

# Christopher G. Arges, Ph.D.

1130 S. Michigan Ave. Apt. 1107, Chicago, IL 60605 | carges@uchicago.edu | 312-806-3061 | U.S. Citizen | www.chrisarges.com

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## PROFESSIONAL EXPERIENCE

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**Louisiana State University – Cain Department of Chemical Engineering** Baton Rouge, LA  
*Gordon A. and Mary Cain Professorship #1 – Assistant Professor* Planned start date: Jan 2016

**University of Chicago – Institute for Molecular Engineering** Chicago, IL  
**Argonne National Laboratory – Materials Science Division** Lemont, IL  
*Postdoctoral Scholar (UChicago)* Oct 2013 – Present  
*Postdoctoral Research Associate (Argonne)* Jul 2014 – Present  
Project: Directed self-assembly of block copolymer electrolytes for energy conversion and storage  
Adviser: Professor Paul Nealey

**HGST: A Western Digital Company** San Jose, CA  
*Visiting Scientist* Summer 2014  
Project: Solvent annealing of block copolymers to create ordered nanostructures & investigation of underlying chemical patterns for the directed self-assembly of block copolymers

**Membrane Solutions** Chicago, IL  
*Co-founder/Chief Technology Officer* Apr 2014– Nov 2014  
Start-up focused on custom-made ion-exchange/polymer electrolyte membranes  
Selected for NSF iCorps program for Energy & Transportation in Detroit, MI

**Baxter International, Inc.** Round Lake, IL  
*Research Associate II* Jul 2007 – Aug 2009  
Project: Product development of combinatorial drug delivery-medical devices. Continuum-based mathematical modeling of drug solution interactions with medical plastics

**Hospira, Inc.** Clayton, NC  
*Associate Scientist (promoted from Assistant Scientist)* Jun 2005 – Jun 2007  
Project: R&D lead for transfer of 80 drug product codes from one manufacturing plant to another; initiated process analytical technology (PAT) program for in-line monitoring of chemical processes

## EDUCATION

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**Illinois Institute of Technology** Chicago, IL  
*Doctoral of Philosophy in Chemical Engineering* Aug 2009 – Sep 2013  
Dissertation: Structure-property relationships in anion exchange membranes for electrochemical energy conversion and storage  
Adviser: Professor Vijay Ramani

**North Carolina State University** Raleigh, NC  
*Master of Science in Chemical Engineering (non-thesis)* May 2006 – Dec 2008

**University of Illinois** Urbana-Champaign, IL  
*Bachelor of Science in Chemical Engineering* Aug 2001 – May 2005  
Thesis: Steady-state and time-resolved fluorescence for studying electron energy transfer mechanisms in organic dendrimers and DNA  
Adviser: Professor Christopher J. Bardeen (now at University of California Riverside)

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**PUBLICATIONS – h-index: 11 | over 350 citations – Google Scholar**

## Peer-reviewed articles:

1. C.G. Arges\*, L. Wang\*, and V. Ramani, Mechanically stable poly(aryl ether) anion exchange membranes from commercially available polymers for alkaline fuel cells, *J. Electrochem. Soc.*, **2015**, *162*, F1, \*contributed to article equally
2. L. Weng, H.L. Xie, C.G. Arges, J. Tang, G.Q. Zhong, H.L. Zhang, and E.Q. Chen, Combined main-chain/ side-chain ionic liquid crystalline polymer based on “jacketing” effect: design, synthesis, supra-molecular self-assembly and photophysical properties, *eXPRESS Poly. Lett.*, **2015**, *9*, 536.
3. C.G. Arges, Lihui Wang, and V. Ramani, Simple and facile synthesis of water-soluble poly(phosphazanium) polymer electrolytes, *RSC Adv.*, **2014**, *4*, 61869.
4. C.G. Arges, V. Prabhakaran, L. Wang, and V. Ramani, Bipolar polymer electrolyte interfaces for hydrogen-oxygen and direct borohydride fuel cells, *Int. J. Hydrogen Energy*, **2014**, *39*, 14312, \*contributed to article equally.
5. J. Parrondo, C.G. Arges, M. Niedzwiecki, E.B. Anderson, K.E. Ayers, and V. Ramani, Degradation of anion exchange membranes used for hydrogen production by ultrapure water electrolysis, *RSC Adv.*, **2014**, *4*, 9875.
6. V. Prabhakaran, C.G. Arges, and V. Ramani, In-situ fluorescence spectroscopy correlates polymer electrolyte degradation to reactive oxygen species generation in an operating fuel cell, *Phys. Chem. Chem. Phys.*, **2013**, *15*, 18965.
7. C.G. Arges, L. Wang, J. Parrondo, and V. Ramani, Best practices for investigating anion exchange membrane suitability for alkaline electrochemical devices - Case study using quaternary ammonium poly (2,6-dimethyl 1,4-phenylene)oxide anion exchange membranes, *J. Electrochem. Soc.*, **2013**, *160*, F1258.
8. M.-S. Jung, J. Parrondo, C. G. Arges, and V. Ramani, Polysulfone-based anion exchange membranes demonstrate excellent chemical stability and performance for the all-vanadium redox flow battery, *J. Mater. Chem. A.*, **2013**, *1*, 10458.
9. C.G. Arges and V. Ramani, Investigation of cation degradation in anion exchange membranes using multi-dimensional NMR spectroscopy, *J. Electrochem. Soc.*, **2013**, *160*, F1006.
10. C.G. Arges and V. Ramani, Two-dimensional NMR spectroscopy reveals cation-triggered backbone degradation in polysulfone-based anion exchange membranes, *Proc. Natl. Acad. Sci. U. S. A.*, **2013**, *110*, 2490.
11. C.G. Arges, J. Parrondo, G. Johnson, A.E. Nadhan, and V. Ramani, Assessing the influence of different cation chemistries on ionic conductivity and alkaline stability of anion exchange membranes, *J. Mater. Chem.*, **2012**, *22*, 3733.
12. V. Prabhakaran, C.G. Arges, and V. Ramani, Investigation of polymer electrolyte membrane chemical degradation and degradation mitigation using in situ fluorescence spectroscopy, *Proc. Natl. Acad. Sci. U. S. A.*, **2012**, *109*, 1029.
13. M.-S. Jung, C.G. Arges, and V. Ramani, A perfluorinated anion exchange membrane with a 1, 4-dimethylpiperazinium cation, *J. Mater. Chem.*, **2011**, *21*, 6158.
14. S.V. Aathimanikandan, B.S. Sandanaraj, C.G. Arges, C.J. Bardeen, and S. Thayumanavan, Effect of guest molecule flexibility in access to dendritic interiors, *Organic Letters*, **2005**, *7*, 2809.
15. K. Sivanandan, S.V. Aathimanikandan, C.G. Arges, C.J. Bardeen, and S. Thayumanavan, Probing every layer in dendrons, *J. Amer. Chem. Soc.*, **2005**, *127*, 2020.

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## PUBLICATIONS (continued)

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### *Refereed educational articles:*

1. C.G. Arges, V. Ramani, and P. Pintauro, Anion exchange membrane fuel cells, *The Electrochemical Society Interface*, **2010**, 19, 31

### *Papers in revision, review, or preparation (continued)*

1. C.G. Arges and V. Ramani, Degradation phenomena of anion exchange polymer electrolyte membranes for electrochemical energy conversion and storage, (perspective - in preparation)
2. C.G. Arges, Y. Kambe, and P.F. Nealey, Engineered anion conducting highways in block copolymer electrolyte films through self-assembly or directed self-assembly, (in preparation)

### *Transactions Papers/Conference Proceedings:*

1. C.G. Arges and V. Ramani, Best practices for examining anion exchange membrane alkaline stability for solid-state alkaline fuel cells, *ECS Trans.*, **2013**, 58, 1551.
2. C.G. Arges and V. Ramani, Alkaline stability and ion conductivity of polysulfone anion exchange membranes (AEMs) with different cation chemistries, *ECS Trans.*, **2012**, 50, 2183.
3. V. Prabhakaran, C.G. Arges, and V. Ramani, Investigation of PEM degradation kinetics and degradation mitigation using in-situ fluorescence spectroscopy and real-time monitoring of fluoride-ion release, *ECS Trans.*, **2012**, 50, 935.
4. C.G. Arges, M.-S. Jung, G. Johnson, J. Parrondo, and V. Ramani, Anion exchange membranes (AEMs) with perfluorinated and polysulfone backbones with different cation chemistries, *ECS Trans.*, **2011**, 41, 1795.
5. V. Prabhakaran, C.G. Arges, and V. Ramani, An in-situ probe for investigating PEM degradation kinetics and degradation mitigation, *ECS Trans.*, **2011**, 41, 1347.
6. V. Prabhakaran, C.G. Arges, and V. Ramani, Investigation of molecular probes sensitivity to the Fenton reaction using fluorescence spectroscopy, *ECS Trans.*, **2010**, 33, 889.
7. C.G. Arges, S. Kulkarni, A. Baranek, K. Pan, M.J. Jung, D. Patton, K.A. Mauritz, and V. Ramani, Quaternary ammonium and phosphonium based anion exchange membranes for alkaline fuel cells, *ECS Trans.*, **2010**, 33, 1903.

## PATENTS

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1. C.G. Arges, J. Parrondo, V. Ramani, "Reversible alkaline membrane hydrogen fuel cell-water electrolyzer" non-provisional U.S. patent, Application # 14/289,789, Illinois Institute of Technology, May 2014

## HONORS AND AWARDS

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- IE&EE Division Student Achievement Award – Electrochemical Society (ECS) *May 2013*
- Best student award at Gordon Research Conference (Fuel Cells) *Aug 2012*
- Student travel grant for the 220<sup>th</sup> Electrochemical Society Meeting *Oct 2011*
- 1st place in student poster competition for IIT Ralph Peck Lectureship *May 2011*
- Dean's Fellowship – Illinois Institute of Technology (IIT) *Aug 2009*
- Electrochemical Society Meeting Travel Grants – 220<sup>th</sup> and 224<sup>th</sup> Meetings *Oct 2011 & 2013*

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## CONFERENCE PRESENTATIONS & INVITED TALKS

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### *Invited talks:*

1. C.G. Arges, S. Yun, M.-s. J. Jung, L. Wang, J. Parrondo, and V.K. Ramani, Anion Exchange and Bipolar Membranes for Electrochemical Energy Conversion and Storage: Conduction and Degradation Phenomena, *Advances in Polymers for Fuel Cells and Energy Devices (ACS Polymer Chemistry Division) – Asilomar Conference Grounds, February 2015.*
2. C.G. Arges, Chemical structure relationships for improved alkaline stability and ionic conductivity of anion exchange polymer electrolyte membranes, *National Renewable Energy Laboratory (NREL), April 2013.*
3. C.G. Arges, Multi-dimensional NMR probes alkaline degradation mechanisms of anion exchange polymer electrolyte membranes, *Los Alamos National Laboratory (LANL), February 2013.*
4. C.G. Arges and V. Ramani, Electrochemical properties and degradation of polysulfone anion exchange membranes for use in solid alkaline fuel cells, *Best of the posters at Gordon Research Conference – Fuel Cells, August 2012.*

### *Selected contributed talks (as presenting author only):*

5. C.G. Arges, L. Wang, J. Parrondo, and V. Ramani. Best practices for examining anion exchange membrane alkaline stability for solid-state alkaline fuel cells, *224<sup>th</sup> ECS Meeting, 2013.*
6. C.G. Arges, J. Parrondo, and V. Ramani. Anion exchange polymer electrolyte membranes for alkaline fuel cells and water electrolyzers, *223<sup>rd</sup> ECS Meeting, 2013.*
7. C.G. Arges, G. Johnson, and V. Ramani, Stable anion exchange and bipolar membranes for direct borohydride fuel cells for unmanned underwater vehicles, *Fuel Cell Seminar, 2012.*
8. C.G. Arges and V. Ramani, Alkaline stability and ion conductivity of polysulfone anion exchange membranes (AEMs) with different cation chemistries, *222<sup>nd</sup> ECS Meeting, 2012.*
9. C.G. Arges, M.-S. Jung, G. Johnson, J. Parrondo, and V. Ramani, Anion exchange membranes (AEMs) with perfluorinated and polysulfone backbones with different cation chemistries, *220<sup>nd</sup> ECS Meeting, 2011.*
10. C.G. Arges, S. Kulkarni, A. Baranek, K. Pan, M.J. Jung, D. Patton, K.A. Mauritz, and V. Ramani, Quaternary ammonium and phosphonium based anion exchange membranes for alkaline fuel cells, *218<sup>th</sup> ECS Meeting, 2010.*

## OTHER PROFESSIONAL SERVICE AND EXPERIENCE

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### *Postdoctoral Scholar at University of Chicago*

- Institute for Molecular Engineering safety committee chair
- Mentoring one Ph.D. student
- Institute for Molecular Engineering student ambassador during graduate recruitment (2014 & 2015)

### *Graduate Research Assistant at Illinois Institute of Technology*

- Safety point of contact– performed safety trainings and maintained lab safety compliance
- Responsible for ordering chemicals and equipment and maintaining chemical inventory
- Supervised two master students, four undergraduates, and one high school student

### *Teaching Assistant at Illinois Institute of Technology – iPro 321*

- Interdisciplinary product design course
- Supervised laboratory operations, lectured classes, and graded reports

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## OTHER PROFESSIONAL SERVICE AND EXPERIENCE (cont'd)

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### *Journal Reviewer*

- Journal of Membrane Science (n=1)
- ECS Journal of Solid State Science and Technology (n=1)
- Polymer Chemistry (n=1)
- Journal of Materials Chemistry A (n=1)
- Journal of Materials Chemistry C (n=1)
- Journal of the Electrochemical Society (n=6)
- ChemElectroChem (n=3)
- ChemSusChem (n=2)
- Journal of Power Sources (n=1)

### *Chair for technical sessions*

- Polymer Electrolyte Membranes Session for 227<sup>th</sup> Electrochemical Society Meeting, **2015**
- Discussion Leader for 2014 Gordon Research Seminar for Fuel Cells, **2014**
- Electrolysis & Alkaline Fuel Cell Materials for the 222<sup>nd</sup> Electrochemical Society Meeting, **2012**

## GRANTS

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### *Grants*

1. Assisted in preparation of ONR DURIP proposal, Title: Acquisition of Instrumentation for Thermal, Optical and Electrochemical Characterization of Multifunctional Materials for Electrochemical Energy Conversion and Storage, \$ 421,904 for 1 year (July 2012-July 2013). PI: Vijay Ramani
2. Assisted in preparation of ONR Young Investigator Program proposal, Title: Anion Exchange and Bipolar Membranes for Electrochemical Energy Conversion, \$ 510,000 for 3 years (May 2010 – April 2013). PI: Vijay Ramani

## USER PROPOSALS

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### *User proposals*

1. Center for Nanoscale Materials at Argonne National Laboratory, CNM User Proposal # 37900, Title: Directed self-assembly of supramolecular chemistries, ion-containing block copolymers, and liquid crystals in films and characterization of their 3D structures, January 2014 to January 2015

## PROFESSIONAL AFFILIATIONS

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- Member of the American Chemical Society
- Member of the American Institute of Chemical Engineers
- Member of the Electrochemical Society

## COMMUNITY INVOLVEMENT

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### *Working in the Schools Tutor (WITS, Non-Profit)*

- Tutored elementary school children in reading and math every other Saturday throughout the academic year

## PERSONAL HOBBIES

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- Athletics – two-time marathoner and several half-marathons, boxing, and rugby
- Spending time with family and reading