

## **STEVEN A. BENSON**

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### **EDUCATION AND PROFESSIONAL EXPERIENCE**

#### **Education**

1987 Ph.D., Fuel Science, Pennsylvania State University  
1977 B.S., Chemistry, Minnesota State University

#### **Professional Experience**

2010-Present Director, Petroleum Engineering, University of North Dakota  
2008-Present Professor, Chemical Engineering, University of North Dakota  
1999-2008 Senior Research Manager/Advisor, Energy & Environmental Research Center, University of North Dakota (EERC, UND)  
1994-1999 Associate Director for Research, EERC, UND  
1991-Present President, Microbeam Technologies Incorporated  
1986-1994 Senior Research Manager, EERC, UND  
1989-1991 Assistant Professor of Geological Engineering, UND  
1984-1986 Graduate Research Assistant, Fuel Science Program, Department of Materials Science and Engineering, Penn State  
1983-1984 Research Supervisor, UND Energy Research Center  
1979-1983 Research Chemist, U.S. Department of Energy, Grand Forks Energy Technology Center, Grand Forks, North Dakota  
1977-1979 Chemist, U.S. Department of Energy, Grand Forks Energy Technology Center, Grand Forks, North Dakota

#### **Professional Associations and Service**

2008 Technical Panelist, United States Senate Committee on the Environment and Public Works  
2005 Technical Panelist, United States Senate Committee on the Environment and Public Works  
2005-Present Member, Executive Committee, Fuel Division, American Chemical Society  
2004-2005 Chair, Fuel Division, American Chemical Society  
2004-2005 Executive Committee Member, Fuel Division, American Chemical Society  
2004-2005 Councilor, Fuel Division, American Chemical Society  
2002 Chair Elect, Fuel Division, American Chemical Society  
Member, Committee on Environmental Improvement  
Advisory Member, Committee on Corrosion and Deposition Resulting from Impurities in Gas Streams, American Society for Mechanical Engineers  
Member, Mercury Reduction Initiative, Minnesota Pollution Control Agency  
Editorial Board Member, Elsevier Science, *Fuel Processing Technology*

## **COURSES DEVELOPED AND TAUGHT**

### **Undergraduate Level**

- ChE 332 Unit Operations in Chemical Engineering
- ChE 340 Professional Integrity in Engineering
- ChE 493 Impurities in Combustion and Gasification Systems

### **Graduate Level**

- ChE 503 Fuel Technology

## **RESEARCH**

### **Research Advisees (since 2008)**

#### Ph.D. Students

- Prasanna Seshadri
- Dennis Sisk

#### M.S. Students

- Carlos Bucaram Chemical Engineering, 2010
- Charles Thumbi
- Junior Nasah
- Idris Rampurwala
- Jeremy Elbers
- Nathan Bosquez

### **Peer-Reviewed Publications**

#### Books and Special Issues

- Pavlish, J. H.; Laumb, J. D.; Benson S. A.; "Eds, Air Quality VI: Mercury, Trace Elements, SO<sub>3</sub>, Particulate Matter, & Greenhouse Gases", Special Issue of *Fuel Processing Technology*, Elsevier Science Publishers: Amsterdam, 2009, Vol. 90, No. 11, 1327-1434.

#### Publications

- Van Dyk, J. C.; Benson, S. A.; Laumb, M. L.; Waanders, B.; "Coal and Coal Ash Characteristics to Understand Mineral Transformations and Slag Formation", *Fuel*, 2009, Vol. 88, No. 6, 1057-1063.
- Benson, S. A.; Pavlish, J. H.; Holmes, M. J.; Crocker, C. R.; Galbreath, K. C.; Zhaung, Y.; "Mercury Control Testing in a Pulverized Lignite-Fired System", *Fuel Processing Technology*, 2009, Vol. 90, No. 11, 1378-1387.

- Olson, E. S.; Azenkeng, A.; Laumb, J. D.; Jensen, R. R.; Benson, S. A.; Hoffmann, M. R.; “New Developments in the Theory and Modeling of Mercury Oxidation and Binding on Activated Carbons in Flue Gas”, *Fuel Processing Technology*, 2009, Vol. 90, No. 11, 1360-1363.
- Van Dyk, J. C.; Waanders, F. B.; Benson, S. A.; Laumb, M. L.; Hack, K.; “Viscosity Predictions of the Slag Composition of Gasified Coal, Utilizing FactSage Equilibrium Modeling”, *Fuel*, 2009, Vol. 88, 67-74.
- Azenkeng, A.; Laumb, J. D.; Jensen, R.; Olson, E. S.; Benson, S. A.; Hoffmann, M. R.; “Carbene Proton Attachment Energies: Theoretical Study”, *Physical Chemistry A*, 2008, Vol. 112, 5269–5277.

### Conference Presentations

- Fix, G.; Seames, W. S.; Mann, M. D.; Benson, S. A.; Miller, D.; “Coal Ash Fine-Fragmentation Model Formation Mechanisms: Part 1. The Effects of Fuel-to-Oxygen Stoichiometry”, International Conference on Coal Science & Technology in South Africa, October 26-29, 2009.
- Jassim, E.; Benson, S. A.; Seames, W. S.; Mann, M. D.; “Modeling Pyrite Behavior in Gasification Environments”, AIChE Annual Meeting, November 8-13, 2009.

## **HONORS AND AWARDS**

### **Patents**

- 7,574,968 - Method and apparatus for capturing gas phase pollutants such as sulfur trioxide.
- 7,628,969 - Multifunctional abatement of air pollutants in flue gas.

5 patent applications

### **Grant Proposals Submitted and Awarded - since 2008**

- Submitted 9 proposals with a combined value approximately \$18 million.

### **Honors**

- Lignite Energy Council, Distinguished Service Award, Research & Development, 1997
- GEMS Award, College of Earth and Mineral Sciences, Pennsylvania State University, 2002
- Lignite Energy Council, Distinguished Service Award, Research & Development, 2003
- Lignite Energy Council, Distinguished Service Award, Government Action Program (Regulatory), 2005

- Lignite Energy Council, Distinguished Service Award, Research & Development, 2008