

# Andrew J. Medford

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## Education

### Stanford University : *Doctor of Philosophy* : Expected Spring 2015

- Chemical Engineering

### Stanford University : *Master of Science* : Sept. 2014

- Chemical Engineering

### Technical University of Denmark : *Open University* : Sept. 2009 - May 2010

- Courses in Chemical Engineering and Physics

### North Carolina State University : *Bachelor of Science* : May 2009

- Major: Textile Engineering
- Minor: Graphic Communications

## Research Experience

### Theoretical investigation of activity and selectivity trends in syngas catalysis

Prof. Jens Nørskov - *Stanford University*

Stanford, California - January 2011 - Present

- Use first-principles calculations to investigate kinetic trends in ethanol production on transition-metal catalysts.
- Develop software for automated solution of descriptor-based microkinetic models.

### Microkinetic analysis of methanol synthesis on ZnO surfaces

Prof. Ib Chorkendorff - *Technical University of Denmark*

Dr. Poul Georg Moses - *Haldor Topsøe A/S*

Copenhagen, Denmark - June 2012 - Jan 2013

- Computed the energetics of methanol synthesis intermediates on ZnO surfaces
- Constructed and solved mean-field microkinetic model of methanol synthesis on ZnO(0001)

### Optimization of roll-to-roll processed organic photovoltaics

Dr. Frederik Krebs - *Risø National Laboratory for Sustainable Energy*

Roskilde, Denmark - August 2009 - July 2010

- Studied effects of post-treatments on the efficiency of organic solar cells processed using high-throughput production.
- Developed solution-processible aluminum-doped zinc oxide electron conduction layer for organic solar cells.

### Synthesis and electrospinning of poly(alkyl-thiophenes)

Dr. Adisorn Tuantranont - *National Electronics and Computer Technology Center*

Pathum Thani, Thailand - June 2009 - August 2009

- Implemented electrospinning setup and began optimizing parameters to produce polymeric sensing devices.

### Catalytic activity of platinum-iridium alloys for oxygen reduction and evolution reactions

Dr. Thomas Jaramillo - *Stanford University*

Stanford, California - June 2008 - Aug. 2008

- Studied catalytic activity of nanoparticulate and thin film platinum-iridium alloys using cyclic voltammetry.

### **Fabrication and characterization of porous carbon nanofiber electrodes**

Dr. Xiangwu Zhang - North Carolina State University  
Raleigh, North Carolina - Oct. 2007 - May 2009

- Fabricated porous carbon nanofibers using electrospun precursor fibers for application as lithium ion battery anodes.
- Characterized materials using electron microscopy, Raman spectroscopy, and a variety of analytical techniques.

## **Teaching Experience**

### **Final Project Leader (SUNCAT Summer Institute)**

Jens Nørskov - *Stanford University*  
Summer 2013

- Created final project for week long summer school.
- Delivered lecture and instruction to 120 students.

### **Teaching Assistant (Basic Principles of Heterogeneous Catalysis)**

Jens Nørskov - *Stanford University*  
Fall 2011, Fall 2012

- Assisted in creation and grading of homeworks and exams.
- Held weekly office hours and managed course website.

### **Teaching Assistant (Introduction to Textiles)**

Philip Dail - *North Carolina State University*  
Fall 2007, Fall 2008

- Graded assignments and enforced class policies.

### **Campus Tutor (Chemistry, Physics, Calculus)**

Philip Dail - *North Carolina State University*  
Oct. 2005 - Jan. 2006

- Helped students grasp concepts of core courses in science and engineering

## **Awards and Honors**

- Outstanding Teaching Assistant Award (June 2012)
- National Defense Science and Engineering Graduate Research Fellow (September 2012 - Present)
- National Science Foundation Graduate Research Fellowship (August 2010 - September 2012 )
- National Science Foundation Nordic Research Opportunity (July 2012 - September 2012)
- Department of Energy Computational Science Graduate Research Fellowship (2012 - Could not Accept)
- J. William Fulbright Fellowship - Risø National Labs, Denmark (August 2009 - June 2010)
- North Carolina State University Valedictorian (May 2009)
- College of Textiles Academic Achievement Award (May 2009)
- NSF REU Grant - FREEDM Systems Center - NCSU (Jan - May 2009)
- NSF REU Grant - CPIMA - Stanford University (June - Aug. 2008)
- NCSU Energy Related Undergraduate Research Grant (Oct. 2007 - May 2008)
- North Carolina Textile Foundation Scholarship (Aug. 2005 - May 2009)
- Robert C. Byrd Scholarship (Aug. 2005 - May 2009)

## Publications

□ Total Publications: 24

□ Total Citations: 803 by 632 documents

□ H-Index: 14

(via Scopus, November 21, 2014)

1. "Assessing the reliability of calculated catalytic ammonia synthesis rates"  
A. J. Medford, J. Wellendorff, A. Vojvodic, F. Studt, F. Abild-Pedersen, K. W. Jacobsen, T. Bligaard, J. K. Nørskov  
*Science* 345 (2014) pp. 197-200
2. "Departures from the adsorption energy scaling relations for metal carbide catalysts"  
R. Michalsky, Y. Zhang, A. J. Medford, A. A. Peterson  
*Journal of Physical Chemistry C* 118 (2014) pp. 13026-13034
3. "Exploring the limits: A low-pressure, low-temperature Haber-Bosch process"  
A. Vojvodic, A. J. Medford, F. Studt, F. Abild-Pedersen, T. S. Khan, T. Bligaard, J. K. Nørskov  
*Chemical Physics Letters* 598 (2014) pp. 108-112
4. "High pressure CO hydrogenation over bimetallic Pt-Co catalysts"  
J. M. Christensen, A. J. Medford, F. Studt, A. D. Jensen  
*Catalysis Letters* 144 (2014) pp. 777-782
5. "Methanol-to-hydrocarbons conversion: The alkene methylation pathway"  
R. Y. Brogaard, H. R. Schuurman, A. J. Medford, P. G. Moses, P. Beato, S. Svelle, J. K. Nørskov, U. Olsbye  
*Journal of Catalysis* 314 (2014) pp. 159-169
6. "Activity and selectivity trends in synthesis gas conversion to higher alcohols"  
A. J. Medford, A. C. Lausche, F. Abild-Pedersen, B. Temel, N. C. Schjødt, J. K. Nørskov, F. Studt  
*Topics in Catalysis* 57 (2014) pp. 135-142
7. "Thermochemistry and micro-kinetic analysis of methanol synthesis on ZnO(0001)"  
A. J. Medford, J. Sehested, J. Rossmeisl, I. Chorkendorff, F. Studt, J. K. Nørskov, P. G. Moses  
*Journal of Catalysis* 309 (2014) pp. 397-407
8. "On the effect of coverage-dependent adsorbate-adsorbate interactions for CO methanation on transition metal surfaces"  
A. C. Lausche, A. J. Medford, T. S. Khan, Y. Xu, T. Bligaard, F. Abild-Pedersen, J. K. Nørskov, F. Studt  
*Journal of Catalysis* 307 (2013) pp. 275-282
9. "Finite-size effects in O and CO adsorption for the late transition metals"  
A. A. Peterson, L. C. Grabow, T. P. Brennan, B. Shong, C. Ooi, D. M. Wu, C. W. Li, A. Kushwaha, A. J. Medford, F. Mbuga, L. Li, J. K. Nørskov  
*Topics in Catalysis* 55 (2012) pp. 1276-1282
10. "Elementary steps of syngas reactions on Mo<sub>2</sub>C(001): Adsorption thermochemistry and bond dissociation"  
A. J. Medford, A. Vojvodic, F. Studt, F. Abild-Pedersen, J. K. Nørskov  
*Journal of Catalysis* 290 (2012) pp. 108-117
11. "Electrocatalytic interaction of nano-engineered palladium on carbon nanofibers with hydrogen peroxide and  $\beta$ -NADH"  
Z. Lin, L. Ji, A. J. Medford, Q. Shi, W. E. Krause, X. Zhang  
*Journal of Solid State Electrochemistry* 15 (2011) pp. 1287-1294
12. "An inter-laboratory stability study of roll-to-roll coated flexible polymer solar modules"  
S. A. Gevorgyan, A. J. Medford, E. Bundgaard, F. C. Krebs *et. al.*  
*Solar Energy Materials and Solar Cells* 95 (2011) pp. 1398-1416

13. "Ultra-fast and parsimonious materials screening for polymer solar cells using differentially pumped slot-die coating"  
J. Alstrup, M. Jørgensen, A. J. Medford, F. C. Krebs  
*ACS Applied Materials and Interfaces* 2 (2011) pp. 2819-2827
14. "The effect of post-processing treatments on inflection points in current-voltage curves of roll-to-roll processed polymer photovoltaics"  
M. R. Lilliedal, A. J. Medford, M. V. Madsen, K. Norrman and F. C. Krebs  
*Solar Energy Materials and Solar Cells* 94 (2011) pp. 2018-2031
15. "Grid-connected polymer solar panels: initial considerations of cost, lifetime, and practicality"  
A. J. Medford, M. R. Lilliedal, M. Jørgensen, D. Aarø, H. Pakalski, J. Fyenbo, and F. C. Krebs  
*Energy Express* 18 (2010) pp. A272-A285
16. "Assembly of carbon-SnO<sub>2</sub> core-sheath composite nanofibers for superior lithium storage"  
L. Ji, Z. Lin, B. Guo, A. J. Medford, X. Zhang  
*Chemistry-A European Journal* 16 (2010) pp. 11543-11548
17. "Formation and electrochemical performance of copper/carbon composite nanofibers"  
L. Ji, Z. Lin, R. Zhou, Q. Shi, O. Toprakci, A. J. Medford, C. R. Millns, and X. Zhang  
*Electrochimica Acta* 55 (2010) pp. 1605-1611
18. "Fabrication of carbon nanofiber-driven electrodes from electrospun polyacrylonitrile/polypyrrole bicomponents for high-performance rechargeable lithium-ion batteries"  
L. Ji, Y. F. Yao, O. Toprakci, Z. Lin, Y. Z. Liang, Q. Shi, A. J. Medford, C. R. Millns, and X. Zhang  
*Journal of Power Sources* 195 (2010) pp. 2050-2056
19. "In-situ encapsulation of nickel particles in electrospun carbon nanofibers and the resultant electrochemical performance"  
L. Ji, Z. Lin, A. J. Medford, and X. Zhang  
*Chemistry-A European Journal* 15 (2009) pp. 10718-10722
20. "Porous carbon nanofibers from electrospun polyacrylonitrile/SiO<sub>2</sub> composites as an energy storage material"  
L. Ji, Z. Lin, A. J. Medford, and X. Zhang  
*Carbon* 47 (2009) pp. 3346-3354
21. "Electrospun polyacrylonitrile micro- and nanofibers with dispersed Si nanoparticles and their electrochemical behaviors after carbonization"  
L. Ji, K. H. Jung, A. J. Medford, and X. Zhang  
*Journal of Materials Chemistry* 19 (2009) pp. 4992-4997
22. "Porous carbon nanofibers loaded with manganese oxide particles: formation mechanism and electrochemical performance as energy-storage materials"  
L. Ji, A. J. Medford, and X. Zhang  
*Journal of Materials Chemistry* 19 (2009) pp. 5593-5601
23. "Fabrication of carbon fibers with nanoporous morphologies from electrospun polyacrylonitrile/poly(L-lactide) blends"  
L. Ji, A. J. Medford and X. Zhang  
*Journal of Polymer Science B* 47 (2009) pp. 493-503
24. "Electrospun polyacrylonitrile/zinc chloride composite nanofibers and their response to hydrogen sulfide"  
L. Ji, A. J. Medford, and X. Zhang  
*Polymer* 50 (2009) pp. 605-612

## Conference Presentations

### CAMD Summer School on Electronic Structure and Materials Design - Copenhagen - August 2014

- “Recent developments in microkinetic modeling” (Poster)  
A. J. Medford, A. C. Lausche, T. Khan, J. Wellendorff, F. Studt, F. Abild-Pedersen, J. K. Nørskov  
*Best Poster*

### American Chemical Society Conference - San Francisco - August 2014

- “Implications of uncertainty on computationally predicted rates and trends in catalytic ammonia synthesis”  
A. J. Medford, J. Wellendorff, F. Studt, F. Abild-Pedersen, J. K. Nørskov
- “From fundamental understanding to catalyst design: CO and CO<sub>2</sub> hydrogenation”  
presented for F. Studt

### American Institute of Chemical Engineers Conference - San Francisco - November 2013

- “Activity and selectivity trends in ethanol synthesis”  
A. J. Medford, A. C. Lausche, F. Studt, and J. K. Nørskov
- “Effects of adsorbate-adsorbate interactions on CO methanation”  
A. C. Lausche, A. J. Medford, T. Khan, F. Studt, F. Abild-Pedersen, and J. K. Nørskov

### Materials Research Society Conference - San Francisco - April 2012

- “A theoretical investigation of syngas reactions on Mo<sub>2</sub>C(001)” (Poster)  
A. J. Medford, A. Vojvodic, F. Studt, F. Abild-Pedersen, and J. K. Nørskov  
*Best Poster Nominee*

### Emerging Issues Forum on Energy - Raleigh, NC - Feb. 2008

- “Fabrication of porous carbon nanofibers from electrospun PAN/PLA blends” (Poster)  
A. J. Medford, L. Ji, and X. Zhang

## Supplemental Experience

### Machine Design Assistant

Dr. Richard Kotek - *North Carolina State University*  
Mar. 2008 - May 2008

- Cooperated with lab operator and other students to create a 3D CAD design of a liquid isothermal bath for high temperature spinning of fibers.

### Editing Assistant

Dr. Marian McCord - *North Carolina State University*  
Feb. 2008 - May 2008

- Helped prepare a published chapter of the book *Safety Evaluation in the Development of Medical Devices and Combination Products* by making grammatical corrections and re-formatting text and images into a publishable template.

### Resident Assistant

University Towers - Raleigh, NC  
May. 2006 - Jan. 2008

- Managed a hall of 60+ residents
- Planned events and directed building tours

## Memberships and Activities

- American Institute of Chemical Engineers Member (September 2013 - Present)
- Chemical Engineering Graduate Recruitment Committee (December 2011 - May 2012)
- American Physical Society Member (Nov 2011 - Present)
- United Nations Climate Change Conference: Volunteer at American Delegation (December 2009)
- Engineer-in-Training (May 2009 - Present)
- Electrochemical Society Member (Aug. 2008 - Present)
- Kappa Tau Beta Textile Service Fraternity (Dec. 2007 - May 2009)
- Phi Psi Textile Professional Fraternity (Dec. 2006 - May 2009)