistry of fuel cell materials with durability and performance using advanced, analytical aberration-corrected scanning transmission electron microscopy.
- Fuel cells, electrolyzers, single atom catalysts, energy dispersive X-ray spectroscopy.

Research and Professional Experience:

2020- Present	Senior R&D Staff Scientist	Oak Ridge National Laboratory
2014-2020	R&D Staff Scientist	Oak Ridge National Laboratory
2012-2014	R&D Associate	Oak Ridge National Laboratory
2010-2012	Alvin M. Weinberg Fellowship	Oak Ridge National Laboratory (Mentor: Karren L. More)
2005-2010	Graduate Research Associate	Arizona State University (Mentor: David J. Smith)

Leadership Experience:

2020-Present	M2FCT Consortium FOA Coordination Officer
2019- Present	ElectroCat Consortium Steering Committee
2019-2020	FC-PAD Consortium Component Diagnostics and Characterization Thrust Coordinator
2018-2019	Fuel Cell Technologies Program Manager, Sustainable Transportation Program, ORNL
2016-2018	Team Lead, Applied Materials Characterization, MSTD Division, ORNL

Honors and Awards:

2020	Fuel Cell R&D Technical Program Award, Hydrogen and Fuel Cell Technologies Office
2020	R&D 100 Finalist: "A low-cost manufacturing process for hollow silica particles."
2019	Presidential Early Career Award for Scientists and Engineers
2013	Appalachian Regional Microscopy Society Young Investigator Award
2010	Alvin M. Weinberg Early Career Fellowship, Oak Ridge National Laboratory
2009	ARCS (Achievement Rewards for College Scientists) Scholar, Phoenix Chapter

U.S. Patents:

2020	N. Orlovskaya, R. Blair, Z. Xie, D.A. Cullen. "Mechanochemical synthesis of iridium diboride and iridium monoboride" US10427946B2.
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Funding:

2020- Present	EERE-HFTO "Million Mile Fuel Cell Truck (M ² FCT) Consortium" (PI and FOA coordinator)
2020- Present	EERE-HFTO "ElectroCat 2.0 Consortium" (PI and Steering Committee Member)
2020- Present	EERE-HFTO "Hydrogen and Fuel Cell Technologies Office Hydrogen from the Next-generation of Electrolyzers of Water (H ₂ NEW) Consortium" (co-PI)
2020- Present	EERE-HFTO "Advanced Manufacturing Processes for Gigawatt-Scale Proton Exchange Membrane Water Electrolyzer Oxygen Evolution Reaction Catalysts and Electrodes" (co-PI with 3M Company lead)
2020- Present	EERE-HFTO "Integrated Membrane Anode Assembly & Scale-up" (co-PI with Giner Inc. lead)

Career Highlights

Awards: 2019 Presidential Early Career Award for Scientists and Engineers

Funding: DOE-EERE Hydrogen and Fuel Cell Technologies Office (HFTO)

Professional Service: ACS and M&M Symposia Organizer, ORNL Postdoc Group Mentoring Program, ORNL Cycling Club President

- 2017-2020 EERE-HFTO: "Thin and Tunable Liquid / Gas Diffusion Electrodes for Hydrogen Production from Low-Temperature Water Electrolysis" (co-PI with UTSI lead)
- 2016-2020 EERE-HFTO "Fuel Cell Performance and Durability (FC-PAD) Consortium" (co-PI)
- 2015-2020 EERE-HFTO "ElectroCat Consortium" (co-PI)
- 2014-2015 EEFRE-HFTO "Magnetic Annealing of Pt-alloy Nanostructure Thin Film Catalysts for Enhanced Activity." (PI)
- 2011-2019 EERE-HFTO "Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports." (co-PI with 3M lead)
- 2010-2012 ORNL LDRD Alvin M. Weinberg Early Career Fellowship: "Advanced Electron Microscopy Studies of Energy-related Catalysts." (Role: PI)

Invited Book Chapters:

1. DA Cullen, DM Myers, P Zelenay: "Chapter 3: Characterization approaches for atomically dispersed platinum group metal-free catalysts", in PEM Fuel Cells: Characterization and Modeling, De Gryuter, 2023.
2. RT Atanasoski, LL Atanasoska, DA Cullen: "Efficient Oxygen Evolution Reaction Catalysts for Cell Reversal and Start/Stop Tolerance" in M. Shao ed., "Electrocatalysis in Fuel Cells: A Non and Low Platinum Approach", Chapter 22, Springer, March 2013.

Select Journal Articles Published in Peer Reviewed Journals:

C.H. Lee, W.J.M. Kort-Kamp, H. Yu, D.A. Cullen, B.M. Patterson, T.A. Arman, S.K. Babu, R. Mukundan, R.L. Borup, J.S. Spendelow, "Grooved electrodes for high-power-density fuel cells" Nature Energy (2023). <https://www.nature.com/articles/s41560-023-01263-2>

S. Liu, C. Li, M.J. Zachman, Y. Zeng, H. Yu, B. Li, M. Wang, J. Braaten, J. Liu, H.M. Meyer, M. Lucero, A.J. Kropf, E.E. Alp, Q. Gong, Q. Shi, Z. Feng, H. Xu, G. Wang, D.J. Myers, J. Xie, D.A. Cullen, S. Litster, G. Wu, "Atomically dispersed iron sites with a nitrogen-carbon coating as highly active and durable oxygen reduction catalysts for fuel cells Nature Energy 7 (2022) 652–663 <https://www.nature.com/articles/s41560-022-01062-1>

H. Yu, M.J. Zachman, K.S. Reeves, J.H. Park, N.N. Kariuki, L. Hu, R. Mukundan, K.C. Neyerlin, D.J. Myers, and D.A. Cullen "Tracking Nanoparticle Degradation Across Fuel Cell Electrodes by Automated Analytical Electron Microscopy" ACS Nano 16 (2022) 12083–12094. <https://doi.org/10.1021/acsnano.2c02307>

H. Zhang, L. Osmieri, J. Hyung Park, H.T. Chung, D.A. Cullen, K.C. Neyerlin, D.J. Myers, P. Zelenay, "Standardized protocols for evaluating platinum group metal-free oxygen reduction reaction electrocatalysts in polymer electrolyte fuel cells" Nature Catalysis 5, 455–462 (2022). <https://doi.org/10.1038/s41929-022-00778-3>

D.A. Cullen, K. C. Neyerlin, R.K. Ahluwalia, R. Mukundan, K.L. More, R.L. Borup, A.Z. Weber, D.J. Myers & A. Kusoglu, "New roads and challenges for fuel cells in heavy-duty transportation" Nature Energy Review (2021). <https://doi.org/10.1038/s41560-021-00775-z>

X. Xie, C. He, B. Li, Y. He, D.A. Cullen, E.C. Wegener, A.J. Kropf, U. Martinez, Y. Cheng, M.H. Engelhard, M.E. Bowden, M. Song, T. Lemmon, X.S. Li, Z. Nie, J. Liu, D.J. Myers, P. Zelenay, G. Wang, G. Wu, V. Ramani and Y. Shao. "Performance enhancement and degradation mechanism identification of a single-atom Co–N–C catalyst for proton exchange membrane fuel cells" Nature Catalysis 3 (2020) 1044–1054. <https://doi.org/10.1038/s41929-020-00546-1>

R.L. Borup, A. Kusoglu, K.C. Neyerlin, R Mukundan, R.K. Ahluwalia, D.A. Cullen, K.L. More, A.Z. Weber, D.J. Myers, "Recent Developments in Catalyst-Related PEM Fuel Cell Durability" Current Opinion in Electrochemistry 21 (2020) 192-200. <https://doi.org/10.1016/j.coelec.2020.02.007>

L. Jiao, J. Li, L. L. Richard, Q. Sun, T. Stracensky, E. Liu, M. T. Sougrati, Z. Zhao, F. Yang, S. Zhong, H. Xu, S. Mukerjee, Y. Huang, D. A. Cullen, J. H. Park, M. Ferrandon, D. J. Myers, F. Jaouen, and Q. Jia. "Chemical vapour deposition of Fe–N–C oxygen reduction catalysts with full utilization of dense Fe–N₄ sites" Nature Materials 20 (2021) 1385–1391. <https://doi.org/10.1038/s41563-021-01030-2>

H.T. Chung, D. A. Cullen, D. Higgins, B. T. Sneed, E. F. Holby, K. L. More, and P. Zelenay, "Direct Atomic-Level Insight into the Active Sites of a High-Performance PGM free ORR Catalyst," Science. 357 (2017) 479-484. <https://doi/10.1126/science.aan2255>