Dilip Krishnamurthy

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Education

Carnegie Mellon University — Pittsburgh, PA
Doctor of Philosophy (Ph.D.) in Mechanical Engineering [GPA: 4.0/4.0] — Aug 2015 – May 2021 (expected)
Advisor: Professor Venkatasubramanian Viswanthan
Interests: Computational material design for energy storage and conversion devices; Physics-aware machine learning

Indian Institute of Technology Madras — Chennai, India
B.Tech. and M.Tech. in Mechanical Engineering [GPA: 9.35/10.0] — Aug 2010 – Jun 2015
Research advisor: Professor Sankara J. Subramanian
Interests: Inverse design of composite materials through mechanical response characterization using digital image correlation (DIC)

Research Experience

Carnegie Mellon University — Pittsburgh, PA
Ph.D. candidate — Aug 2015 – present
- Implemented machine learning based approaches to predict molecular (solvatochromic) properties of electrolytes for electrochemical ammonia synthesis.
- Developed principles for synergistic design of the electrode-electrolyte assembly for lithium-oxygen batteries.
- Identified the active sites leading to selective electrochemical hydrogen peroxide synthesis using nanowire-templated fuzzy graphene.
- Developed a structure-performance relationship to guide the material synthesis team towards enhanced activity for hydrogen peroxide.
- Developed several approaches for robust prediction of material performance using uncertainty quantification and propagation techniques.
- Mentored multiple students at the undergraduate level and the graduate level.

National Tsing Hua University — Hsinchu, Taiwan
Intern — May 2013 – July 2013
- Artificial neural network modeling to devise a novel method in transformer diagnosis to provide a tool for real-time equipment managers. Presented at the International Asia Conference on Industrial Engineering and Management Innovation, National Taiwan University, Taiwan (2013).

Industry Experience

MRF Tires — Chennai, India
Intern — Jan 2014 – Jan 2015
- Developed a robust methodology for material property (hyperelasticity) characterization of carbon-filled rubbers using the eigenfunction virtual fields method.
- Carried out experiments with multiple relaxation steps for obtaining hyperelastic parameters; captured full-field strain data using 3D Digital Image Correlation (3D-DIC). Designed and optimized a novel specimen to obtain heterogeneous strains using a planar test setup.

Publications

Google Scholar page: Citation Metrics: h-index: 6, i10-index: 3, total citations: 95

Electrocatalysis for Energy Conversion Devices:

D.S. Roman†, **D. Krishnamurthy**†, R. Garg, H. Hafiz, N.T. Nuhfer, V. Viswanathan, and T. Cohen-Karni, "Engineering Three-Dimensional (3D) Out-of-Plane Graphene Edge Sites for Highly-Selective Two-Electron Oxygen Reduction Electrocatalysis." (arXiv link)

D. Krishnamurthy, V. Sumaria, and V. Viswanathan, "Quantifying Robustness of DFT Predicted Pathways and Activity Determining Elementary Steps for Electrochemical Reactions." J. Chem. Phys. 150, 041717 (2019)

G. Houchins†, **D. Krishnamurthy**†, and V. Viswanathan, "The Role of Uncertainty Quantification and Propagation in Accelerating the Discovery of Electrochemical Functional Materials." MRS Bull. 44, 204 (2019)

O. Vinogradova, **D. Krishnamurthy**, V. Pande, and V. Viswanathan, "Quantifying Confidence in Density Functional Theory Predicted Surface Pourbaix Diagrams at Solid-Liquid Interfaces and its Implications for Electrochemical Processes." Langmuir 34, 12259 (2018)

V. Sumaria, **D. Krishnamurthy**, and V. Viswanathan, "Quantifying Confidence in DFT Predicted Surface Pourbaix Diagrams and Associated Reaction Pathways for Chlorine Evolution." ACS Catal. 8, 9024 (2018).

D. Krishnamurthy†, V. Sumaria†, and V. Viswanathan, "Maximal predictability approach for identifying the right descriptors for electrocatalytic reactions." J. Phys. Chem. Lett. 9, 588 (2018).

B. Yan†, **D. Krishnamurthy**†, C. H. Hendon, S. Deshpande, Y. Surendranath, and V. Viswanathan, "Surface Restructuring of Nickel Sulfide Generates Optimally Coordinated Active Sites for Oxygen Reduction Catalysis." Joule 1, 600 (2017).

Material Design for Next-Generation Batteries:

A. Lee†, **D. Krishnamurthy**†, and V. Viswanathan, "Exploring MXenes as Cathodes for Non Aqueous Lithium Oxygen Batteries: Design Rules for Selectively Nucleating Li_2O_2." ChemSusChem 11, 1911 (2018).

A. Khetan, **D. Krishnamurthy**, and V. Viswanathan. "Towards Synergistic Electrode-Electrolyte Design Principles for Nonaqueous Li-O_2 batteries." Top. Curr. Chem 376, 11 (2018).

D. Krishnamurthy, H. A. Hansen, and V. Viswanathan, "Universality in Nonaqueous Alkali Oxygen reduction on Metal Surfaces: Implications for Li-O_2 and Na-O_2 Batteries." ACS Energy Lett. 94, 162 (2016).

Machine Learning Driven Material Design:

D. Krishnamurthy, H. Weiland, A.B. Farimani, E. Anton, J. Green, and V. Viswanathan, "Accelerating Energy Materials Discovery and Optimization through Machine Learning based Approaches." ACS Energy Lett. 4, 187 (2018)
(equally contributing authors†)

Patent

Y-M Chiang, V. Viswanathan, L. Li, V. Pande, **D. Krishnamurthy**, Z. Ahmad, and W. H. Woodford. "Lithium Metal Electrodes and Batteries Thereof." U.S. Patent 20170288281, WO Patent 2017176936, October 5, 2017.
Licensed by 24M Technologies Inc.

Select Awards & Honors

Bradford & Diane Smith Fellowship, awarded to a department-nominated Ph.D. candidate	2018
Kokes Award by the North American Catalysis Society (NACS)	2017
Neil & Jo Bushnell Fellowship, awarded to one department-nominated Ph.D. candidate	2017
Sundback Graduate Fellowship, awarded to one department-nominated Ph.D. candidate	2016
Institute Merit Prizes at IIT Madras for the best academic record in the department	2014 & 2012
Indian Research Internship Program Scholarship, awarded to 23 students in India	2013
Merit Certificate - Indian National Maths Olympiad, awarded to 50 students in India	2010
Rank 16 in the **Regional Math Olympiad Karnataka**	2010

Conference Presentations

D. Krishnamurthy and V. Viswanathan, "Robust Activity and Selectivity Predictions in Electrocatalysis from Density Functional Theory Calculations", North American Catalysis Society Meeting, Chicago, IL (2019).

D. Krishnamurthy and V. Viswanathan, "Generalized Geometric Descriptors for Oxygen Reduction Activity on Transition Metal Sulfides", American Institute of Chemical Engineers (AIChE) Annual Meeting, Pittsburgh, PA (2018).

D. Krishnamurthy, A. Lee, V. Viswanathan, "Exploring the Promise of MXenes as Cathodes for Non-Aqueous Lithium-Oxygen Batteries" (poster), Batteries Conference Gordon Research Conference, Ventura, CA (2018).

D. Krishnamurthy and V. Viswanathan, "Geometric Descriptors for the Oxygen Reduction Activity of Transition-Metal Sulfides" (poster), Materials Research Society Fall Meeting & Exhibit, Boston, MA (2017).

D. Krishnamurthy and V. Viswanathan, "Structure-Activity Descriptors for Transition Metal Sulfides Reactivity for Oxygen Reduction Reaction", International Society of Electrochemistry Annual Meeting, Providence, RI (2017).

D. Krishnamurthy and V. Viswanathan, "Nickel Sulfides as Non-Precious Metal Catalysts for Oxygen Reduction Reaction" (poster), North American Catalysis Society Meeting, Denver, CO (2017).

Teaching Experience

Spring 2018 **Teaching Assistant**, 24-311 Numerical Methods, Carnegie Mellon University
Spring 2017 **Teaching Assistant**, 24-311 Numerical Methods, Carnegie Mellon University