Asghar Aryanfar, PhD

Lab of Energy Materials and Sustainability (*LEMS*)

• Assistant Professor, Mechanical Engineering
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AUB *American University of Beirut*
• Visiting Associate, ChemE/EnvSci
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Citizenships

• United States • Persian

Education

• **PhD** in Mechanical Engineering, Caltech, Pasadena, CA, USA — Sep'09 - Jun'15
Dissertation: Dendrites inhibition in rechargeable lithium metal batteries
Co-Advisors: Michael R. Hoffmann (NAE), William A. Goddard III (NAS)
• **MSc** in Mechanical Engineering, Caltech, Pasadena, CA, USA — Sep'09 - Jun'10
• **BSc** in Mechanical Engineering (***top* 5%**), Sharif U of Tech, Tehran, Iran — Sep'05 - Jun'09
Thesis:Modeling internal hydraulic jump in density currents
• **BSc** in Civil Engineering (***top 2%***), Sharif U of Tech, Tehran, Iran — Sep'04 - Jun'08

Previous Appointments

• Lecturer, Mechanical and Civil Engineering, Bahçeşehir University, Istanbul, Turkey — Sep'16 - Aug'18
✓ *Multi-physics simulation of coupled transport and electrochemical reaction in rechargeable batteries.*
✓ *Start-up (funded) on developing novel save and high-energy batteries (Battergy LLC).*
✓ *Teaching various (under)graduate courses in Mechanical and Civil engineering.*
• Postdoctoral Scholar, Material Sci. & Eng., UCLA, Los Angeles, CA — June'15 - Aug'16
✓ *Performing numerical simulation for developing predictive models for high temperature corrosion of metals.*
• Research Assistant, Caltech, Pasadena, CA — Sep'09 - May'15
✓ *Developing algorithms and numerical simulations for improving life and predicting of failure mechanisms for advanced rechargeable lithium-based batteries.*
✓ *Design, fabrication and integration of innovative battery cells. (patented)*
✓ *Experimental investigations for boosting the reliability and energy density of rechargeable batteries.*
✓ *Design, fabrication and assembly of solar-powered prototype for wastewater treatment system. (1^{st} prize winner, Gates Foundation)*
✓ *Teaching/TA for 4 under/graduate courses.*
• Researcher (HVAC), FARAB hydropower plant Co., Tehran, Iran. — Jun'07 - Sep'07
• Researcher (Design), Azerbaijan Steel rolling Co., Mianeh, Iran. — Jun'06 - Sep'06

Honors

• Internal grant competition award for research advancement. ($\$60K$+$\$40K$) — Nov'17
• Entrepreneurship awards (KOSGEB + BIGG). ($\$100K$) — Nov'17, May'18
• Senior-level engineering job offer from Tesla and Intel — Jun '16
• **American Institute of Physics** interview on extending battery's lifetime : [AIP], [Phys.org], [Chemeurope]. — Oct'15
• **Cover Image**, The Journal of Chemical Physics: [Link] — Oct'15
• **CNN** interview on a novel method for electrochemical treatment of wastewater. [CNN] — May'13
• **SolidWorks** cover design. [SolidWorks] — Jun'13
• 1^{st} Prize: Grant Challenge, *Gates Foundation* ,[Science], [CNN], [Reuters] — Aug'12
• PhD Fellowship, California Institute of Technology — Sep'09

- **Top 2%**, Undergraduate class, Sharif U of Tech, Tehran, Iran — Sep'04 - Jun'09
- **6/15000+**, National Civil Engineering Olympiad, Iran — Jul'08
- **1/500000+**, National non-profit college entrance exam — Jun'04

Journals

1. **Asghar Aryanfar**, Dimitri M. Saad, William A. Goddard III: *A Novel Method for Estimating the Charge Equilibrium within the Dendrites of Rechargeable Batteries* , ***Computational Materials Science***, 187, 110059 **2021**

2. **Asghar Aryanfar**, Sajed Medlej, William A. Goddard III: *Morphometry of Dendritic Materials in Rechargeable Batteries*, ***J Power Sources***, 481, 228914 **2021**

3. **Asghar Aryanfar**, Irem Sanal, Jaime Marian: *Novel Percolation-based Measure for Fibre Efficacy in fiber-reincored concrete Beams*, ***Structural Concrete*** **2020**

4. **Asghar Aryanfar**, M Hoffmann, W Goddard III : *Finite pulse waves for efficient suppression of evolving mesoscale dendrites in rechargeable batteries*, ***Physical Review E***, 100, 042801 **2019**

5. **Asghar Aryanfar**, William A. Goddard III, Jaime Marian: *Constriction Percolation Model for Coupled Diffusion-Reaction Corrosion of Zr in PWR*, ***Corrosion Science***, 158, 108058 **2019**

6. M. Reyes. **Asghar Aryanfar**, S. W. Baek, J. Marian: *Multilayer interface tracking model of zirconium clad oxidation*, ***J Nuclear Materials***, 509, 550-565. **2018**

7. **Asghar Aryanfar**, D.J. Brooks, W. A. Goddard III: *Theoretical pulse charge for optimal inhibition of growing dendrites*, ***MRS Advance***s, 1, 1-7 **2018**

8. C. Xu, Z. Ahmad, **Asghar Aryanfar**, V. Viswanathan, J. R. Greer: *Enhanced strength and temperature dependence of mechanical properties of Li at small scales and its implications for Li metal anodes*, ***PNAS***, 114 (1), 57 **2017**

9. **Asghar Aryanfar**, J. Thomas, A. Van der Ven, D. Xu, M. Youssef, J. Yang, B. Yildiz, J. Marian: *Integrated computational modeling of water-side corrosion in zirconium metal clad under nominal LWR operating conditions*, ***J Metals Minerals & Materials***, 47, 1543-1851. **2016**

10. L. M. Kasmaee, **Asghar Aryanfar**, Z. Chikneyan, M.R. Hoffmann, A. J. Colussi: *Improving solid-electrolyte interfaces via underpoetential solvent electropolymerization*, ***Chemical Physics Letters***, 661, 65. **2016**

11. **Asghar Aryanfar**, T. Cheng, , A. J. Colussi, B. V. Merinov, W. A. Goddard, M. R. Hoffmann: *Annealing kinetics of electrodeposited lithium dendrites*, ***J Chemical Physics***, 143, 134701. **2015**

12. **Asghar Aryanfar**, D. J. Brooks, B. V. Merinov, A. J. Colussi, W. A. Goddard, M. R. Hoffmann: *Thermal relaxation of lithium dendrites*, ***Physical Chemistry Chemical Physics***, 17, 8000 **2015**

13. **Asghar Aryanfar**, D. J. Brooks, B.V. Merinov, W. A. Goddard III, A. J. Colussi, M. R. Hoffmann: Dynamics of lithium dendrite growth and inhibition: pulse charging experiments and monte carlo calculations, ***J Physical Chemistry Letters***, 5(10), 1721 **2014**

14. **Asghar Aryanfar**, D. J. Brooks, A. J. Colussi, M. R. Hoffmann: *Quantifying the Dependence of Dead Lithium Crystals on Cycling Period in Lithium Metal Batteries*, ***Physical Chemistry Chemical Physics*** , 16, 24965 **2014**

15. K. Cho, Y Qu, D. Kwon, H. Zhang, C. Cid, **Asghar Aryanfar**, M. R. Hoffmann: *Effects of anodic potential and chloride ion on overall reactivity in semiconductor electrochemical reactors designed for solar-powered wastewater treatment*, ***Environmental Science & Technology***, 48(4), 2377 **2014**

Conference Papers

1. **A. Aryanfar**, et al: *Bulk properties of amorphous lithium dendrites*, ECS Transactions 80 (10), 365-370 **2017**
2. **A. Aryanfar**, et al: *Lithium dendrite inhibition on post-charge anode surface: The kinetics role*, MRS proceedings, V 1774, **2015**
3. **A. Aryanfar**, et al: *Lithium dendrite growth control using local temperature variation*, MRS Proceedings, V 1680. **2014**

Book Chapter

A.Aryanfar, et al: *Electropolymerization: Fundamental and Applications/ Electrodes and Double Layers*, ***Advances in Material Science and Engineering***, Vol 39, Nova Publishers, ISBN: 978-1-53616-176-2. **2019**

Patents

• **Asghar Aryanfar**: *Method and device for dendrite research and discovery in batteries*, US Patent App, 14/201, 979. **2017**
• MR Hoffmann, **Asghar Aryanfar**, C Cid, K Cho, D J Kwon, Y Qu:*Self-contained PV-powered Toilet and Domestic Wastewater Disinfection System*, US Pat App, 14/048, 163. **2014**

Invited Talks

- American University of Beirut May'19
- EPFL, Lausanne, Switzerland May'16
- ECS, National Harbor, MD Oct'17
- ECS, Chicago, IL May '15
- MIT, Cambridge, MA Dec'14
- MRS, San Francisco, CA Apr '14
- ICAPP 2016, San Francisco, CA May'16
- MIT, Cambridge, MA Jul'15
- MRS, San Francisco, CA Apr'15
- ECS, Orlando, FL May'14
- Sharif U of Tech, Tehran, Iran Mar'14
- ECS, Honolulu, HI Oct'12

Reviewer Activities

- Physical Review E
- J Materials Chem A
- ECS Electrochemistry Letters
- Chemical Reviews
- J Electrochemical Society
- Chemical Society Reviews
- J Fluid Mechanics

Teaching Experience

- Mechanical Engineering Design S'17, S'18, S'20
- Finite Element Methods F'18
- Transport Phenomena F'17
- Mech of Materials F'16, F'17, F'20
- Statics and Dynamics F'11, F'20
- Structural Loading F'06
- Thermodynamics F'16, S'18
- Vehicle Aerodynamics F'18
- Fluid Mech & heat transfer S'17, S'18
- Mechanics of Materials F'10
- Hydraulics F'07
- Tutoring Science/Engineering '04-'15

Poster Presentation

- Featured research, Caltech Board of Trustees, Pasadena , CA — Jan '12
- International Energy Storage Conference (IPS-19), Pasadena, CA — Jul'12
- Reinvent the Toilet fair, Gates Foundation, Seattle, WA — Aug'12

Skills

Python, Matlab, SolidWorks (design and simulation), AutoCAD, Photoshop, LaTeX

Memberships

ECS, ASME, ASCE, Caltech Alumni Association

Languages

Azerbajani (native) Persian English Turkish

References

1. Prof. Michael R. Hoffmann (NAE)
Professor of Environmental Sciences
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2. Prof. William A. Goddard (NAS)
Professor of Chemistry and Mat Sci
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3. Dr. Agustin J. Colussi
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4. Dr. Boris Merinov
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5. Prof. Jaime Marian
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