Asghar Aryanfar, PhD

Lab of Energy Materials and Sustainability (***LEMS***)

- Assistant Professor, Mechanical Engineering
404 Masri Institute, x4976 [map]
AUB *American University of Beirut*
- Visiting Associate, ChemE/EnvSci
California Institute of Technology [map]

Phone: 626-344-9750
Skype: asghararyanfar
Email: aryanfar@caltech.edu
Web: aaryanfar.github.io
Profile: Google Scholar

Citizenships

• United States • Iran

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, I. Sanal, J. Marian: *Percolation-Based Image Processing for the Plastic Viscosity of Cementitious Mortar with Super Absorbent Polymer,* **Int J Concrete Structures and Materials, accepted** **2021**

2. Asghar Aryanfar, Y. Ghamlouche, W. A. Goddard III: *Real-time Control of Dendritic Propagation in Rechargeable Batteries using Adaptive Pulse Relaxation*, **J Chemical Physics, accepted** **2021**

3. Asghar Aryanfar, S. Medlej, A. Tarhini, A. Tehrani : *Elliptic Percolation Model for Predicting the Electrical Conductivity of Graphene-Polymer Composites,* ***Soft Matter***, 17, 2081 **2021**

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

5. Asghar Aryanfar, S. Medlej, W. A. Goddard III: *Morphometry of dendritic materials in Rechargeable Batteries*, ***J Power Sources***, 481, 228914 **2021**

6. Asghar Aryanfar, Y. Ghamlouche, W. A. Goddard III: Pulse-Reverse Protocol for Efficient Suppression of Dendritic Micro-structures in Rechargeable Batteries, ***Electrochimica Acta***, 367, 137469 **2021**

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

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

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

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

11. 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**

12. 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**

13. 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**

14. 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**

15. 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**

16. 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**

17. 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**

18. 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**

19. 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: *Image Processing for Workability of Concrete with Super Absorbent Polymer,* Int Conf in Intelligent Decision Science, Springer, Cham, 681-685. **2020**

2. **A. Aryanfar**, et al: *Bulk properties of amorphous lithium dendrites*, ECS Transactions 80 (10), 365-370. **2017**

3. **A. Aryanfar**, et al: *Lithium dendrite inhibition on post-charge anode surface: The kinetics role*, MRS proceedings, V 1774. **2015**

4. **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

- MRS Conference, Spring 2021 Apr'21
- American University of Beirut May'19
- Tesla Corporation, Palo Alto, CA Apr'16
- 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
- ECS Conference, Spring 2021 May'21
- 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 Eng. Design	Sp'17, Sp'18, Sp'20,'21	• Thermodynamics	Fa'16, Sp'18
• Finite Element Methods	Fa'18	• Vehicle Aerodynamics	Fa'18
• Transport Phenomena	Fa'17	• Fluid Mech & heat transfer	Sp'17, Sp'18
• Mech of Materials	Fa'16, Fa'17, Fa'20	• Mechanics of Materials	Fa'10
• Statics and Dynamics	Fa'11, Fa'20	• Hydraulics	Fa'07
• Structural Loading	Fa'06	• 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
204 Linde-Robinson Lab, Caltech
mrh@caltech.edu
626-395-4391

2. Prof. William A. Goddard (NAS)
Professor of Chemistry and Mat Sci
321 Beckman Institute, Caltech
wag@wag.caltech.edu
626-395-3093

3. Prof. Jaime Marian
Associate Professor
2121F, Mat Sci and Eng, UCLA
jmarian@ucla.edu
310-206-9161

4. Dr. Boris Merinov
Director of Energy Conversion and Storage
315A Beckman Institute, Caltech
merinov@wag.caltech.edu
626-395-4442

5. Dr. Agustin J. Colussi
Senior Scientist, Environmental Science
G26A, Linde-Robinson Lab, Caltech
ajcoluss@caltech.edu
626-395-6350

updated: May 6, 2021