

# **Thomas H. Fletcher**

## **Professor and Chair, Chemical Engineering Department Brigham Young University**

tom\_fletcher@byu.edu

<http://www.et.byu.edu/~tom>

---

### **Education**

- Ph. D. Chemical Engineering, Brigham Young University, 1983
- M. S. Chemical Engineering, Brigham Young University, 1980
- B. S. Chemical Engineering, Brigham Young University, 1979  
(cum laude; minor: Mathematics)

### **Experience**

- Chemical Engineering Department, **Brigham Young University**
  - Associate Professor, 1991-1997; Professor, 1997-present
  - Associate Chair, 2006-2016
  - Chair, 2016-present
  - Taught classes at BYU in Coal Combustion, Combustion Fundamentals, Combustion Modeling, Energy and the Environment, Chemical Reactor Design, Process Control, Unit Operations, Career Skills, and Material and Energy Balances.
- Advanced Combustion Engineering Research Center (**ACERC**) at BYU and the University of Utah
  - Associate Director, 1993-1997; Director as of Sept. 1, 1997
- Combustion Research Facility, **Sandia National Laboratories**, Livermore, California
  - Senior Member of Technical Staff, 1984-1991

### **Research Interests**

- Solid fuel devolatilization and combustion science (coal, biomass, oil shale)
- Nitrogen evolution from organic materials
- Soot formation from aromatics
- Turbulence and combustion
- Laser and optical diagnostics in combustion systems
- Comprehensive combustion modeling
  - pulverized coal combustion/gasification
  - gas turbine combustion

### **Publications and Presentations**

- 112 peer-reviewed publications
- Co-author on 1 book and 5 book chapters
- Advisor on 10 completed M.S. Theses and 19 completed Ph.D. Dissertations
- 230 presentations at national or international technical meetings

### **Major Coal-Related Models Developed**

- Chemical Percolation Devolatilization (CPD) model for coal pyrolysis (1992)
- Pulverized Coal Gasification and Combustion in 2-dimensions (PCGC-2) (1983)

### **Professional Organizations and Service**

- The Combustion Institute, ACS Division of Fuel Chemistry, ASME, AIChE
- Editorial Board of *Combustion and Flame* (2013-2019)
- Editorial Board of *Fire* (2017- )
- Adjunct Faculty, Chemical Engineering Dept., University of Utah (2014-present)
- Co-Colloquia Chair, Solid Fuel Combustion, Int'l Symposium on Combustion (2016)
- Colloquia Chair, Solid Fuel Combustion, Int'l Symposium on Combustion (2018)

### **Awards/Recognition**

- Izatt-Christensen Excellence in Research in BYU Chemical Engineering Dept. (2015)
- Excellence in Scholarship Award, College of Engineering, BYU (2014)

- Sponsored Research Award, BYU Office of Research (2012)
- J.J. Christensen Professorship in Chemical Engineering (2010-2015)
- Karl G. Maeser Excellence in Teaching Award, Brigham Young University, 2008
- Bill and Margaret Pope Professorship in Chemical Engineering (2002-2007)
- Outstanding Faculty Award in Chemical Engineering (1999, 2002, 2008)
- Best Paper Awards, Heat Transfer Committee, ASME Turbo Expo (2004; 2006(2), 2009)

### **Advisory Boards**

- Air Liquide Delaware Research Center (2015-present)
- Wormser Energy (2014-present)

### **Consulting**

- |                    |                                      |
|--------------------|--------------------------------------|
| • ABB              | • General Electric                   |
| • Air Liquide      | • Geneva Steel                       |
| • Air Products     | • Headwaters                         |
| • Airflow Sciences | • Pusan Clean Coal Centre            |
| • Babcock & Wilcox | • Reaction Engineering International |
| • Con Edison       | • Sabic                              |
| • DOE/NETL         | • TRW                                |
| • EPRI             | • Wormser Energy                     |

### **Books and Book Chapters**

1. Smith, L. K., L. D. Smoot, T. H. Fletcher, and R. J. Pugmire, "Chapter 3. Coal Characteristics, Structure, and Reaction Rates," in Fundamentals of Coal Combustion for Clean and Efficient Use, edited by L. D. Smoot, Elsevier, New York (1993).
2. Smith, L. K., L. D. Smoot, T. H. Fletcher, and R. J. Pugmire, The Structure and Reaction Processes of Coal, Plenum Press, New York (1994).
3. Liu, K., Z. Cui, and T. H. Fletcher, "Chapter 4. Coal Gasification," in H<sub>2</sub> and Syngas Production and Purification Technologies, edited by K. Liu, C. Song, and V. Subramani, AIChE and Wiley, Hoboken, New Jersey, pp. 156-218 (2010).
4. Fletcher, T. H., R. J. Pugmire, M. S. Solum, C. L. Mayne, A. M. Orendt, and J. C. Facelli, "Chapter 5: Chemical and Structural Characterization of Oil Shale from the Green River Formation," in Utah Oil Shale: Science, Technology, and Policy Perspectives, edited by J. Spinti, CRC Press, Boca Raton, FL, pp. 87-117 (2017). ISBN-13: 978-1-4987-2172-1
5. Fletcher, T. H., R. J. Pugmire, M. S. Solum, C. L. Mayne, "Chapter 6: Oil Shale Pyrolysis Rates and Mechanisms," in Utah Oil Shale: Science, Technology, and Policy Perspectives, edited by J. Spinti, CRC Press, Boca Raton, FL, pp. 119-156 (2017). ISBN-13: 978-1-4987-2172-1
6. Fletcher, T. H., "Chapter 6. Gasification Fundamentals," in Introduction to Gasification for IGCC Systems, edited by T. Wang and G. Stiegel, Woodhead Publishing, pp. 223–256 (2017). ISBN-13: 978-0-0810-0167-7

### **Peer-Reviewed Journal Articles (in reverse chronological order)**

116. Laycock, R. and T. H. Fletcher, "Errata to 'Time-Dependent Deposition Characteristics of Fine Coal Flyash in a Laboratory Gas Turbine Environment' (*J. Turbomach.* 2012;135(2):021003-021003-8. doi:10.1115/1.4006639)," submitted to *Journal of Turbomachinery* (August, 2017).

115. Shen, C., M. E. Fletcher, J. R. Gallacher, T. Adams, C. A. Seielstad, and T. H. Fletcher, "Geometrical Construction of Chamise and Big Sagebrush Shrubs using L-Systems Guided by LiDAR," submitted to *Annals of Botany* (May, 2017).
114. Gallacher, J. R., V. Lansinger, S. Smith, A. Doll, D. R. Weise, and T. H. Fletcher, "Effects of Season on the Ignition and Burning of Live Wildland Fuels Using a Flat-Flame Burner System," submitted to the *International Journal of Wildland Fire* (Dec., 2016).
113. Gallacher, J. R., B. Ripa, B. Butler, and T. H. Fletcher, "The Influence of the Coanda Effect on Flame Attachment to Slopes and Firefighter Safety Zone Considerations," submitted to the *International Journal of Wildland Fire* (Dec., 2016).
112. Holland, T., S. Bhat, P. Marcy, J. Gattiker, J. D. Kress, and T. H. Fletcher, "Modeling Effects of Annealing on Coal Char Reactivity to O<sub>2</sub> and CO<sub>2</sub> Based on Preparation Conditions," accepted, *Energy & Fuels* (2017).
111. Josephson, A. J., N. D. Gaffin, S. T. Smith, T. H. Fletcher, D. O. Lignell, "Modeling Soot Consumption with Bayesian Statistics," accepted, *Energy & Fuels* (August, 2017).
110. Mohammad-S. Safdari, M. Rahmati, F. Fazlollahi, T. H. Fletcher, and W. V. Wilding, "Development of Bioreactors for Comparative Study of Natural Attenuation, Biostimulation, and Bioaugmentation of Petroleum-hydrocarbon Contaminated Soil," accepted, *Journal of Hazardous Materials* (August, 2017).
109. Yang, H., T. H. Fletcher, S. Li, H. Hu, and Y. Li, "Model for the Evolution of Pore Structure in a Lignite Particle during Pyrolysis : 2. Influence of Cross-linking Reactions, Molten Metaplast and Molten Ash on Particle Surface Area," *Energy & Fuels*, **31**, 8036–8044 (2017). DOI: 10.1021/acs.energyfuels.7b01163
108. Holland, T. and T. H. Fletcher, "A Comprehensive Model of Single Particle Pulverized Coal Combustion Extended to Oxy-coal Conditions," *Energy & Fuels*, **31**, 2722–2739 (2017). DOI: 10.1021/acs.energyfuels.6b03387
107. Prince, D. R., C. Shen, and T. H. Fletcher, "Semi-empirical Model for Fire Spread in Shrubs with Spatially-defined Fuel Elements and Flames," *Fire Technology*, **53**, 1439–1469 (2017). DOI: 10.1007/s10694-016-0644-9
106. Mohammad-S. Safdari, H.-R. Kariminia, Z. G. Nejad, and T. H. Fletcher, "Study Potential of Indigenous *Pseudomonas Aeruginosa* and *Bacillus Subtilis* in Bioremediation of Diesel-contaminated Water," *Water, Air, & Soil Pollution*, **228**:37, 1-7 (2017). DOI 10.1007/s11270-016-3220-5
105. Holland, T. and T. H. Fletcher, "Global Sensitivity Analysis for a Comprehensive Char Conversion Model in Oxy-fuel Conditions," *Energy & Fuels*, **30**, 9339–9350 (2016). DOI: 10.1021/acs.energyfuels.6b02190
104. Richards, A. P. and T. H. Fletcher, "A Comparison of Simple Global Kinetic Models for Coal Devolatilization with the CPD Model," *Fuel*, **185**, 171-180 (2016).
103. Josephson, A. J., D. O. Lignell, A. L. Brown, and T. H. Fletcher, "Revision to Modeling Soot Derived from Pulverized Coal," *Energy & Fuels*, **30**, 5198-5199 (2016). DOI: 10.1021/acs.energyfuels.6b01007.
102. Laycock, R. and T. H. Fletcher, "Independent Effects of Surface and Gas Temperature on Coal Flyash Deposition in Gas Turbines at Temperatures up to 1400°C," *ASME Journal for Gas Turbines and Power*, **138**, 021402-1 thru 8 (February, 2016).
101. Li, S., H. Yang, T. H. Fletcher, and M. Dong, "Model for the Evolution of Pore Structure in a Lignite Particle during Pyrolysis," *Energy & Fuels*, **29**, 5322-5333 (2015). DOI: 10.1021/acs.energyfuels.5b00726

100. Fletcher, T. H., D. Barfuss, and R. J. Pugmire, “Modeling Light Gas and Tar Yields from Pyrolysis of Green River Oil Shale Demineralized Kerogen Using the CPD Model,” *Energy & Fuels*, **29**, 4921-4926 (2015). DOI: 10.1021/acs.energyfuels.5b01146
99. H. Yang, Li, S., T. H. Fletcher, M. Dong, “Simulation of the Swelling of High Volatile Bituminous Coal during Pyrolysis: 2. Influence of the Maximum Particle Temperature”, *Energy & Fuels*, **29**, 3953–3962 (2015).
98. Lewis, A. D., T. M. Holland, N. R. Marchant, E. G. Fletcher, D. J. Henley, E. G. Fuller, and T. H. Fletcher, “Steam Gasification Rates of Three Bituminous Coal Chars in an Entrained-Flow Reactor at Pressurized Conditions,” *Energy & Fuels*, **29**, 1479–1493 (2015). DOI: 10.1021/ef502608y
97. Shen, C. and T. H. Fletcher, “Fuel Element Combustion Properties for Live Wildland Utah Shrubs,” *Combustion Science and Technology*, **187**, 428–444 (2015). dx.doi.org/10.1080/00102202.2014.950372
96. Yang, H., S. Li, T. H. Fletcher, M. Dong, “Simulation of the Plastic Swelling of High Volatile Bituminous Coal during Pyrolysis,” *Energy & Fuels*, **28**, 7216–7226 (2014). dx.doi.org/10.1021/ef5016846
95. Lewis, A. D., E. G. Fletcher, and T. H. Fletcher, “CO<sub>2</sub> Char Gasification Rates of Sawdust, Switchgrass, and Corn Stover in a Pressurized Entrained-Flow Reactor,” *Energy & Fuels*, **28**, 5812-5825 (September, 2014). dx.doi.org/10.1021/ef500903c
94. Prince, D. R. and T. H. Fletcher, “Differences in Burning Behavior of Live and Dead Leaves, Part 1: Measurements,” *Combustion Science and Technology*, **186**, 1844–1857 (2014). dx.doi.org/10.1080/00102202.2014.923412
93. Lewis, A. D., E. G. Fletcher, and T. H. Fletcher, “CO<sub>2</sub> Gasification Rates of Petroleum Coke in a Pressurized Flat-Flame Burner Entrained-Flow Reactor,” *Energy & Fuels*, **28**, 4447-4457 (2014). dx.doi.org/10.1021/ef500690j
92. Yang, H., S. Li, T. H. Fletcher, M. Dong, and W. Zhou, “Simulation of the Evolution of Pressure in a Lignite Particle during Pyrolysis,” *Energy & Fuels*, **28**, 3511-3518 (2014). dx.doi.org/10.1021/ef500584q
91. Fletcher, T. H., R. Gillis, J. Adams, T. Hall, C. L. Mayne, M. S. Solum, and R. J. Pugmire, “Characterization of Macromolecular Structure Elements from a Green River Oil Shale, II. Characterization of Pyrolysis Products by <sup>13</sup>C NMR, GC/MS, and FTIR,” *Energy & Fuels*, **28**, 2959–2970 (2014). dx.doi.org/10.1021/ef500095j
90. Prince, D. R., M. E. Fletcher, C. Shen, and T. H. Fletcher, “Application of L-Systems to Geometrical Construction of Chamise and Juniper Shrubs,” *Ecological Modelling*, **273**, 86-95 (2014).
89. Solum, M. S., C. L. Mayne, A. M. Orendt, R. J. Pugmire, J. Adams, T. H. Fletcher, “Characterization of Macromolecular Structure Elements from a Green River Oil Shale, I. Extracts,” *Energy & Fuels*, **28**, 453-465 (2014). dx.doi.org/10.1021/ef401918u
88. Hillier, J. L., T. H. Fletcher, M. S. Solum, and R. J. Pugmire, “Characterization of Macromolecular Structure of Pyrolysis Products from a Colorado Green River Oil Shale,” *Industrial and Engineering Chemistry Research*, **52**, (44), 15522-15532 (2013). dx.doi.org/10.1021/ie402070s
87. Shurtz, R. C. and T. H. Fletcher, “Coal Char-CO<sub>2</sub> Gasification Measurements and Modeling in a Pressurized Flat-Flame Burner,” *Energy & Fuels*, **27**, 3022-3038 (2013). dx.doi.org/10.1021/ef400253c

86. Laycock, R. G. and T. H. Fletcher, "Time-dependent Deposition Characteristics of Fine Coal Flyash in a Laboratory Gas Turbine Environment," *ASME Journal of Turbomachinery*, **135**, 21003-1 thru 8 (2013).
85. Lewis, A. D. and T. H. Fletcher, "Prediction of Sawdust Pyrolysis Yields from a Flat-Flame Burner Using the CPD Model," *Energy & Fuels*, **27**, 942-953 (2013).  
dx.doi.org/10.1021/ef3018783
84. Ai, W., N. Murray, T. H. Fletcher, S. Harding, J. P. Bons, "Effect of Hole Spacing on Deposition of Fine Coal Flyash Near Film Cooling Holes," *Journal of Turbomachinery*, **134**:4, 041021-1 thru 9 (July, 2012).
83. Ai, W. and T. H. Fletcher, "Computational Analysis of Conjugate Heat Transfer and Particulate Deposition on a High Pressure Turbine Vane," *Journal of Turbomachinery*, **134**:4, 041020-1 thru 12 (July, 2012).
82. Ai, W., N. Murray, T. H. Fletcher, S. Harding, S. Lewis, and J. Bons, "Deposition Near Film Cooling Holes on a High Pressure Turbine Vane," *Journal of Turbomachinery*, **134**:4, 041013-1 thru 11 (July, 2012).
81. Fletcher, T. H., H. R. Pond, J. Webster, and L. L. Baxter, "Prediction of Tar and Light Gas during Pyrolysis of Black Liquor and Biomass," *Energy & Fuels*, **26**, 3381-3387 (2012).  
doi 10.1021/ef300574n
80. Shurtz, R. C., J. W. Hogge, K. C. Fowers, G. S. Sorensen, and T. H. Fletcher, "A Coal Swelling Model for Pressurized High Particle Heating Rate Pyrolysis Applications," *Energy & Fuels*, **26**, 3612-3627 (2012). doi 10.1021/ef300442r
79. Sowa, J. M. and T. H. Fletcher, "Investigation of an Iron-Based Additive on Coal Pyrolysis and Char Oxidation at High Heating Rates," *Fuel Processing Technology*, **92**, 2211-2218 (2011).
78. Cole, W. J., M. H. Dennis, T. H. Fletcher, and D. R. Weise, "The Effects of Wind on the Flame Characteristics of Individual Leaves," *International Journal of Wildland Fire*, **20**, 657-667 (2011).
77. Lewis, S., B. Barker, J. Bons, W. Ai, and T. Fletcher, "Film Cooling Effectiveness and Heat Transfer Near Deposit-Laden Film Holes," *ASME Journal of Turbomachinery*, **133**:3, 031003-1 thru 9 (July 2011).
76. Ai, W., R. G. Laycock, D. S. Rappleye, T. H. Fletcher, J. P. Bons, "Effect of Particle Size and Trench Configuration on Deposition from Fine Coal Flyash Near Film Cooling Holes," *Energy & Fuels*, **25**, 1066-1076 (2011).
75. Shurtz, R. C., K. K. Kolste, and T. H. Fletcher, "A Coal Swelling Model for CFD Applications at High Heating Rates," *Energy & Fuels*, **25**, 2163-2173 (2011).
74. Hillier, J. L. and T. H. Fletcher, "Pyrolysis Kinetics of a Green River Oil Shale Using a Pressurized TGA," *Energy & Fuels*, **25**, 232-239 (2011).
73. Sowa, J. M., K. K. Kolste, and T. H. Fletcher, "Investigation of Nitrogen Release during Coal Pyrolysis in an Oxy-fuel Combustion Process," *Energy & Fuels*, **24**, 6411-6416 (2010).
72. Hillier, J., T. Bezzant, and T. H. Fletcher, "Improved Method for Determination of Kinetic Parameters from Non-isothermal TGA Data," *Energy & Fuels*, **24**, 2841-2847 (2010).
71. Zhao, X., C. Zeng, Y. Mao, W. Li, Y. Peng, T. Wang, B. Eiteneer, V. Zamansky, and T. Fletcher, "The Surface Characteristics and Reactivity of Residual Carbon in Coal Gasification Slag," *Energy & Fuels*, **24**, 91-94 (2010).

70. Pickett, B. M., C. Isackson, R. Wunder, T. H. Fletcher, B. W. Butler, and D. R. Weise, "Experimental Measurements during Combustion of Moist Individual Foliage Samples," *International Journal of Wildland Fire*, **19**, 153-162 (2010).
69. Clark, M. M., T. H. Fletcher, R. R. Linn, "A Sub-Grid, Mixture-Fraction-Based Thermodynamic Equilibrium Model for Gas Phase Combustion in FIRETEC: Development and Results," *International Journal of Wildland Fire*, **19**, 202-212 (2010).
68. Kim, R.-G., B. H. Lee, C. H. Jeon, J. H. Song, Y. J. Chang, and T. H. Fletcher, "An Experimental and Numerical Study on the Characteristics of Devolatilization Process for Coals Utilized in Korea Using CPD Model," *Transactions of the Korean Society of Mechanical Engineers B* 33(8):613-621 (July, 2009). (in Korean)
67. Jupudi, R. S., V. Zamansky, and T. H. Fletcher, "Prediction of Light Gas Composition in Coal Devolatilization," *Energy & Fuels*, **23**, 3063-3067 (2009).
66. Pickett, B. M., Isackson, R. Wunder, T. H. Fletcher, B. W. Butler, and D. R. Weise, "Flame Interactions and Burning Characteristics of Two Live Leaf Samples," *International Journal of Wildland Fire*, **18**, 865-874 (2009).
65. Wammack, J. E., J. Crosby, D. Fletcher, J. P. Bons, T. H. Fletcher, "Evolution of Surface Deposits on a High Pressure Turbine Blade, Part I: Physical Characteristics," *ASME Journal of Turbomachinery*, **130**, 021020-1 thru 8 (2008).
64. Crosby, J. M., S. Lewis, J. P. Bons, W. Ai, and T. H. Fletcher, "Effects of Temperature and Particle Size on Deposition in Land Based Turbines," *ASME Journal of Engineering for Gas Turbines and Power*, **130**(5), 051503-051503-9 (2008). doi: 10.1115/1.2903901
63. Bons, J. P., J. E. Wammack, J. Crosby, D. Fletcher, T. H. Fletcher, "Evolution of Surface Deposits on a High Pressure Turbine Blade, Part II: Convective Heat Transfer," *ASME Journal of Turbomachinery*, **130**, 021021-1 thru 7 (2008).
62. Winans, R. E., N. A. Tomczyk, J. E. Hunt, M. S. Solum, R. J. Pugmire, Y. J. Jiang, and T. H. Fletcher, "Model Compound Study of the Pathways for Aromatic Hydrocarbon Formation in Soot," *Energy & Fuels*, **21**, 2584-2593 (2007).
61. Fletcher, T. H., B. M. Pickett, S. G. Smith, G. S. Spittle, M. M. Woodhouse, E. Haake and D. R. Weise, "Effects of Moisture on Ignition Behavior of Moist California Chaparral and Utah Leaves," *Combustion Science and Technology*, **179**, 1183-1203 (2007).
60. Price, R. J., T. H. Fletcher, and R. J. Jensen, "Using CFD Modeling to Improve the Performance of a Solar CO<sub>2</sub> Converter," *Industrial & Engineering Chemistry Research*, **46**, 1959-1967 (2007).
59. Bons, J. P., J. Crosby, J. E. Wammack, B. I. Bentley, and T. H. Fletcher, "High pressure Turbine Deposition in Land Based Gas Turbines from Various Synfuels," *ASME Journal for Gas Turbines and Power*, **129**, 135-143 (2007).
58. Zeng, D. and T. H. Fletcher, "The Effect of Pressure on Coal Pyrolysis and Char Morphology," *Energy & Fuels*, **19**, 1828-1838 (2005).
57. Jensen, J. W., S. W. Squire, J. P. Bons, and T. H. Fletcher, "Simulated Land-Based Deposits in an Accelerated Deposition Facility," *ASME Journal of Turbomachinery*, **127**, 462-470 (2005).
56. Hedman, P. O., T. H. Fletcher, D. V. Flores, S. G. Graham, J. K. Haslam, R. L. Murray, G. W. Timothy, "Observations of Flame Behavior in a Laboratory-Scale Pre-Mixed Natural Gas/Air Gas Turbine Combustor from PLIF Measurements of OH, LDA Velocity measurements, and CARS Temperature Measurements," *ASME Journal for Gas Turbines and Power*, **127**:4, 724-739 (2005).

55. Zeng, D., M. Clark, T. Gunderson, W. C. Hecker, and T. H. Fletcher, "Swelling Properties and Intrinsic Reactivities of Coal Chars Produced at Elevated Pressures and High Heating Rates," *Proceedings of the Combustion Institute*, **30**, 2213-2221 (2005).
54. Engstrom, J. D., J. K. Butler, S. G. Smith, L. L. Baxter, T. H. Fletcher, and D. R. Weise, "Ignition Behavior of Live California Chaparral Leaves," *Combustion Science and Technology*, **176**, 1-15, (2004).
53. Price, R. J., D. A. Morse, S. L. Hardy, T. H. Fletcher, S. C. Hill, and R. J. Jensen, "Modeling the Direct Solar Conversion of CO<sub>2</sub> to CO and O<sub>2</sub>," *Industrial and Engineering Chemistry Research*, **43**, 2446-2453 (2004).
52. Matsuoka, K., Z. Ma, H. Akiho, Z. Zhang, A. Tomita, T. H. Fletcher, M. A. Wojtowicz, and S. Niksa, "High-Pressure Coal Pyrolysis in a Drop Tube Furnace," *Energy & Fuels*, **17**, 984-990 (2003).
51. Hecker, W. C., P. M. Madsen, M. R. Sherman, J. W. Allen, R. J. Sawaya, and T. H. Fletcher, "High Pressure Intrinsic Oxidation Kinetics of Two Coal Chars," *Energy & Fuels*, **17**, 427-432 (2003).
50. Hessler, J. P., S. Seifert, R. E. Winans, and T. H. Fletcher, "Small-Angle X-ray Scattering Studies of Soot Inception and Growth," *Faraday Discus.*, **119**, 395-407 (2001).
49. Zhang, H. and T. H. Fletcher, "Nitrogen Transformations during Secondary Coal Pyrolysis," *Energy & Fuels*, **15**, 1512-1522 (2001).
48. Tian, Y., K. Xie, S. Zhu, and T. H. Fletcher, "Simulation of Coal Pyrolysis in Plasma Jet by CPD Model," *Energy & Fuels*, **15**, 1354-1358 (2001).
47. Solum, M. S., A. F. Sarofim, R. J. Pugmire, T. H. Fletcher, and H. Zhang, "<sup>13</sup>C NMR Analysis of Soot Produced from Model Compounds and a Coal," *Energy & Fuels*, **15**, 961-971 (2001).
46. Rigby, J., J. Ma, B. W. Webb, and T. H. Fletcher, "Transformations of Coal-Derived Soot at Elevated Temperature," *Energy & Fuels*, **15**, 52-59 (2001).
45. Perry, S., E. M. Hambly, T. H. Fletcher, M. S. Solum, and R. J. Pugmire, "Solid-State <sup>13</sup>C NMR Characterization of Matched Tars and Chars From Rapid Coal Devolatilization," *Proceedings of the Combustion Institute*, **28**, 2313-2319 (2000).
44. Hong, J., W. C. Hecker, and T. H. Fletcher, "Modeling High Pressure Char Oxidation Using Langmuir Kinetics with an Effectiveness Factor," *Proceedings of the Combustion Institute*, **28**, 2215-2223 (2000).
43. Perry, S., T. H. Fletcher, R. J. Pugmire, M. S. Solum, "A Global Free-Radical Mechanism for Light Gas Nitrogen Release from Coal during Devolatilization," *Energy & Fuels*, **14**, 1094-1102 (2000).
42. Hong, J., W. C. Hecker, and T. H. Fletcher, "Improving the Accuracy of Predicting Effectiveness Factors for m-th Order and Langmuir Rate Equations in Spherical Coordinates," *Energy & Fuels*, **14**, 663-670 (2000).
41. Veranth, J. M., T. H. Fletcher, D. W. Pershing, and A. F. Sarofim, "Measurement of Soot and Char in Pulverized Coal Fly Ash," *Fuel*, **79**(9), 1067-1075 (2000).
40. Flores, D. V. and T. H. Fletcher, "The Use of Two Mixture Fractions to Treat Coal Combustion in Turbulent Pulverized-Coal Flames," *Combustion Science and Technology*, **150**, 1-26 (2000).
39. Genetti, D. and T. H. Fletcher, "Modeling Nitrogen Release during Devolatilization on the Basis of Chemical Structure of Coal," *Energy & Fuels*, **13**, 1082-1091 (1999).

38. Genetti, D., T. H. Fletcher, and R. J. Pugmire, "Development and Application of a Correlation of  $^{13}\text{C}$  NMR Chemical Structure Analyses of Coal Based on Elemental Composition and Volatile Matter Content," *Energy & Fuels*, **13**, 60-68 (1999).
37. Mallampalli, H., T. H. Fletcher, and J. Y. Chen, "Evaluation of  $\text{CH}_4/\text{NO}_x$  Reduced Mechanisms Used for Modeling Lean Premixed Turbulent Combustion of Natural Gas," *Journal of Engineering for Gas Turbines and Power*, **120**, 703-712 (1998).
36. Brown, A. L. and T. H. Fletcher, "Modeling Soot Derived from Pulverized Coal," *Energy & Fuels*, **12**, 745-757 (1998).
35. Kelemen, S. R., M. L. Gorbaty, P. J. Kwiatek, T. H. Fletcher, M. Watt, M. S. Solum, and R. J. Pugmire, "Nitrogen Transformations in Coal during Pyrolysis," *Energy & Fuels*, **12**, 159-173 (1998).
34. Fletcher, T. H., J. Ma, J. R. Rigby, A. L. Brown, and B. W. Webb, "Soot in Coal Combustion Systems," *Progress in Energy and Combustion Science*, **23**, 283-301 (1997).
33. Baxter, L. L., R. E. Mitchell, and T. H. Fletcher, "Release of Inorganic Material During Coal Devolatilization," *Combustion & Flame*, **108**, 494-502 (1997).
32. Ma, J., T. H. Fletcher, and B. W. Webb, "Conversion of Coal Tar to Soot During Coal Pyrolysis in a Post-Flame Environment," *Twenty-Sixth Symposium (International) on Combustion*, The Combustion Institute, Pittsburgh, PA, 3161-3167 (1996).
31. Watt, M., T. H. Fletcher, S. Bai, M. S. Solum, and R. J. Pugmire, "Chemical Structure of Coal Tar During Devolatilization," *Twenty-Sixth Symposium (International) on Combustion*, The Combustion Institute, Pittsburgh, PA, 3153-3160 (1996).
30. Chen, W., L. D. Smoot, S. C. Hill, and T. H. Fletcher, "Part 2. A Global Rate Expression for Nitric Oxide Reburning," *Energy & Fuels*, **10**, 1046-1052 (1996).
29. Chen, W., L. D. Smoot, T. H. Fletcher, and R. D. Boardman, "Part 1. A Computational Method for Determining Global Fuel-NO Rate Expressions", *Energy & Fuels*, **10**, 1036-1045 (1996).
28. Gale, T. K., C. H. Bartholomew, and T. H. Fletcher, "Effects of Pyrolysis Heating Rate on Intrinsic Reactivities of Coal Chars," *Energy & Fuels*, **10**, 766-755 (1996).
27. Baxter, L. L., R. E. Mitchell, T. H. Fletcher, and R. H. Hurt, "Nitrogen Release during Coal Combustion," *Energy & Fuels*, **10**, 188-196 (1996).
26. Ma, J., T. H. Fletcher, and B. W. Webb, "Thermophoretic Sampling of Coal-Derived Soot Particles During Devolatilization," *Energy & Fuels*, **9**, 802-808 (1995).
25. Gale, T. K., T. H. Fletcher, and C. H. Bartholomew, "Effects of Pyrolysis Conditions on Internal Surface Areas and Densities of Coal Chars Prepared at High Heating Rates in Reactive and Non-Reactive Atmospheres," *Energy & Fuels*, **9**(3), 513-524 (1995).
24. Gale, T. K., C. H. Bartholomew, and T. H. Fletcher, "Decreases in the Swelling and Porosity of Bituminous Coals During Devolatilization at High Heating Rates," *Combustion and Flame*, **100**, 94-100 (1995).
23. Solomon, P. R. and T. H. Fletcher, "The Impact of Pyrolysis in Combustion," an invited review paper, *Twenty-Fifth Symposium (International) on Combustion*, 463-474 (1994).
22. Fletcher, T. H. and S. C. Hill, "An Overview of ACERC Comprehensive Model Development," *Energy & Fuels*, **7**:6, 870-873 (1993).
21. Pugmire, R. J. and T. H. Fletcher, "An Overview of ACERC Research in Fuel Characterization and Reaction Mechanisms," *Energy & Fuels*, **7**:6, 700-703 (1993).



20. Fletcher, T. H., S. Bai, R. J. Pugmire, M. S. Solum, S. Woods, and D. M. Grant, "Chemical Structural Features of Pyridine Extracts of the Argonne Premium Coals Using  $^{13}\text{C}$  NMR Spectroscopy," *Energy & Fuels*, **7**:6, 734-742 (1993).
19. Fletcher, T. H., "Swelling Properties of Coal Chars During Rapid Coal Pyrolysis and Combustion," *Fuel*, **72**:11, 1485-1495 (1993).
18. Hurt, R. H., T. H. Fletcher, and R. S. Sampaio, "Heat Transfer from a Molten Phase to an Immersed Coal Particle During Devolatilization," *ASME Journal of Heat Transfer*, **155**:3, 717-723 (1993).
17. Solomon, P. R., T. H. Fletcher, and R. J. Pugmire, "Progress in Coal Pyrolysis," *Fuel*, **72**:5, 587-597 (1993).
16. Fletcher, T. H., M. S. Solum, D. M. Grant, and R. J. Pugmire, "Chemical Structure of Char in the Transition from Devolatilization to Combustion," *Energy & Fuels*, **6**, 643-650 (1992).
15. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, M. S. Solum, and D. M. Grant, "A Chemical Model of Coal Devolatilization: 3. Direct Use of  $^{13}\text{C}$  NMR Data to Predict Effects of Coal Type," *Energy & Fuels*, **6**(4), 414-431 (1992).
14. Pugmire, R. J., M. S. Solum, D. M. Grant, S. Critchfield, and T. H. Fletcher, "Structural Evolution of Matched Tar/Char Pairs in Rapid Pyrolysis Experiments," *Fuel*, **70**, 414-423 (1991).
13. Fletcher, T. H., M. S. Solum, D. M. Grant, S. Critchfield, and R. J. Pugmire, "Solid-State  $^{13}\text{C}$  and  $^1\text{H}$  NMR Studies of the Evolution of the Chemical Structure of Coal Char and Tar During Devolatilization," *Twenty-Third Symposium (International) on Combustion*, The Combustion Institute, Pittsburgh, PA, p. 1231-1237 (1990).
12. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, and D. M. Grant, "Chemical Percolation Model for Devolatilization: II. Temperature and Heating Rate Effects on Product Yields," *Energy & Fuels*, **4**, 54 (1990).
11. Fletcher, T. H., "Time-Resolved Particle Temperature and Mass Loss Measurements of a Bituminous Coal During Devolatilization," *Combustion and Flame*, **78**, 223 (1989).
10. Fletcher, T. H., "Time-Resolved Temperature Measurements of Individual Coal Particles During Devolatilization," *Combustion Science and Technology* **63**, 89 (1989).
9. Grant, D. M., R. J. Pugmire, T. H. Fletcher, and A. R. Kerstein, "A Chemical Model of Coal Devolatilization Using Percolation Lattice Statistics," *Energy & Fuels*, **3**, 175-186 (1989).
8. Baxter, L. L., Fletcher, T. H., and Ottesen, D. K., "Spectral Emittance of Coal Particles," *Energy & Fuels*, **2**, 423 (1988).
7. Dudek, D. R., T. H. Fletcher, J. P. Longwell, and A. F. Sarofim, "Natural Convection Induced Drag Forces on Spheres at Low Grashof Numbers: Comparison of Theory with Experiment," *International Journal of Heat and Mass Transfer*, **31**:4, 863-873 (1988).
6. Smith, P. J. and T. H. Fletcher, "A Study of Two Chemical Reaction Models in Turbulent Coal Combustion," *Combustion Science and Technology*, **58**, 59-76 (1988).
5. Niksa, S., A. R. Kerstein, and T. H. Fletcher, "Predicting Devolatilization at Typical Coal Combustion Conditions with the Distributed-Energy Chain Model," *Combustion and Flame*, **69**, 221-228 (1987).
4. Holve, D. J., T. H. Fletcher, and K. Gomi, "Comparative Combustion Studies of Ultrafine Coal/Water Slurries and Pulverized Coal," *Combustion Science and Technology*, **52**, 269-291 (1987), Sandia Report SAND85-8706 (May 1985).
3. Suzuki, T., L. D. Smoot, T. H. Fletcher, and P. J. Smith, "Prediction of High-Intensity Pulverized Coal Combustion," *Combustion Science and Technology*, **45**, 167-183 (1986).

2. Musarra, S. P., T. H. Fletcher, S. Niksa, and H. A. Dwyer, "Heat and Mass Transfer in the Vicinity of a Devolatilizing Coal Particle," *Combustion Science and Technology*, **45**, 289-307 (1986).
1. Smith, P. J., T. H. Fletcher, and L. D. Smoot, "Model for Coal-Fired Reactors," *Eighteenth Symposium (International) on Combustion*, The Combustion Institute, Pittsburgh, PA, p. 1285 (1980).

### **M.S. Thesis and Ph.D. Dissertation**

1. Fletcher, T. H., "Theoretical Modeling of Reacting Coal Particles in Pulverized Coal Combustion and Gasification," M.S. Thesis, Chemical Engineering Department, Brigham Young University (December, 1980).
2. Fletcher, T. H., "A Two-Dimensional Model for Coal Gasification and Combustion," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (August, 1983).

### **Other Published Papers and Reports (not peer-reviewed)**

1. Hedman, P. O., L. D. Smoot, T. H. Fletcher, P. J. Smith, and A. U. Blackham, "Prediction and Measurement of Entrained Flow Coal Gasification Processes," Interim Report Volume I prepared for U.S. DOE/METC, Contract No. DE-AC21-81MC16518, Combustion Laboratory, Brigham Young University (October, 1983).
2. Smith, P. J., L. D. Smoot, and T. H. Fletcher, "User's Manual for a Computer Program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)," Interim Report Volume II prepared for U.S. DOE/METC, Contract No. DE-AC21-81MC16518, Combustion Laboratory, Brigham Young University (October, 1983).
3. Smoot, L. D., T. H. Fletcher, and K. R. Christensen, "Data Book: For Evaluation of Pulverized Coal Reaction Models," Interim Report Volume III prepared for U.S. DOE/METC, Contract No. DE-AC21-81MC16518, Combustion Laboratory, Brigham Young University (1984).
4. Smith, P. J., T. H. Fletcher, L. L. Baxter, and L. D. Smoot, "Coal-Water Mixtures Combustion Modeling," Final Report for U.S. DOE/ METC Contract No. DE-AC21-83MC20182, Combustion Laboratory, Brigham Young University (December, 1984).
5. Dudek, D. and T. H. Fletcher, "Numerical Calculation of the Drag Force Induced by Natural Convection on Spheres at Low Grashof Numbers," Sandia Report SAND87-8201, available NTIS (February, 1987).
6. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, M. S. Solum, and D. M. Grant, "A Chemical Percolation Model for Devolatilization: Milestone Report," Sandia report SAND92-8207, available NTIS (May, 1992). (72 pages, not peer-reviewed external to Sandia)
7. Fletcher, T. H. and D. R. Hardesty, "Compilation of Sandia Coal Devolatilization Data: Milestone Report," for DOE/PETC under contract FWP 0709, Sandia Report No. SAND92-8209, available NTIS (May, 1992). (338 pages, not peer-reviewed external to Sandia)

8. Fletcher, T. H., T. Brady, W. Reade, and J. N. Harb, "Fuel Characterization Tests," Final Report for TRW P.R. No. GE4471 (August, 1993).
9. Hedman, P. O., L. D. Smoot, B. S. Brewster, and T. H. Fletcher, "Combustion Modeling in Advanced Gas Turbine Systems," Final Report for Subcontract 93-01-SR014, South Carolina Energy Research and Development Center (February, 1998).
10. Ulibarri, T. A., D. K. Derzon, K. L. Erickson, J. Castaneda, T. T. Borek, A. M. Renlund, J. C. Miller, D. Clayton, T. Fletcher, "Preliminary Investigation of the Thermal Decomposition of Ablefoam and EF-AR20 Foam (Ablefoam Replacement)," Sandia Report No. SAND2002-0183 (January, 2002).
11. Hobbs, M. L., K. L. Erickson, T. Y. Chu, T. T. Borek, K. R. Thompson, K. J. Dowding, D. Clayton, and T. H. Fletcher, "CPUF – A Chemical-Structure-Based Polyurethane Foam Decomposition and Foam Response Model," Sandia Report No. SAND2003-2282 (July, 2003).
12. Baxter, L. L., E. G. Eddings, T. H. Fletcher, K. E. Kelly, J. S. Lighty, R. J. Pugmire, A. F. Sarofim, G. D. Silcox, P. J. Smith, J. N. Thornock, J. O. L. Wendt, and K. J. Whitty, "Clean Coal Program Research Activities," Final Report for DOE Cooperative Agreement DE-FC26-06NT42808 (May, 2010).
13. Gallacher, J. R., T. H. Fletcher, V. Lansinger, S. Hansen, T. Ellsworth, and D. R. Weise, "Physical Characteristics of Shrub and Conifer Fuels for Fire Behavior Models," Research Paper PSW-RP-269, Pacific Southwest Research Station, USDA Forest Service, pp. 1-43 (January, 2017). (peer-reviewed)

### **Presentations at ACERC Meetings**

1. Pugmire, R. J. and T. H. Fletcher, "An Overview of Thrust Area 1," presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
2. Fletcher, T. H., T. K. Gale, and C. H. Bartholomew, "Changes in Diameter and Surface Areas of Chars During Pyrolysis at Heating Rates, Temperatures, and Steam Concentrations Typical of Commercial Combustion Environments," presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
3. Hill, S. C. and T. H. Fletcher, "Overview of Thrust Area 5," presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
4. Chen, W., Smoot, L. D., S. C. Hill, and T. H. Fletcher, "An Improved NO<sub>x</sub> submodel with Reburning," presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
5. Watt, M. and T. H. Fletcher, "Coal Nitrogen Chemistry in Coal," poster presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
6. Pugmire, R. J., T. H. Fletcher, and D. B. Genetti, "Predicting <sup>13</sup>C NMR Measurements Based on Coal Elemental Composition," poster presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
7. Fletcher, T. H., J. Ma, B. W. Webb, and J. Rigby, "Soot in Coal Combustion," poster presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
8. Flores, D. V. and T. H. Fletcher, "A Two Mixture Fraction Approach for Modeling Turbulent Combustion of Coal Volatiles and Char Oxidation Products," poster presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).

9. Hedman, P. O., T. H. Fletcher, S. Schmidt, C. Phillips, R. Dawson, J. Haslam, R. Murray, and H. Mallampalli, "Advanced Gas Turbine Systems (ATS) Research Program," poster presented at the 9th Annual ACERC Conference, Provo, Utah (April 5-6, 1995).
10. Fletcher, T. H., J. Ma, J. Rigby, and B. W. Webb, "Understanding the Role of Soot in Coal Combustion," presented at the 10th Annual ACERC Conference, Provo, Utah (March 6-8, 1996).
11. Watt, M., E. Hambly, D. Genetti, and T. H. Fletcher, "Nitrogen Release During Coal Devolatilization," poster presented at the 10th Annual ACERC Conference, Provo, Utah (March 6-8, 1996).
12. Fletcher, T. H., J. Ma, J. Rigby, and B. W. Webb, "Understanding the Role of Soot in Coal Combustion," presented at the 10th Annual ACERC Conference, Provo, Utah (March 6-8, 1996).
13. Brown, A. L., D. V. Flores, and T. H. Fletcher, "Model Improvements in PCGC-3," poster presented at the 10th Annual ACERC Conference, Provo, Utah (March 6-8, 1996).
14. Hedman, P. O., T. H. Fletcher, R. W. Dawson, D. V. Flores, J. K. Haslam, K. B. Kinghorn, H. P. Mallampalli, R. L. Murray, and C. G. Phillips, "Advanced Gas Turbine System (ATS) Research Program, poster presented at the 10th Annual ACERC Conference, Provo, Utah (March 6-8, 1996).
15. Fletcher, T. H. and D. Genetti, "Predicting  $^{13}\text{C}$  NMR Measurements of the Chemical Structure of Coal Based on Proximate and Ultimate Analysis," oral and poster presentation at the 11th Annual ACERC Conference, Provo, Utah (March 12-13, 1997).
16. Fletcher, T. H. and S. C. Hill, "Research Advances in Comprehensive Modeling," presented at the 11th Annual ACERC Conference, Provo, Utah (March 12-13, 1997).
17. Hambly, E., D. Genetti, S. Perry, and T. H. Fletcher, "Nitrogen Release During Coal Devolatilization," poster presented at the 11th Annual ACERC Conference, Provo, Utah (March 12-13, 1997).
18. Brown, A. and T. H. Fletcher, "Modeling Soot in Coal Combustion," poster presented at the 11th Annual ACERC Conference, Provo, Utah (March 12-13, 1997).
19. Fletcher, T. H. and A. Brown, "Modeling Soot in Pulverized Coal Flames," oral presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
20. Hambly, E. and T. H. Fletcher, "Solid-State  $^{13}\text{C}$  NMR Analysis of Coal Tar," poster presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
21. Genetti, D. B. and T. H. Fletcher, "Chemical Percolation Devolatilization Model (CPD)," poster presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
22. Perry, S. T. and T. H. Fletcher, "Use of Chemical Structural Char Data to Better Understand Nitrogen Release Chemistry," poster presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
23. Zhang, H. and T. H. Fletcher, "Char Oxidation during Late Burnout," poster presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
24. Hong, J. and T. H. Fletcher, "High Pressure Char Oxidation Modeling," poster presentation at the 12<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 25-26, 1998).
25. Fletcher, T. H. and D. Genetti, "Advancements in Modeling Coal Pyrolysis Based on Chemical Structure," oral presentation at the 13<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 1999).

26. Hong, J. and T. H. Fletcher, "Analytical Expressions for Predicting the Effectiveness Factor for the mth Order and Langmuir Rate Equations in Spherical Coordinates," poster presented at the 13<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 1999).
27. Genetti, D. and T. H. Fletcher, "An Advanced Model for Coal Nitrogen Pyrolysis Based on Chemical Structure," poster presented at the 13<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 1999).
28. Perry, S. T., and T. H. Fletcher, "A Global Mechanisms for Nitrogen Release during Primary Coal Devolatilization," poster presented at the 13<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 1999).
29. Zhang, H. and T. H. Fletcher, "Nitrogen Transformations during Secondary Coal Pyrolysis," poster presented at the 13<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 1999).
30. Fletcher, T. H., S. T. Perry, R. J. Pugmire, and M. S. Solum, "A Global Free-Radical Mechanism for Nitrogen Release during Coal Devolatilization Based on Chemical Structure," oral presentation at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
31. Hedman, P. O. and T. H. Fletcher, "Observations of Flame Behavior in a Laboratory-Scale Premixed Natural Gas/Air Gas Turbine Combustor: Planar Laser Induced Fluorescence (PLIF) of OH," oral presentation at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
32. Pugmire, R. J., M. S. Solum, H. Zhang, and T. H. Fletcher, "Soot Characterization by Solid-State NMR," oral presentation at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
33. Fletcher, T. H. and D. Clayton, "Decomposition of Low-Density Polyurethane Foam at High Pressure," poster presented at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
34. Hong, J., W. C. Hecker, and T. H. Fletcher, "Modeling Char Oxidation at Atmospheric and Elevated Pressures using an Intrinsic Langmuir Rate Equation and an Effectiveness Factor," poster presented at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
35. Parker, J. T., T. H. Fletcher, R. E. Winans, and S. Seifert, "Small Angle X-Ray Scattering Study of Coal Soot Formation," poster presented at the 14<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 17-18, 2000).
36. Fletcher, T. H., D. Zeng, M. Clark, B. Crenshaw, and W. C. Hecker, "High Pressure Coal Combustion," presented at the 16<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 14-15, 2002).
37. Clayton, D. and T. H. Fletcher, "High Pressure Thermal Decomposition of Two Rigid Closed-Cell Foams," poster presented at the 16<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 14-15, 2002).
38. Fletcher, T. H., D. Zeng, M. Clark, B. Crenshaw, and W. C. Hecker, "High Pressure Char Combustion," poster presented at the 16<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 14-15, 2002).
39. Lahn, S., H. R. Pond, T. H. Fletcher, and L. L. Baxter, "CPD Modeling for Black Liquor Devolatilization," poster presented at the 16<sup>th</sup> Annual ACERC Conference, Provo, Utah (March 14-15, 2002).

40. Fletcher, T. H., L. L. Baxter, J. Engstrom, and J. Butler, "Fundamental Combustion Rates of Live Fuels," presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
41. Pond, H. R., T. H. Fletcher, and L. L. Baxter, "Prediction of Tar and Light Gas During Pyrolysis of Black Liquor and Biomass," presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
42. Zeng, D., M. Clark, and T. H. Fletcher, "High Pressure Coal Pyrolysis," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
43. Lu, H., J. Scott, L. L. Baxter, and T. H. Fletcher, "Effects of Particle Shape and Size on Particle Reactivity," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
44. Ip, E., H. Lu, J. Scott, L. L. Baxter, T. H. Fletcher, and K. Whitty, "Surface Temperature Distribution Measurement Using Imaging Cameras, poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
45. Webster, J., L. L. Baxter, and T. H. Fletcher, "Black Liquor Pyrolysis," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
46. Damstedt, B., D. Dunaway, S. Lokare, R. Marsh, D. Rogers, C. Wu, L. L. Baxter, T. H. Fletcher, and D. R. Tree, "The Study of SO<sub>x</sub> Reduction by K<sub>2</sub>CO<sub>3</sub> in Petroleum Coke Combustion," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
47. Damstedt, B., R. March, C. Wu, L. L. Baxter, T. H. Fletcher, and D. R. Tree, "Fuel-Nitrogen Functional Groups and Their Evolution in Low-Grade Fuel Combustion," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
48. Hardy, S., D. Morse, R. Price, T. H. Fletcher, and S. C. Hill, "Modeling the Direct Solar Conversion of CO<sub>2</sub> to CO," poster presented at the 17<sup>th</sup> Annual ACERC Conference, Salt Lake City, Utah (February 20-21, 2003).
49. Zeng, D., T. Gunderson, W. C. Hecker, and T. H. Fletcher, "Swelling Properties and Intrinsic Reactivities of Coal Chars Produced at Elevated Pressures and High Heating Rates," oral presentation and poster presented at the 18<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 12-13, 2004).
50. Lu, H., J. Scott, M. Vickers, B. Ripa, R. Farr, T. H. Fletcher, and L. L. Baxter, "Effects of Particle Shape and Size on Biomass Reactivity," oral presentation and poster presented at the 18<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 12-13, 2004).
51. Price, R. J., T. H. Fletcher, R. J. Jensen, "The Solar Conversion of CO<sub>2</sub> to CO and O<sub>2</sub>," poster presented at the 18<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 12-13, 2004).
52. Smith, S. G., T. H. Fletcher, L. L. Baxter, and D. R. Weise, "Ignition Behavior of Live California Chaparral Leaves," poster presented at the 18<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 12-13, 2004).
53. Clark, M., T. H. Fletcher, and R. R. Linn, "Improvements to a Wildland Fire Model," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
54. Smith, S. G., G. S. Spittle, B. M. Pickett, M. M. Woodhouse, T. H. Fletcher, and D. R. Weise, "Effect of Moisture on Combustion of Live Leaves," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
55. Zeng, D., B. Christensen, W. C. Hecker, and T. H. Fletcher, "The Effect of Pressure on Coal Pyrolysis, Char Intrinsic Reactivity, and Morphology," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).

56. Zeng, D., W. C. Hecker, and T. H. Fletcher, "The Effect of Pressure on Char Combustion Kinetics," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
57. King, N., W. V. Wilding, and T. H. Fletcher, "Modeling Vapor/Liquid Equilibrium of Polymer/Solvent Solutions During Thermal Decomposition of Removable Epoxy Foam," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
58. Price, R. and T. H. Fletcher, "Improvements to the Coal Submodels in Star-CD," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
59. Wooters, T. J., T. H. Fletcher, and L. L. Baxter, "CPD Modeling of Black Liquor Pyrolysis," poster presented at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
60. Fletcher, T. H. and D. Zeng, "The Effect of Pressure on Coal Pyrolysis and Char Morphology," oral presentation at the 19<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 17-18, 2005).
61. Zeng, D., and T. H. Fletcher, "High Pressure High Temperature O<sub>2</sub>-Char Reactivity Experiments," oral presentation at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
62. King, N., W. V. Wilding, and T. H. Fletcher, "Modeling Vapor/Liquid Equilibrium of Polymer/Solvent Solutions During Thermal Decomposition of Removable Epoxy Foam," poster presented at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
63. Pickett, B., M. Woodhouse, L. Haake, D. Weise, and T. H. Fletcher, "Effect of Moisture on Combustion of Live Leaves," poster presented at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
64. Clark, M., T. H. Fletcher, and R. R. Linn, "A Subgrid Gas-Phase Combustion Model for *FIRETEC*," poster presented at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
65. Price, R., R. Jensen, and T. H. Fletcher, "Modeling the Direct Solar Conversion of CO<sub>2</sub> to CO and O<sub>2</sub>," poster presented at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
66. Fletcher, D., S. Grange, J. Crosby, J. Wammack, J. Bons, and T. H. Fletcher, "Evolution of Surface Deposits on a High Pressure Turbine Blade," poster presented at the 20<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 16-17, 2006).
67. Crosby, J., W. Ai, S. Lewis, A. Mason, R. Laycock, T. H. Fletcher, and J. Bons, "Effects of Particle Size, Gas Temperature, and metal Temperature on High Pressure Turbine Deposition in Land Based Gas Turbines from Various Synfuels," oral presentation at the 21<sup>st</sup> Annual ACERC Conference, Provo, Utah (February 27-28, 2007).
68. Price, R. and T. H. Fletcher, "Implementation of PCGC-3 Coal Combustion Submodels into STAR-CD," oral presentation at the 21<sup>st</sup> Annual ACERC Conference, Provo, Utah (February 27-28, 2007).
69. King, N., T. H. Fletcher, W. V. Wilding, and K. L. Erickson, "Vapor/Liquid Equilibrium of Polymer Solutions during Thermal Decomposition of Removable Epoxy Foam," poster presented at the 21<sup>st</sup> Annual ACERC Conference, Provo, Utah (February 27-28, 2007).
70. Pickett, B. M., S. Christensen, J. Fletcher, C. Isackson, T. Do, T. H. Fletcher, and D. Weise, "Combustion Behavior of Fresh Wildland Forest Fuels," poster presented at the 21<sup>st</sup> Annual ACERC Conference, Provo, Utah (February 27-28, 2007).
71. Price, R. and T. H. Fletcher, "Premixed Turbulent Combustion Measurements," poster presented at the 21<sup>st</sup> Annual ACERC Conference, Provo, Utah (February 27-28, 2007).

72. Ai, W. and T. H. Fletcher, "Deposition of Particulate from Coal-Derived Syngas on Turbine Blades with Film Cooling," oral presentation and poster at the 22<sup>nd</sup> Annual ACERC Conference, Provo, Utah (February 26-27, 2008).
73. Hillier, J. and T. H. Fletcher, "Kinetics of Kerogen Extracted from Green River Oil Shale Measured at Different Pressures," oral presentation and poster at the 22<sup>nd</sup> Annual ACERC Conference, Provo, Utah (February 26-27, 2008).
74. Shurtz, R., D. Johnson, T. H. Fletcher, M. S. Solum, and R. J. Pugmire, "Soot Formation from Coal Tar Surrogates under Gasification Conditions," oral presentation and poster at the 22<sup>nd</sup> Annual ACERC Conference, Provo, Utah (February 26-27, 2008).
75. Sowa, J., K. Kolste, and T. H. Fletcher, "Investigation of Nitrogen Release during Pyrolysis in an Oxycombustion Process," oral presentation and poster at the 22<sup>nd</sup> Annual ACERC Conference, Provo, Utah (February 26-27, 2008).
76. Pickett, B. M., C. Isackson, R. Miller, T. H. Fletcher, B. W. Butler, and D. R. Weise, "Burning Characteristics of Multiple Moist Forest Fuel Samples," poster presented at the 22<sup>nd</sup> Annual ACERC Conference, Provo, Utah (February 26-27, 2008).
77. Ai, W., S. Harding, R. Laycock, N. Murray, D. Rappleye, T. H. Fletcher, and J. P. Bons, "Computational Analysis of Conjugate Heat Transfer and Particulate Deposition Prediction," oral presentation and poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
78. Cole, W. J., B. M. Pickett, and T. H. Fletcher, "A Semi-empirical Multi-leaf Model for Fire Spread through a Manzanita Bush," oral presentation and poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
79. Sowa, J., K. Kolste, and T. H. Fletcher, "Investigation of Nitrogen Release during Coal Pyrolysis in an Oxyfuel Combustion Process," oral presentation and poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
80. Hillier, J. and T. H. Fletcher, "An Improved Method for Determination of Kinetic Parameters from Constant Heating Rate TGA Oil Shale Pyrolysis Data," oral presentation and poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
81. Shurtz, R., D. Johnson, D. Prince, J. Van Wagoner, G. Sorenson, and T. H. Fletcher, "A Pressurized Flat-Flame Burner for Gasification Studies," poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
82. Kim, R., K. Kolste, C. Jeon, J. Song, and T. H. Fletcher, "Nitrogen Release during Devolatilization in Coals Utilized in Korea," poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
83. Adams, C., T. H. Fletcher, K. Fowers, D. Hinckley, B. Alexander, C. Moss, "The CHES Process: High Efficiency Shale Oil Recovery," poster at the 23<sup>rd</sup> Annual ACERC Conference, Provo, Utah (February 23-24, 2009).
84. Shurtz, R. and T. H. Fletcher, "Pressurized Coal Pyrolysis and CO<sub>2</sub> Gasification at High Initial Heating Rates," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
86. Lewis, A. and T. H. Fletcher, "Predicting Sawdust Pyrolysis Yields Using the CPD Code with a Tar Cracking Model," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
87. Pugmire, R. J., M. S. Solum, R. Shurtz, and T. H. Fletcher, "Structure Transformations of Coal to Char and Tar/Soot Formation during Gasification," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).



88. Dennis, M., W. Cole, and T. H. Fletcher, "Effects of Wind on Flame Characteristics of Leaves and Needles," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
89. Cole, W., M. Dennis, and T. H. Fletcher, "Observations of Burning Bush Behavior as a Function of Wind and Moisture Content," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
90. Andersen, B., W. Cole, M. Dennis, and T. H. Fletcher, "Modeling a Burning Bush with and without Wind using a Semi-Empirical Model," oral presentation and poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
91. Laycock, R., D. Rappleye, J. Gallacher, W. Ai, T. H. Fletcher, and J. P. Bons, "Deposition of Particulate from Coal-derived Syngas on Turbine Blades with Film Cooling," poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).
92. Hillier, J., T. Bezzant, and T. H. Fletcher, "Structural Information of an Organic Sample from Pyrolysis Products," poster at the 24<sup>th</sup> Annual ACERC Conference, Provo, Utah (February 25-26, 2010).

### **Student M.S. Theses**

1. Flores, D. V., "The Use of Two Mixture Fractions to Treat Coal Combustion Products in Turbulent Pulverized-Coal Flames," M.S. Thesis, Chemical Engineering Department, Brigham Young University (April, 1996).
2. Watt, M., "The Chemical Structure of Coal Tar and Char During Devolatilization," M.S. Thesis, Chemical Engineering Department, Brigham Young University (August, 1996).
3. Mallampalli, H., "Evaluation of CH<sub>4</sub>/NO Global Mechanisms Used for Modeling Lean Premixed Turbulent Combustion of Natural Gas," M.S. Thesis, Chemical Engineering Department, Brigham Young University (August, 1996).
4. Brown, Alexander L., "Modeling Soot in Pulverized Coal Flames," M.S. Thesis, Mechanical Engineering Department, Brigham Young University (August, 1997).
5. Hambly, Eric M., "The Chemical Structure of Coal Char and Tar during Devolatilization," M.S. Thesis, Chemical Engineering Department, Brigham Young University (April, 1998).
6. Genetti, D. B., "An Advanced Model of Coal Devolatilization Based on Chemical Structure," M.S. Thesis, Chemical Engineering Department, Brigham Young University (April, 1999).
7. Smith, S. G., "Effects of Moisture on Combustion Characteristics of Live California Chaparral and Utah Foliage," M.S. Thesis, Chemical Engineering Department, Brigham Young University (August, 2005).
8. Sowa, J. M., "Studies of Coal Nitrogen Release Chemistry for Oxyfuel Combustion and Chemical Additives," M.S. Thesis, Chemical Engineering Department, Brigham Young University (December, 2009).
9. Lewis, A. D., "Sawdust Pyrolysis and Petroleum Coke CO<sub>2</sub> Gasification at High Heating Rates," M.S. Thesis, Chemical Engineering Department, Brigham Young University (April, 2011).
10. Shen, C., "Application of Fuel Element Combustion Properties to a Semi-Empirical Flame Propagation Model for Live Wildland Utah Shrubs," M.S. Thesis, Chemical Engineering Department, Brigham Young University (April, 2013).

### **Student Ph.D. Dissertations**

1. Ma, J., "Soot Formation During Coal Pyrolysis," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (August, 1996).
2. Perry, S. T., "A Global Free-Radical Mechanism for Nitrogen Release during Coal Devolatilization Based on Chemical Structure," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (December, 1999).
3. Hong, J., "Modeling Char Oxidation as a Function of Pressure Using an Intrinsic Langmuir Rate Equation," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (April, 2000).
4. Zhang, H., "Nitrogen Evolution and Soot Formation during Secondary Pyrolysis," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (April, 2001).
5. Clayton, D. J., "Modeling Flow Effects during Polymer Decomposition Using Percolation Lattice Statistics," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (December, 2002).
6. Flores, D. V., "Analysis of Lean Premixed Turbulent Combustion Using Coherent Anti-Stokes Raman Spectroscopy Temperature Measurements," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (April, 2003).
7. Zeng, D., "Effects of Pressure on Coal Pyrolysis at High Heating Rates and Char Combustion," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (December, 2005).
8. Price, R., J., "Modeling Three Reacting Flow Systems with Modern Computational Fluid Dynamics," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University, (August, 2007).
9. Clark, M. M., "Development and Evaluation of a Sub-Grid Combustion Model for a Landscape Scale 3-D Wildland Fire Simulator," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (August, 2008).
10. King, N. H., "Vapor-Liquid Equilibrium of Polymer Solutions during Thermal Decomposition of Rigid Foams," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (August, 2008).
11. Pickett, B. M., "Effects of Moisture on Combustion of Live Wildland Forest Fuels," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University, (August, 2008).
12. Ai, W., "Deposition of Particulate from Coal-derived Syngas on Gas Turbine Blades Near Film Cooling Holes," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (December, 2009).
13. Hillier, J. L., "Pyrolysis Kinetics and Chemical Structure Considerations of a Green River Oil Shale and its Derivatives," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (April, 2011).
14. Shurtz, R. C., "Effects of Pressure on the Properties of Coal Char under Gasification Conditions at High Heating Rates," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (December, 2011).
15. Prince, D. R., "Measurement and Modeling of Fire Behavior in Leaves and Sparse Shrubs," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (July, 2014).
16. Lewis, A. D., "Gasification of Biomass, Coal, and Petroleum Coke at High Heating Rates and Elevated Pressure," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (November, 2014).

17. Gallacher, J. R., "The Influence of Season, Heating Mode and Slope Angle on Wildland Fire Behavior," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (February, 2016).
18. Laycock, R. G., "Particle Deposition Behavior from Coal-Derived Syngas in Gas Turbines at Modern Turbine Inlet Temperatures," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (July, 2017).
19. Holland, T. M., "A Comprehensive Coal Conversion Model Extended to Oxy-coal Conditions," Ph.D. Dissertation, Chemical Engineering Department, Brigham Young University (July, 2017).

### **Presentations at Technical Meetings**

**(requiring associated paper unless stated; ACERC meetings listed separately)**

1. Fletcher, T. H., P. J. Smith, and L. D. Smoot, "Evaluation of a 2-D Coal Combustion Model," 1984 Spring Meeting of the Western States Section of the Combustion Institute, Boulder, Colorado (April, 1984).
2. Fletcher, T. H., P. J. Smith, L. L. Baxter, and L. D. Smoot, "Coal-Water Mixtures Modeling," First Annual Heat Engines Contractor's Meeting, U.S. DOE/METC, Morgantown, West Virginia (May, 1984).
3. Baxter, L. L., T. H. Fletcher, P. J. Smith, and L. D. Smoot, "Coal-Water Mixtures Combustion Model," 1984 Fall Meeting of the Western States Section of the Combustion Institute, Palo Alto, California (October, 1984).
4. Brown, B. W., K. B. Christensen, T. H. Fletcher, P. O. Hedman, P. J. Smith, and L. D. Smoot, "Modeling and Experimental Studies of An Entrained Flow Gasifier," presented at the AIChE 1984 Annual Meeting, San Francisco, California (November 25-30, 1984).
5. Holve, D. J., K. Gomi, and T. H. Fletcher, "Comparative Combustion Studies of Ultrafine Coal/Water Slurries and Pulverized Coal," presented at the Seventh International Symposium on Coal Slurry Fuels Preparation and Utilization, New Orleans, Louisiana (May 21-24, 1985).
6. Musarra, S. P., T. H. Fletcher, S. Niksa, and H. A. Dwyer, "Heat and Mass Transfer in the Vicinity of a Devolatilizing Coal Particle," presented at the 23rd ASME/AIChE National Heat Transfer Conference, Denver, Colorado (August, 1985).
7. Fletcher, T. H., "Sensitivity of Combustion Calculations to Devolatilization Rate Expressions," presented at the 1985 Fall Meeting of the American Flame Research Committee, Sandia National Laboratories, Livermore, California (October 17-18, 1985).
8. Holve, D. J., J. Hoornstra, and T. H. Fletcher, "The Influence of Size Distribution Characteristics in Heterogeneous Combustion," presented at the 1985 Fall Meeting of the American Flame Research Committee, Sandia National Laboratories, Livermore, California (October 17-18, 1985).
9. Smith, P. J. and T. H. Fletcher, "A Study of Two Chemical Reaction Models in Turbulent Coal Combustion," presented at the 1985 Fall Meeting of the Western States Section of the Combustion Institute, Davis, California (October 21-22, 1985).
10. Smith, P. J. and T. H. Fletcher, "A Study of Two Chemical Reaction Models in Turbulent Coal Combustion," presented at the ASME 107th Winter Annual Meeting (1986).
11. Niksa, S., A. R. Kerstein, and T. H. Fletcher, "Predicting Devolatilization at Typical Coal Combustion Conditions with the Distributed-Energy Chain Model," American Chemical

- Society Division of Fuel Chemistry Preprints, **31**:3, 237, Anaheim, California (September, 1986)
12. Niksa, S., A. R. Kerstein, and T. H. Fletcher, "Predicting Devolatilization at Typical Coal Combustion Conditions with the Distributed-Energy Chain Model," presented at the 2nd ASME/JSME Thermal Engineering Joint Conference, Honolulu, Hawaii (March, 1987).
  13. Baxter, L. L., D. K. Ottesen, and T. H. Fletcher, "Spectral Emission Characteristic of Coal Particles," presented at the 1987 Spring Meeting of the Western States Section of the Combustion Institute, Provo, Utah (April, 1987).
  14. Fletcher, T. H., Baxter, L. L., and Ottesen, D. K., "Spectral Emissivities of Size-Graded Coal Particles: Implications for Pyrometry," *1987 International Conference on Coal Science*, ed. Moulign, J. A., Nater, K. A., and Chermin, H. A. G., Elsevier, New York, p. 945 (1987).
  15. Fletcher, T. H., L. L. Baxter, and D. K. Ottesen, "Spectral Emission Characteristics of Size-Graded Coal Particles," ACS Division of Fuel Chemistry preprints, **32**:3, 42-50, New Orleans, Louisiana (1987).
  16. Fletcher, T. H., "Kinetics of Rapid Coal Devolatilization," presented at the 1987 PETC/METC AR&TD Contractors' Review Meeting, Morgantown, West Virginia (October 14-16, 1987).
  17. Grant, D. M., R. J. Pugmire, T. H. Fletcher, and A. R. Kerstein, "A Chemical Model of Coal Devolatilization Using Percolation Lattice Statistics," presented at the 1988 Spring Meeting of the Western States Section of the Combustion Institute, Salt Lake City, Utah (March, 1988). Also in ACS Division of Fuel Chemistry preprints, **33**:2, 322 Toronto, Canada (June, 1988).
  18. Fletcher, T. H., "Time-Resolved Temperature Measurements of Individual Coal Particles During Devolatilization," presented at the 1988 Spring Meeting of the Western States Section of the Combustion Institute, Salt Lake City, Utah (March, 1988). Presented at the poster session of the 22nd Symposium (International) on Combustion, Seattle, Washington (August, 1988).
  19. Fletcher, T. H., "Kinetics of Rapid Coal Devolatilization," presented at the 1988 PETC/METC AR&TD Contractors' Review Meeting, Pittsburgh, Pennsylvania (September 6-9, 1988).
  20. Fletcher, T. H., "Time-Resolved Particle Temperature and Mass Loss Measurements of a Bituminous Coal During Devolatilization," presented at the 1988 Fall Meeting of the Western States Section of the Combustion Institute, Dana Point, California (October 17-18, 1988).
  21. Solum, M. S., R. J. Pugmire, D. M. Grant, T. H. Fletcher, and P. Solomon, "Solid State  $^{13}\text{C}$  NMR Studies of Coal Char Structure Evolution," presented at the 1989 Spring Meeting of the Western States Section of the Combustion Institute, Pullman, Washington (March 20-21, 1989).
  22. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, and D. M. Grant, "Prediction of the Effects of Heating Rate and Temperature on Pulverized Coal Devolatilization," presented at the First Symposium on Advances in Coal Spectroscopy, Snowbird, Utah (June 14-16, 1989).
  23. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, R. J., and D. M. Grant, "A Chemical Percolation Model for Devolatilization: II. Temperature and Heating Rate Effects," ACS Division of Fuel Chemistry preprints, **34**:4, 1272, Miami Beach, Florida (1989).

24. Solum, M. S., R. J. Pugmire, D. M. Grant, T. H. Fletcher, and P. R. Solomon, "Solid State  $^{13}\text{C}$  NMR Studies of Coal Char Structure Evolution," ACS Division of Fuel Chemistry preprints, **34**:4, 1337, Miami Beach, Florida (1989).
25. Fletcher, T. H., A. R. Kerstein, R. J. Pugmire, and D. M. Grant, "A Chemical Percolation Model for Devolatilization: II. Temperature and Heating Rate Effects," presented at the 1989 Fall Meeting of the Western States Section of the Combustion Institute, Livermore, California (October, 1989).
26. Fletcher, T. H., "Kinetics of Rapid Coal Devolatilization," presented at the 1989 PETC/METC AR&TD Contractors' Review Meeting, Morgantown, West Virginia (October 3-5, 1989).
27. Pugmire, R. J., T. H. Fletcher, D. M. Grant, and A. R. Kerstein, "A Chemical Model of Coal Devolatilization Using Percolation Lattice Statistics," *Proceedings of the 1989 International Conference on Coal Science*, Elsevier Press, London, England, vol. 1, p. 481 (October 23-27, 1989).
28. Mitchell, R. E. and T. H. Fletcher, "Particle-Sizing Pyrometry in Pulverized Coal-Seeded Flow Reactors," presented at the Annual Meeting of the American Institute of Chemical Engineers, San Francisco, CA (November, 1989). (no associated technical paper)
29. Lo, R., T. H. Fletcher, R. J. Pugmire, and H. Meuzelaar, "Curie-Point Desorption GC/MS and Low Voltage MS Studies of the Chemical Composition of Coal Tars During Rapid Devolatilization," presented at the 13th Annual Symposium of the Rocky Mountain Fuel Society, Salt Lake City, Utah (March, 1990).
30. Pugmire, R. J., T. H. Fletcher, M. S. Solum, S. Critchfield, and D. M. Grant, "Structural Evolution of Matched Tar/Char Pairs in Rapid Pyrolysis Experiments," presented at the poster session for the Twenty-Third Symposium (International) on Combustion, Orleans, France (July 22-27, 1990).
31. Lo, R., R. J. Pugmire, T. H. Fletcher, and H. L. C. Meuzelaar, "Mass Spectrometric Studies of the Chemical Composition of Coal Tars Produced in a Laminar Flow Reactor," ACS Division of Fuel Chemistry preprints, **35**:3, 697, Washington D. C. (1990).
32. Pugmire, R. J., M. S. Solum, D. M. Grant, S. Critchfield, and T. H. Fletcher, "Structural Evolution of Matched Tar/Char Pairs in Rapid Pyrolysis Experiments," presented at the International Conference on Coal Structure and Reactivity, Queens College, Cambridge, UK (September 5-7, 1990).
33. Baxter, L. L., R. E. Mitchell, and T. H. Fletcher, "Experimental Determination of Mineral Matter Release During Coal Devolatilization," proceedings of the Seventh Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, p. 62 (1990).
34. Solomon, P. R., T. H. Fletcher, and R. J. Pugmire, "Progress in Coal Pyrolysis," proceedings of the Seventh Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, p. 3 (1990).
35. Fletcher, T. H., "Rates and Mechanisms of Pulverized Coal Devolatilization at Rapid Heating Rates," presented at the DOE/PETC Advanced Research and Technology Development, Direct Utilization and Instrumentation and Diagnostics Contractors' Review Meeting, Pittsburgh, Pennsylvania (September 16-18, 1990).
36. Fletcher, T. H., D. M. Grant, and R. J. Pugmire, "Predicting Vapor Pressures of Tar and Metaplast During Coal Pyrolysis," ACS Division of Fuel Chemistry preprints, **36**:1, 250, Atlanta, Georgia (1991).

37. Pugmire, R. J., T. H. Fletcher, M. S. Solum, and D. M. Grant, "Correlations of Pyrolysis Yields with NMR Data," poster presented at the International Conference on Coal Science, Newcastle upon Tyne, England (September, 1991).
38. Fletcher, T. H., M. S. Solum, D. M. Grant, and R. J. Pugmire, "Chemical Structure of Char in the Transition from Devolatilization to Combustion," ACS Division of Fuel Chemistry preprints, **37**:2, 677, San Francisco, California (1992).
39. Pugmire, R. J., M. S. Solum, D. M. Grant, and T. H. Fletcher, "The Use of C-13 NMR Structural Information for Predicting Coal Devolatilization Behavior," presented at Coal Structure 92: 2nd International Symposium on Structure, Properties and Reactivity of Coal, Krakow, Poland (21-23 September, 1992).
40. Pugmire, R. J., M. S. Solum, T. H. Fletcher, and D. M. Grant, "Coal and Char Structural Parameters Derived from Solid State  $^{13}\text{C}$  NMR Studies," presented at the 5th Australian Coal Science Conference, University of Melbourne, Australia (December, 1992).
41. Gale, T. K., C. H. Bartholomew, and T. H. Fletcher, "Comparison of the Physical Structure of Chars Prepared Under Different Pyrolysis Conditions Such as: Temperature, Gas Atmospheres, and Heating Rates," presented at the Rocky Mountain Fuel Symposium, Salt Lake City, Utah (March 11-12, 1993).
42. Fletcher, T. H., S. Bai, R. J. Pugmire, M. S. Solum, S. Woods, and D. M. Grant, "Chemical Structural Features of Pyridine Extracts of the Argonne Premium Coals Using  $^{13}\text{C}$  NMR Spectroscopy," presented at the 1993 Spring Meeting of the Western States Section of the Combustion Institute, Salt Lake City, Utah (March 22-23, 1993).
43. Pugmire, R. J., M. S. Solum, S. Bai, T. H. Fletcher, S. Woods, and D. M. Grant, "The Use of Solid State C-13 NMR Spectroscopy to Study Pyridine Extracted and Extraction Residues in the Argonne Premium Coals," ACS Division of Fuel Chemistry preprints, **38**:2, 647-654, Denver, Colorado (March 28-April 2, 1993).
44. Fletcher, T. H., S. Bai, J. Ma, S. Woods, M. S. Solum, R. J. Pugmire, and D. M. Grant, " $^{13}\text{C}$  NMR Chemical Structural Features of Coal Extracts, Chars and Tars During Rapid Pyrolysis," poster presentation at Coal Utilization and the Environment, sponsored by *Fuel*, Orlando, Florida (May 17-20, 1993).
45. Cope, R. F., T. H. Fletcher, and W. C. Hecker, "Mineral Effects on the Reactivity of Beulah Zap Lignite Char," poster presentation at Coal Utilization and the Environment, sponsored by *Fuel*, Orlando, Florida (May 17-20, 1993).
46. Gale, T. K., C. H. Bartholomew, and T. H. Fletcher, "Comparison of Reactivity and Physical Structure of Chars Prepared Under Different Pyrolysis Conditions, i.e., Temperature, Gas Atmosphere, and Heating Rate," Proceedings of the 7th International Conference on Coal Science, Vol. 2, pp. 17-20, Banff, Alberta, Canada (September 12-17, 1993).
47. Fletcher, T. H., S. Bai, J. Ma, S. Woods, M. S. Solum, R. J. Pugmire, and D. M. Grant, "Chemical Structural Features of Coal Chars, Tars, and Char Extracts During Rapid Pyrolysis Using  $^{13}\text{C}$  and  $^1\text{H}$  NMR Spectroscopy," Proceedings of the 7th International Conference on Coal Science, Vol. 2, pp. 293-296, Banff, Alberta, Canada (September 12-17, 1993).
48. Ma, J., M. Dean, J. Rossman, T. Sastrawinata, B. Webb, T. H. Fletcher, "Properties of Soot from Coal Tar," presented at the 1993 Fall Meeting of the Western States Section of the Combustion Institute, SRI, Menlo Park, CA (October 18-19, 1993).

49. Fletcher, T. H. and R. J. Pugmire, "Chemical Structure Changes of Coal, Char, and Tar During Devolatilization," invited paper, ACS Division of Fuel Chemistry preprints, **39**:1, 108-112, San Diego, CA (March, 1994).
50. Fletcher, T. H. and R. J. Pugmire, "Chemical Structure Changes of Coal, Char, and Tar During Devolatilization," poster presentation at the Sci-Mix Session of the ACS Spring Meeting, San Diego, CA (March, 1994).
51. Fletcher, T. H., "Combustion Research at Brigham Young University," invited talk (no paper) at the DOE Combustion Modeling Information Exchange, Argonne National Laboratories (March 29-30, 1994).
52. Gale, T. K., C. H. Bartholomew, and T. H. Fletcher, "Decreases in the Swelling and Porosity of Bituminous Coals During Devolatilization at High Heating Rates," poster presented at the *Twenty-Fifth Symposium (International) on Combustion* (July 31-August 5, 1994).
53. Solomon, P. R. and T. H. Fletcher, "The Impact of Pyrolysis in Combustion," an invited topical review paper presented at the *Twenty-Fifth Symposium (International) on Combustion*, Irvine, California (July 31-August 5, 1994).
54. Fletcher, T. H., "Combustion Modeling in Advanced Gas Turbine Systems," Advanced Gas Turbine Systems Research Workshop II, Indianapolis, Indiana (March 26-29, 1995).
55. Flores, D. V. and T. H. Fletcher, "A Two Mixture Fraction Approach for Modeling Turbulent Combustion of Coal Volatiles and Char Oxidation Products," proceedings of the joint technical meeting of the Central and Western (USA) Sections and Mexican National Section of the International Combustion Institute and American Flame Research Committee, San Antonio, Texas (April 23-26, 1995).
56. Ma, J., T. H. Fletcher, B. W. Webb, "Effect of Flame Environment on Soot Formation in Coal Combustion," poster presented at the 8th International Conference on Coal Science, Oviedo, Spain (September 10-15, 1995); in *Coal Science*, edited by J. A. Pajares and J. M. D. Tascón, **1**, 869-872, Elsevier, New York (1995).
57. Watt, M., W. Allen, and T. H. Fletcher, "Changes in the Forms of Nitrogen and Oxygen during Rapid Coal Pyrolysis," poster presented at the 8th International Conference on Coal Science, Oviedo, Spain (September 10-15, 1995); in *Coal Science*, edited by J. A. Pajares and J. M. D. Tascón, **2**, 1685-1688, Elsevier, New York (1995).
58. Flores, D. V. and T. H. Fletcher, "A Two Mixture Fraction Approach for Modeling Turbulent Combustion of Coal Volatiles and Char Oxidation Products," presented at the 8th International Conference on Coal Science, Oviedo, Spain (September 10-15, 1995); in *Coal Science*, edited by J. A. Pajares and J. M. D. Tascón, **2**, 1767-1770, Elsevier, New York (1995).
59. Genetti, D. B., T. H. Fletcher, and R. J. Pugmire, "Predicting <sup>13</sup>C NMR Measurements Based on Coal Elemental Composition," presented at the 8th International Conference on Coal Science, Oviedo, Spain (September 10-15, 1995); in *Coal Science*, edited by J. A. Pajares and J. M. D. Tascón, **1**, 331-334, Elsevier, New York (1995).
60. Rigby, J. R., B.W. Webb, and T. H. Fletcher, "Measurement of the Optical Properties of Coal-Derived and Propane-Derived Soot," presented at the Spring Meeting of the Western States Section of the Combustion Institute, Tempe, Arizona, March 11-12 (1996).
61. Fletcher, T. H., W. Watt, S. Bai, M. S. Solum, and R. J. Pugmire, "Chemical Structure of Coal Tar During Devolatilization," ACS Division of Fuel Chemistry preprints, **41**(2), 752-755, New Orleans, LA (March, 1996).

62. Watt, M., T. H. Fletcher, S. Bai, M. S. Solum, and R. J. Pugmire, "Chemical Structure of Coal Tar During Devolatilization," presented at the Twenty-Sixth Symposium (International) on Combustion, Naples, Italy (July, 1996).
63. Ma, J., T. H. Fletcher, and B. W. Webb, "Conversion of Coal Tar to Soot During Coal Pyrolysis in a Post-Flame Environment," presented at the Twenty-Sixth Symposium (International) on Combustion, Naples, Italy (July, 1996).
64. Mallampalli, H. P., T. H. Fletcher, and J. Y. Chen, "Evaluation of CH<sub>4</sub>/NO<sub>x</sub> Global Mechanisms Used for Modeling Lean Premixed Turbulent Combustion of Natural Gas," presented at the Fall Meeting of the Western States Section of the Combustion Institute, University of Southern California, Los Angeles, CA (October 28-29, 1996).
65. Brown, Alexander L. and T. H. Fletcher, "Modeling Soot in Coal Combustion Flames," presented at the Fall Meeting of the Western States Section of the Combustion Institute, University of Southern California, Los Angeles, CA (October 28-29, 1996).
66. Fletcher, T. H. and P. O. Hedman, "Combustion Modeling in Advanced Gas Turbine Systems: Experimental Measurements," poster and oral presentation at the DOE Advanced Turbine Systems Annual Program Review, Washington D. C. (November 7-8, 1996).
67. Fletcher, T. H. and P. O. Hedman, "Combustion Modeling in Advanced Gas Turbine Systems: Experimental Measurements," presented at the Advanced Gas Turbine Systems Research (AGTSR) Combustion Workshop IV, Atlanta, GA (March 5-7, 1997).
68. Genetti, D. and T. H. Fletcher, "Predicting <sup>13</sup>C NMR Measurements of Chemical Structure of Coal Based on Elemental Composition and Volatile Matter Content," ACS Division of Fuel Chemistry Preprints, **42**:1, 194-198 (April, 1997).
69. Fletcher, T. H. and R. J. Pugmire, "Determination of the Forms of Nitrogen Released in Coal Tar During Rapid Devolatilization," University Coal Research Contractors Review Conference, Pittsburgh, PA (June 3-4, 1997).
70. Hedman, P. O. and T. H. Fletcher, "CARS Temperature and Species, PLIF Images, and LDA Velocity Results from a Premixed Natural Gas/Air Fueled Model Gas Turbine Combustor," poster presented at the 1997 Gordon Conference on the Physics and Chemistry of Laser Diagnostics in Combustion, Plymouth State College, Plymouth, New Hampshire (July 6-10, 1997).
71. Pugmire, R. J., M. S. Solum, D. M. Grant, T. H. Fletcher, and R. A. Wind, "<sup>15</sup>N NMR Spectroscopy of Coals and Pyrolysis Products," proceedings of the 9th International Conference on Coal Science, **1**:417-420, Essen, Germany (September 7-12, 1997).
72. Hambly, E. M., Fletcher, T. H., and Pugmire, R. J., "Solid-State <sup>13</sup>C NMR Analysis of Coal Tar and Char," ACS Division of Fuel Chemistry Preprints, **43**:1, 203-207 (April, 1998).
73. Perry, S. T., T. H. Fletcher, "Modeling of Nitrogen Release during Rapid Coal Devolatilization Based on Detailed Chemical Structural Changes in the Char," ACS Division of Fuel Chemistry Preprints, **43**:1, 141-145 (April, 1998).
74. Fletcher, T. H. and R. J. Pugmire, "Determination of the Forms of Nitrogen Released in Coal Tar During Rapid Devolatilization," University Coal Research Contractors Review Conference, Pittsburgh, PA (June 2-3, 1998).
75. Veranth, J. M., T. H. Fletcher, D. W. Pershing, and A. F. Sarofim, "Impact of Low NO<sub>x</sub> Firing Conditions on Unburned Carbon Losses," presented at the Fall Meeting of the American Flame Research Committee, Maui, Hawaii (October 12-15, 1998).



76. Genetti, D., T. H. Fletcher, and S. Perry, "Modeling Nitrogen Release during Devolatilization Based on Chemical Structure," invited presentation at the 6<sup>th</sup> Japan-China Symposium on Coal and C<sub>1</sub> Chemistry, Zao, Miyagi, Japan (October 13-17, 1998).
77. Sawaya, R. J., J. W. Allen, W. C. Hecker, T. H. Fletcher, and L. D. Smoot, "Kinetics of High Pressure Oxidation," ACS Division of Fuel Chemistry Preprints, **44**:4, 1016-1019 (August, 1999).
78. Hong, J., W. C. Hecker, and T. H. Fletcher, "Predicting Effectiveness Factor for mth Order and Langmuir Rate Equations in Spherical Coordinates," ACS Division of Fuel Chemistry Preprints, **44**:4, 1011-1015 (August, 1999).
79. Perry, S. T., T. H. Fletcher, M. S. Solum, and R. J. Pugmire, "A Mechanistically Derived Model for Nitrogen Release during Primary Coal Devolatilization," presented at the 218<sup>th</sup> National ACS Meeting, New Orleans, LA (August 22-26, 1999).
80. Fletcher, T. H., D. B. Genetti, and S. T. Perry, "Modeling Nitrogen Release Based on Chemical Structural Evolution During Devolatilization of Pulverized Coal," Prospects for Coal Science in the 21<sup>st</sup> Century (proceedings of the 10<sup>th</sup> International Conference on Coal Science), edited by B. Q. Li and Z. Y. Liu, Shanxi Science & Technology Press, Taiyuan, China (September 12-17, 1999).
81. Hong, J., W. C. Hecker, and T. H. Fletcher, "Predicting Effectiveness Factor for mth Order and Langmuir Rate Equations in Spherical Coordinates," presented at the 10<sup>th</sup> International Conference on Coal Science, Taiyuan, China (September 12-17, 1999).
82. Hecker, W. C., L. W. Allen, R. J. Sawaya, T. H. Fletcher, and L. D. Smoot, "Kinetics of High Pressure Oxidation," presented at the 10<sup>th</sup> International Conference on Coal Science, Taiyuan, China (September 12-17, 1999).
83. Hobbs, M. L., K. L. Erickson, T. Y. Chu, and T. H. Fletcher, "Modeling Decomposition of Confined, Rigid, Close-Celled, Polyurethane Foam," Third Biennial Tri-Laboratory Engineering Conference on Modeling and Simulation, Livermore, CA (Nov. 1999).
84. Winans, R. E., J. T. Parker, S. Seifert, and T. H. Fletcher, "Small Angle X-ray Scattering Study of Coal Soot Formation," ACS Division of Fuel Chemistry Preprints, **45**:3, 357-360 (March 26-30, 2000).
85. Zhang, H. and T. H. Fletcher, "Nitrogen Transformations during Secondary Coal Pyrolysis," ACS Division of Fuel Chemistry Preprints, **46**:1, 138-140 (April 1-5, 2001).
86. Madsen, P. M., T. H. Fletcher, W. C. Hecker, "High Pressure Intrinsic Char Oxidation Kinetics," ACS Division of Fuel Chemistry Preprints **46**:1, 318-320 (April 1-5, 2001).
87. Fletcher, T. H. and P. O. Hedman, "Laser Diagnostic Measurements in a Lean-Premixed Laboratory-Scale Gas Turbine Combustor," US-Ukraine Workshop on Innovative Combustion and Aerothermal Technologies in Energy and Power Systems, Kiev, Ukraine (May 21-24, 2001).
88. Hessler, J. P., S. Seifert, R. E. Winans, and T. H. Fletcher, "Small-Angle X-ray Scattering Studies of Soot Inception and Growth," presented at the Royal Society for Faraday Discussion 119, (July 9-11, 2001, the University of Leeds, U.K.).
89. Hessler, J. P., S. Seifert, R. E. Winans, and T. H. Fletcher, "Small-Angle X-Ray Scattering Studies of Soot Inception and Growth," to be presented at the Fifth International Conference on Chemical Kinetics, National Institute of Standards and Technology, Gaithersburg, MD (July 16-20, 2001).

90. Hobbs, M. L., K. L. Erickson, T. Y. Chu, T. H. Fletcher, and D. Clayton, "Decomposition of Rigid, Closed-Cell Polyurethane Foam," presented at the Eighth International Conference on Composites Engineering, Tenerife, Spain (August 5-11, 2001)
91. Zhang, H., T. H. Fletcher, S. T. Perry, M. S. Solum, and R. J. Pugmire, "Soot Formation during Coal Pyrolysis," proceedings of the 11<sup>th</sup> International Conference on Coal Science, San Francisco, CA (Sept. 30-Oct. 5, 2001).
92. Winans, R. E., S. Seifert, T. H. Fletcher, and J. P. Hessler, "In Situ Study of Soot Formation by Small Angle X-Ray Scattering," proceedings of the 11<sup>th</sup> International Conference on Coal Science, San Francisco, CA (Sept. 30-Oct. 5, 2001).
93. Hedman, P. O., T. H. Fletcher, S. G. Graham, G. W. Timothy, D. V. Flores, and J. K. Haslam, "Observations of Flame Behavior in a Laboratory-Scale Pre-Mixed Natural Gas/Air Gas Turbine Combustor from PLIF Measurements of OH," paper GT-2002-20052, ASME Turbo Expo Meeting, Amsterdam, The Netherlands (June 3-6, 2002).
94. Hedman, P. O., R. L. Murray, and T. H. Fletcher, "Observations of Flame Behavior in a Laboratory-Scale Pre-Mixed Natural Gas/Air Gas Turbine Combustor from LDA Velocity Measurements," paper GT-2002-20053, ASME Turbo Expo Meeting, Amsterdam, The Netherlands (June 3-6, 2002).
95. Hedman, P. O., D. V. Flores, and T. H. Fletcher, "Observations of Flame Behavior in a Laboratory-Scale Pre-Mixed Natural Gas/Air Gas Turbine Combustor from CARS Temperature Measurements," paper GT-2002-20054, ASME Turbo Expo Meeting, Amsterdam, The Netherlands (June 3-6, 2002).
96. Tomczyk, N. A., J. E. Hunt, R. E. Winans, M. S. Solum, R. J. Pugmire, and T. H. Fletcher, "Model Compound Study of the Pathways for Aromatic Hydrocarbon Formation in Soot," ACS Fuel Chem. Div. Preprints, 47(2), 731-732 (2002).
97. Fletcher, T. H., L. L. Baxter, J. Engstrom, and J. Butler, "Fundamental Combustion Rates of Live Fuels," presented at the Wildfire Physics Workshop, University of California's Blodgett Forest Research Station (October 21-22, 2002).
98. Fletcher, T. H., H. Pond, J. Webster, and L. L. Baxter, "Pyrolysis of Biomass and Black Liquor: Experiments and Modeling," poster presented at the Gordon Conference for Hydrocarbon Resources, Ventura, CA (January 12-17, 2003).
99. Hecker, W. C., P. M. Madsen, M. R. Sherman, J. W. Allen, R. J. Sawaya, and T. H. Fletcher, "High Pressure Intrinsic Char Oxidation Kinetics of Pittsburgh #8 and North Dakota Lignite Chars," 28th International Technical Conference on Coal Utilization & Fuel Systems, Clearwater, Florida (March 12, 2003).
100. Pond, H. R., T. H. Fletcher, and L. L. Baxter, "Prediction of Tar and Light Gas During Pyrolysis of Black Liquor and Biomass," presented at the 3<sup>rd</sup> Annual Joint Meeting of the U.S. Sections of the Combustion Institute, Chicago, IL (March 16-19, 2003).
101. Webster, J. D., T. H. Fletcher, and L. L. Baxter, "Black Liquor Pyrolysis," poster presented at the 3<sup>rd</sup> Annual Joint Meeting of the U.S. Sections of the Combustion Institute, Chicago, IL (March 16-19, 2003).
102. Engstrom, J. D., J. K. Butler, T. H. Fletcher, and L. L. Baxter, "Fundamental Combustion Rates of Live Fuels," poster presented at the 3<sup>rd</sup> Annual Joint Meeting of the U.S. Sections of the Combustion Institute, Chicago, IL (March 16-19, 2003).
103. Price, R. J., D. A. Morse, S. L. Hardy, T. H. Fletcher, S. C. Hill, and R. J. Jensen, "Modeling the Direct Solar Conversion of CO<sub>2</sub> to CO and O<sub>2</sub>," poster presented at the 3<sup>rd</sup>

- Annual Joint Meeting of the U.S. Sections of the Combustion Institute, Chicago, IL (March 16-19, 2003).
104. Pond, H. R., J. D. Webster, T. H. Fletcher, L. L. Baxter, "Prediction of Tar and Light Gas During Pyrolysis of Black Liquor and Biomass," presented at the Colloquium on Black Liquor Combustion and Gasification, Park City, UT (May 13-16, 2003)
  105. Fletcher, T. H., Zeng, D., and W. C. Hecker, "High Pressure Reactivities of High Pressure Coal Chars," presented at the 12<sup>th</sup> International Conference on Coal Science, Cairns, Australia (November 2-6, 2003).
  106. S. G. Smith, J. D. Engstrom, J. K. Butler, L. L. Baxter, T. H. Fletcher, and D. R. Weise, "Ignition Behavior of Live California Chaparral Leaves," poster P5.3 presented at the 2<sup>nd</sup> International Wildland Fire Ecology and Fire Management Congress, held concurrently with the 5<sup>th</sup> Symposium on Fire and Forest Meteorology, Orlando, Florida (November 16-20, 2003).
  107. Jensen, J. W., S. W. Squire, J. P. Bons, and T. H. Fletcher, "Simulated Land-Based Deposits in an Accelerated Deposition Facility," Paper GT2004-53324, ASME Turbo Expo Meeting, Vienna, Austria (June 14-17, 2004).
  108. Fletcher, T. H., H. R. Pond, J. Webster, J. Wooters, and L. L. Baxter, "Prediction of Tar and Light Gas During Pyrolysis of Black Liquor and Biomass," presented at the International Chemical Recovery Conference, Charleston, SC (June 6-10, 2004).
  109. Weise, F., T. Fletcher, L. Baxter, S. Mahalingam, Z. Zhou, P. Pagni, R. Linn, and B. Butler, "A Fundamental Look at Fire Spread in California Chaparral," presented at the 11<sup>th</sup> Annual AFAC Conference and Inaugural Bushfire CRC Conference, Perth, Australia (October 7-9, 2004).
  110. Wooters, T. J., L. L. Baxter, and T. H. Fletcher, "CPD Model Calculations of Black Liquor and Biomass Pyrolysis," ACS Division of Fuel Chemistry Preprints, 50(1), 108 (March 13-17, 2005).
  111. Fletcher, T. H., "Relationships Between Particle Chemistry and Decomposition Products," presented at the GCEP Advanced Coal Workshop, Provo, UT (March 15-16, 2005).
  112. Smith, S. G., G. S. Spittle, L. L. Baxter, T. H. Fletcher, and D. R. Weise, "Effects of Moisture on Ignition Behavior of Live California Chaparral Leaves," Paper E11, presented at the 4<sup>th</sup> Joint Meeting of the U.S. Sections of the Combustion Institute, Philadelphia, PA (March 20-23, 2005).
  113. Zeng, D. and T. H. Fletcher, "The Effect of Pressure on Coal Pyrolysis and Char Morphology," Paper D6, presented at the 4<sup>th</sup> Joint Meeting of the U.S. Sections of the Combustion Institute, Philadelphia, PA (March 20-23, 2005).
  114. Bons, J. P., J. Crosby, J. E. Wammack, B. I. Bentley, and T. H. Fletcher, "High pressure Turbine Deposition in Land Based Gas Turbines from Various Synfuels," Paper GT2005-68479, ASME Turbo Expo Meeting, Reno, NV (June 6-9, 2005).
  115. Pickett, B. M., S. G. Smith, T. H. Fletcher, and D. R. Weise, "Burning Characteristics of Live California Chaparral and Utah Leaf Samples," presented at the Joint Sixth Symposium on Fire and Forest Meteorology/Interior West Fire Council Conference, Canmore, Alberta, Canada (October 25-27, 2005).
  116. Weise, D. R., T. Fletcher, S. Smith, S. Mahalingam, X. Zhou, and L. Sun, "Correlation of Mass Loss Rate and Flame Height for Live Fuels," to be presented at the Joint Sixth Symposium on Fire and Forest Meteorology/Interior West Fire Council Conference, Canmore, Alberta, Canada (October 25-27, 2005).

117. Weise, D. R., T. H. Fletcher, S. Smith, S. Mahalingam, X. Zhou, L. Sun, "Correlation of Mass Loss Rate and Flame Height for Live Fuels," presented at the Australasian Bushfire Conference, Brisbane, Australia (June 6-9, 2006).
118. Wammack, J. E., J. Crosby, D. Fletcher, J. P. Bons, T. H. Fletcher, "Evolution of Surface Deposits on a High Pressure Turbine Blade, Part I: Physical Characteristics," Paper GT2006-91246, ASME Turbo Expo Meeting, Barcelona, Spain (May 8-11, 2006); accepted by *ASME Journal for Gas Turbines and Power* (2006).
119. Bons, J. P., J. E. Wammack, J. Crosby, D. Fletcher, T. H. Fletcher, "Evolution of Surface Deposits on a High Pressure Turbine Blade, Part II: Convective Heat Transfer," Paper GT2006-91257, ASME Turbo Expo Meeting, Barcelona, Spain (May 8-11, 2006); accepted by *ASME Journal for Gas Turbines and Power* (2006).
120. Pickett, B. M. and T. H. Fletcher, " 'Live' Leaf Combustion at Brigham Young University," Wildland Fire Research Group Meeting, Missoula, MT (June 2006) (no paper required).
121. Bons, J. P., T. H. Fletcher, J. Crosby, S. Lewis, W. Ai, A. Mason, and R. Laycock, "Deposition of Alternative (Syngas) Fuels on Turbine Blades with Film Cooling," DOE/SCIES Contact Review Meeting, Clemson, SC (October 2006).
122. Zeng, D. and T. H. Fletcher, "High Temperature High Pressure O<sub>2</sub> Reactivities of Coal Char," presented at the ACS Division of Fuel Chemistry, Chicago, IL (March 25-29, 2007).
123. Clark, M. M., T. H. Fletcher, and R. R. Linn, "A Sub-Grid, Mixture-Fraction-Based Thermodynamic Equilibrium Model for Gas Phase Combustion in FIRETEC: Development and Results," presented at the 2nd Fire Behavior and Fuels Conference, Destin, FL (March 26-30, 2007).
124. Pickett, B. M., T. H. Fletcher, and D. R. Weise, "Measurements of Mass and Temperature During Ignition of Fresh Foliage from Western Wildland Environments," presented at the 2nd Fire Behavior and Fuels Conference, Destin, FL (March 26-30, 2007).
125. King, N. H., T. H. Fletcher, W. V. Wilding, and K. L. Erickson, "Vapor/Liquid Equilibrium of Polymer Solutions during Thermal Decomposition of Rigid Foams," poster presentation at the NIST Fire Research Division Annual Fire Conference, Gaithersburg, MD (April 4-5, 2007).
126. Crosby, J. M., S. Lewis, J. P. Bons, W. Ai, and T. H. Fletcher, "Effects of Particle Size, Gas Temperature, and Metal Temperature on High Pressure Turbine Deposition in Land Based Gas Turbines from Various Synfuels," Paper GT2007-27531, presented at the ASME Turbo Expo Meeting, Montreal, Canada (May, 2007).
127. Pugmire, R. J., T. H. Fletcher, R. C. Shurtz, B. Burgener, and J. M. Sowa, "Soot Formation Pathways under Coal Gasification Conditions using 2,6-dimethylnaphthalene as a Coal Tar Surrogate," presented at the Clearwater Coal Conference, Clearwater, FL (June 10-15, 2007).
128. Shurtz, R. C., T. H. Fletcher, B. Burgener, J. M. Sowa, and R. J. Pugmire, "Soot Formation Pathways from a Coal Tar Surrogate under Coal Gasification Conditions," presented at the International Conference on Coal Science and Technology, Nottingham, England (Aug. 28-31, 2007).
129. Bons, J. P., T. H. Fletcher, J. Crosby, S. Lewis, W. Ai, N. Murray, S. Harding, "Deposition of Alternative (Syngas) Fuels on Turbine Blades with Film Cooling" DOE/SCIES Contact Review Meeting, Clemson, SC (October 2007).

130. Shurtz, R. C., T. H. Fletcher, M. S. Solum, and R. J. Pugmire, "Soot Formation Pathways from Coal Tar Surrogates Under Coal Gasification Conditions," presented at the AIChE National Conference. Topical 2: New Frontiers in Energy Research, #9 - Advances in Gasification Research, Salt Lake City, UT (Nov. 5, 2007).
131. J. Hillier and T. H. Fletcher, "Kinetics of Kerogen Extracted from Green River Oil Shale Measured at Different Pressures," presented at the ACS National Meeting, Storch Award presentation session, New Orleans, LA (April, 2008).
132. W. Ai, N. Murray, T. H. Fletcher, S. Harding, S. Lewis, and J. P. Bons, "Deposition Near Film Cooling Holes on a High Pressure Turbine Vane" Paper GT2008-50901, presented at the ASME TurboExpo Meeting, Berlin, Germany (June, 2008).
133. Zamansky, V., B. Eiteneer, J. S. Ravichandra, C. Zeng, T. H. Fletcher, "Gasification Kinetics: Model Development and Validation," presented at the 25<sup>th</sup> Annual International Pittsburgh Coal Conference," Pittsburgh, PA (Sept 29-Oct 2, 2008).
134. Hillier, J. L., J. S. Fletcher, C. Isackson, J. Orgill, and T. H. Fletcher, "An Improved Method for Determination of Kinetic Parameters from Constant Heating Rate TGA Oil Shale Pyrolysis Data," presented at the ACS National Meeting, Salt Lake City, UT (March 22-26, 2009).
135. Zeng, D., S. Hu, A. N. Sayre, and T. H. Fletcher, "Mechanisms of Coal Secondary Pyrolysis and Soot Formation," presented at the 34<sup>th</sup> International Technical Conference on Clean Coal & Fuel Systems, Clearwater, FL (May 31-June 4, 2009).
136. Cole, W. J., B. M. Pickett, T. H. Fletcher, and D. R. Weise, "A Semi-empirical Multi-leaf Model for Fire Spread through a Manzanita Shrub," presented at the 6<sup>th</sup> U.S. National Combustion Institute Meeting, Ann Arbor, MI (May 17-20, 2009).
137. Sowa, J. M. and T. H. Fletcher, "Investigation of Nitrogen Release during Coal Pyrolysis in an Oxy-fuel Combustion Process," presented at the 6<sup>th</sup> U.S. National Combustion Institute Meeting, Ann Arbor, MI (May 17-20, 2009).
138. Ai, W. and T. H. Fletcher, "Computational Analysis of Conjugate Heat Transfer and Particulate Deposition on a High Pressure Turbine Vane," Paper GT2009-59573, ASME Turbo Expo, Orlando, FL (June 8-12, 2009).
139. Ai, W., R. G. Laycock, D. S. Rappleye, T. H. Fletcher, J. P. Bons, "Effect of Particle Size and Trench Configuration on Deposition from Fine Coal Flyash Near Film Cooling Holes," Paper GT2009-59571, ASME Turbo Expo, Orlando, FL (June 8-12, 2009).
140. Ai, W., N. Murray, T. H. Fletcher, S. Harding, J. P. Bons, "Effect of Hole Spacing on Deposition of Fine Coal Flyash Near Film Cooling Holes," Paper GT2009-59569, ASME Turbo Expo, Orlando, FL (June 8-12, 2009).
141. Lewis, S., B. Barker, J. Bons, W. Ai, and T. Fletcher, "Film Cooling Effectiveness and Heat Transfer Near Deposit-Laden Film Holes," Paper GT2009-59567, ASME Turbo Expo, Orlando, FL (June 8-12, 2009).
142. Zhu, H., X. Guo, C. Zeng, Y. Long, X. Zhang, Y. Peng, B. Eiteneer, V. Zamansky, and T. Fletcher, "Rapid Pyrolysis of Biomass in Wire-Mesh Reactor," presented at the Sino-Australia Symposium on Advanced Coal and Biomass Utilisation Technologies, Wuhan, China (December 9-11, 2009).
143. Long, Y., Z. Guo, C. Zeng, H. Zhu, B. Eiteneer, V. Zamansky, and T. Fletcher, "Analysis of Tar from Coal Rapid Pyrolysis in Wire Mesh Reactor by Gas-Chromatography/Mass Spectrometry with Headspace Sampling," presented at the Sino-Australia Symposium on

- Advanced Coal and Biomass Utilisation Technologies, Wuhan, China (December 9-11, 2009).
144. Guo, X., L. Chen, C. Zeng, Y. Long, W. Li, B. Eiteneer, V. Zamansky, and T. Fletcher, "Volatile Evolution Kinetics of Two Coals during Rapid Pyrolysis," presented at the Sino-Australia Symposium on Advanced Coal and Biomass Utilisation Technologies, Wuhan, China (December 9-11, 2009).
  145. Zhao, X., C. Zeng, Y. Mao, W. Li, Y. Peng, T. Wang, B. Eiteneer, V. Zamansky, and T. Fletcher, "The Surface Characteristics and Reactivity of Residual Carbon in Coal Gasification Slag," presented at the Sino-Australia Symposium on Advanced Coal and Biomass Utilisation Technologies, Wuhan, China (December 9-11, 2009).
  146. Fletcher, T. H., "Status of Gasification Technology Development," invited keynote presentation at the Sino-US New Energy Forum, Shanghai, China (September 14, 2009).
  147. Eiteneer, B., R. Subramanian, S. Maghzi, C. Zeng, Z. Guo, Y. Long, L. Chen, R. JS, A. Raman, J. Jain, T. Fletcher, and R. Shurtz, "Gasification Kinetics: Modeling Tools Development and Validation," presented at the International Pittsburgh Coal Conference, Pittsburgh, PA (Sept. 20-23, 2009).
  148. Shurtz, R. and T. H. Fletcher, "Pyrolysis and Gasification of a Sub-Bituminous Coal at High Heating Rates," presented at the International Pittsburgh Coal Conference, Pittsburgh, PA (Sept. 20-23, 2009).
  149. Shurtz, R., T. H. Fletcher, R. J. Pugmire, and M. S. Solum, "The Use of 2-6-Dimethylmaphthalene and 6-(5H)-Phenanthridinone as Surrogates for Studying Soot Formation from Coal Tar," presented at the International Pittsburgh Coal Conference, Pittsburgh, PA (Sept. 20-23, 2009).
  150. Cole, W. J., M. H. Dennis, T. H. Fletcher, and D. R. Weise, "The effects of wind on the flame characteristics of individual leaves," presented at the Western States Section of the Combustion Institute, UC Irvine, Irvine, CA (Oct. 26-27, 2009).
  151. Bons, J., S. Lewis, W. Ai, and T. H. Fletcher, "**Deposition of Alternative (Syngas) Fuels on Turbine Blades with Film Cooling**," presented at the University Turbines Systems Research Workshop, U. Central Florida, Orlando, FL (Oct. 27-29, 2009).
  152. Bons, J., R. Laycock, and T. H. Fletcher, "Designing Turbine Endwalls for Deposition Resistance with 1400°C Combustor Exit Temperatures and Syngas Water Vapor Levels," presented at the University Turbines Systems Research Workshop, U. Central Florida, Orlando, FL (Oct. 27-29, 2009).
  153. Bons, J. R. and T. H. Fletcher, "Designing Turbine Endwalls for Deposition Resistance with 1400-C Combustor Exit Temperatures and Syngas Water Vapor Levels," presented at the FY10 Advanced Turbines Peer Review, NETL, Morgantown, WV (April 26-30, 2010).
  154. Shurtz, R. and T. H. Fletcher, "Pressurized Coal Pyrolysis and Gasification at High Initial Heating Rates," presented at the U.S. Department of Energy ~ National Energy Technology Laboratory 2010 Multiphase Flow Science Workshop, Pittsburgh, PA (May 4-6, 2010)
  155. Bons, J., T. H. Fletcher, and A. Ameri, "Designing Turbine Endwalls for Deposition Resistance with 1400C Combustor Exit Temperatures and Syngas Water Vapor Levels," presented at the 2010 University Turbine Systems Research Workshop, Penn State University (October 19-21, 2010).
  156. Prince, D., B. Andersen, W. Cole, M. Dennis, T. H. Fletcher, "Modeling a Burning Shrub with and without Wind using a Semi-empirical Model," presented at the International

- Association of Wildland Fire 3rd Fire Behavior and Fuels Conference, Spokane, Washington (October 25-29, 2010).
157. Withers, D., M. Dennis, W. Cole, and T. H. Fletcher, "Effects of Wind on Flame Characteristics of Leaves and Needles," poster presented at the International Association of Wildland Fire 3rd Fire Behavior and Fuels Conference, Spokane, Washington (October 25-29, 2010).
  158. Lewis, A., S. Goodrich, K. Kolste, G. Sorensen, and T. H. Fletcher, "Rapid Pyrolysis and CO<sub>2</sub> Gasification of Petroleum Coke and Sawdust in a High Pressure Flat-Flame Burner," presented at the 2010 AIChE Annual Meeting, Salt Lake City, UT (November 7-12, 2010).
  159. Shurtz, R. C., G. Sorensen, S. Goodrich, T. H. Fletcher, "Pressurized Coal Pyrolysis and CO<sub>2</sub> Gasification at High Initial Heating Rates," presented at the 2010 AIChE Annual Meeting, Salt Lake City, UT (November 7-12, 2010).
  160. Shurtz, R. C. and T. H. Fletcher, "A Coal Swelling Model for High Heating Rate Applications," presented at the 7th US National Combustion Institute Meeting, Georgia Institute of Technology, Atlanta, Georgia (March 20-23, 2011).
  161. Lewis, A. D. and T. H. Fletcher, "Predicting Sawdust Pyrolysis Yields Using the CPD Code with a Tar Cracking Model," presented at the 7th US National Combustion Institute Meeting, Georgia Institute of Technology, Atlanta, Georgia (March 20-23, 2011).
  162. R. G. Laycock and T. H. Fletcher, "Time-dependent deposition characteristics of fine coal flyash in a laboratory gas turbine environment," GT2011-46563, presented at the ASME Turbo Expo, Vancouver, Canada (June 6-10, 2011).
  163. J. Bons, A. Ali, T. H. Fletcher, "Deposition of Particulate from Coal-Derived Syngas on Turbine Blades with Film Cooling," presented at the 2011 University Turbine Systems Research Workshop, Ohio State University (October 25 – 27, 2011).
  164. Fletcher, T. H., A. M. Orendt, J. C. Facelli, M. S. Solum, C. L. Mayne, and M. Deo, "Oil Shale Pyrolysis Kinetics and Product Characterization," Unconventional Fuels Conference, University of Utah, Salt Lake City, UT (May 15, 2012).
  165. T. H. Fletcher, "A Fundamental Investigation of Fire Initiation and Fire Behavior in Sparse Vegetation," poster presentation at the NSF 2012 CBET Grantee Conference, Baltimore, MD (June 6-8, 2012).
  166. T. H. Fletcher, "Oil Shale 1: Chemical Structure and Pyrolysis," short course presentation to Statoil, Trondheim, Norway (October 8, 2012).
  167. Shurtz, R. C. and T. H. Fletcher, "Coal Char-CO<sub>2</sub> Gasification Kinetics at High Temperature and Pressure," presented at the International Pittsburgh Coal Conference, Pittsburgh, PA (October 15 - 18, 2012).
  168. Fletcher, M. E. and T. H. Fletcher, "Application of L Systems to Geometrical Construction of Chamise and Juniper Shrubs," presented at the 4<sup>th</sup> Fire Behavior and Fuels Conference, International Association of Wildland Fire, Raleigh, NC (Feb. 18-22, 2013).
  169. Prince, D. R. and T. H. Fletcher, "Semi-empirical Fire Spread Simulator for Utah Juniper and Chamise Shrubs," poster presented at the 4<sup>th</sup> Fire Behavior and Fuels Conference, International Association of Wildland Fire, Raleigh, NC (Feb. 18-22, 2013).
  170. Shen, C. and T. H. Fletcher, "Fuel Element Combustion Properties for Live Wildland Utah Shrubs," poster presented at the 4<sup>th</sup> Fire Behavior and Fuels Conference, International Association of Wildland Fire, Raleigh, NC (Feb. 18-22, 2013).

171. Fletcher, T. H., "The Role of Chemical Structure in Predictions of Coal Pyrolysis and Char Conversion," invited presentation at the Fourteenth International Conference on Numerical Combustion, San Antonio, TX (April 8-10, 2012).
172. Shen, C. and T. H. Fletcher, "Combustion Properties of Fuel Segments for Live Wildland Utah Shrubs," presented at the 8<sup>th</sup> US National Combustion Meeting, The Combustion Institute, Park City, Utah (May 19-22, 2013).
173. Lewis, A. D. and T. H. Fletcher, "Pyrolysis and CO<sub>2</sub> Gasification Rates of Biomass at High Heating-Rate Conditions," presented at the 8<sup>th</sup> US National Combustion Meeting, The Combustion Institute, Park City, Utah (May 19-22, 2013).
174. Lewis, A. D. and T. H. Fletcher, "Pyrolysis Kinetics and CO<sub>2</sub> Gasification Rates of Petroleum Coke at High Heating Rates and Elevated Pressure," presented at the 8<sup>th</sup> US National Combustion Meeting, The Combustion Institute, Park City, Utah (May 19-22, 2013).
175. Prince, D. R. and T. H. Fletcher, "Semi-empirical Fire Spread Simulator for Manzanita, Utah Juniper and Chamise Shrubs," presented at the 8<sup>th</sup> US National Combustion Meeting, The Combustion Institute, Park City, Utah (May 19-22, 2013).
176. Prince, D. R. and T. H. Fletcher, "A Combined Experimental and Theoretical Study of the Combustion of Live vs. Dead Leaves," presented at the 8<sup>th</sup> US National Combustion Meeting, The Combustion Institute, Park City, Utah (May 19-22, 2013).
177. Pugmire R. J., T. H. Fletcher, J. Hillier, M. Solum, C. Mayne, and A. Orendt, "Detailed Characterization and Pyrolysis of Shale, Kerogen, Kerogen Chars, Bitumen, and Light Gases from a Green River Oil Shale Core," presented at the 33<sup>rd</sup> Oil Shale Symposium, Golden, CO (Oct 14-16, 2013).
178. Fletcher, T. H., R. Gillis, J. Adams, T. Hall, C. L. Mayne, M. S. Solum, and R. J. Pugmire, "Characterization of Pyrolysis Products from a Utah Green River Oil Shale by <sup>13</sup>C NMR, GC/MS, and FTIR," presented at the 33<sup>rd</sup> Oil Shale Symposium, Golden, CO (Oct 14-16, 2013).
179. Lansinger, V., J. Gallacher, T. H. Fletcher, "Seasonal Effects on the Ignition Characteristics of Live Fuels in Wildfires," presented at the student poster session of the 2013 AIChE Annual Meeting, San Francisco, CA (November 3-8, 2013).
180. Gallacher, J. R., V. Lansinger, S. Hansen, D. Jack, D. R. Weise, and T. H. Fletcher, "Effects of Season and Heating Mode on Ignition and Burning Behavior of Three Species of Live Fuel Measured in a Flat-flame Burner System," presented at the 2014 Spring Technical Meeting of the Western States Section of the Combustion Institute, California Institute of Technology, Pasadena, CA (March 24-25, 2014).
181. Lewis, A. D., E. G. Fletcher, and T. H. Fletcher, "Entrained-Flow CO<sub>2</sub> Gasification of Sawdust, Switchgrass, and Corn Stover Chars in a Pressurized Flat-Flame Burner Reactor," presented at the 2014 Spring Technical Meeting of the Western States Section of the Combustion Institute, California Institute of Technology, Pasadena, CA (March 24-25, 2014).
182. Lewis, A. D., N. R. Marchant, D. J. Henley, E. G. Fletcher, and T. H. Fletcher, "Steam Gasification Kinetics of Three Bituminous Coal Chars at High Heating Rates and Elevated Pressure," presented at the 2014 Spring Technical Meeting of the Western States Section of the Combustion Institute, California Institute of Technology, Pasadena, CA (March 24-25, 2014).
183. Yang, H., S. Li, T. H. Fletcher, M. Dong, W. Zhou, "Simulation of the Evolution of Pressure in a Lignite Particle during Pyrolysis," presented at the 2014 Spring Technical Meeting of the Western States Section of the Combustion Institute, California Institute of Technology, Pasadena, CA (March 24-25, 2014).



184. Fletcher, T. H., A. D. Lewis, D. R. Prince, "Chemical Structure-Based Pyrolysis Models of Wood and Biomass for Possible Use in CFD Fire Simulations," presented at the 6<sup>th</sup> FM Global Open Source CFD Fire Modeling Workshop, Norwood, MA (May 15-16, 2014).
185. Gallacher, J. R., V. Lansinger, S. Hansen, T. Ellsworth, D. R. Weise, and T. H. Fletcher, "Effects of Season and Heating Mode on Ignition and Burning Behavior of 10 Live Fuel Species Measured in a Flat-flame Burner System," poster presented at the 35<sup>th</sup> International Symposium on Combustion, San Francisco, CA (August 3-8, 2014).
186. Fletcher, T. H., D. C. Barfuss, and R. J. Pugmire, "Modeling Oil Shale Pyrolysis using the Chemical Percolation Devolatilization Model," presented at the 34<sup>th</sup> Oil Shale Symposium, Golden, CO (October 13-15, 2014).
187. Laycock, R. and T. H. Fletcher, "Independent Effects of Surface and Gas Temperature on Coal Flyash Deposition in Gas Turbines at Temperatures Up to 1400°C," presented at the 21<sup>st</sup> International Conference on Impacts of Fuel Quality on Power Production, Snowbird, Utah (October 26-31, 2014).
188. Fletcher, T. H., J. Hillier, R. Gillis, J. Adams, D. Barfuss, C. L. Mayne, M. S. Solum, R. J. Pugmire, "Oil Shale: Structure and Reactions," invited seminar, BYU Chemistry Department (January 13, 2015).
189. Fletcher, T. H., J. Hillier, R. Gillis, J. Adams, D. Barfuss, C. L. Mayne, M. S. Solum, R. J. Pugmire, "Oil Shale: Structure and Reactions," invited seminar, College of Engineering, University of Alabama Huntsville (January 29, 2015).
190. Barfuss, D. and T. H. Fletcher, "Modeling Oil Shale Pyrolysis using the Chemical Percolation (CPD) Devolatilization Model," presented at the ninth annual Utah Conference on Undergraduate Research, Dixie State University, St. George, Utah (February 27<sup>th</sup>, 2015).
191. Holland, T. and T. H. Fletcher, "Coal Particle Combustion," poster presented at the Stewardship Science Academic Programs (SSAP) Symposium, Santa Fe, New Mexico (March 11-12, 2015).
192. Richards, A. and T. H. Fletcher, "A Modified Two-step Model of Devolatilization," presented at the 15<sup>th</sup> International Conference on Numerical Combustion, Avignon, France (April 19-22, 2015).
193. Lignell, D., A. Josephson, B. Isaac, and T. H. Fletcher, "Large eddy simulation of soot formation in an oxy-coal combustor," presented at the 15<sup>th</sup> International Conference on Numerical Combustion, Avignon, France (April 19-22, 2015).
194. Gallacher, J. R., V. Lansinger, S. Hansen, D. R. Weise, and T. H. Fletcher, "Effects of Season and Heating Mode on Ignition and Burning Behavior of Ten Species of Live Fuel Measured in a Flat-flame Burner System," presented at the 9<sup>th</sup> U.S. National Combustion Meeting, Cincinnati, OH (May 17-20, 2015).
195. Yashwanth, B. L., J. R. Gallacher, B. Shotorban, S. Mahalingam, T. H. Fletcher, and D. R. Weise, "Experimental and numerical investigation of the effect of heating modes and moisture content on pyrolysis and ignition of live fuels," presented at the 9<sup>th</sup> U.S. National Combustion Meeting, Cincinnati, OH (May 17-20, 2015).
196. Chen, S., D. O. Lignell, and T. H. Fletcher, "Flame Merging Experiments in Low Speed, Non-Premixed Natural Gas Flames," presented at the 9<sup>th</sup> U.S. National Combustion Meeting, Cincinnati, OH (May 17-20, 2015).
197. Chen, S., J. R. Gallacher, T. H. Fletcher, and D. R. Weise, "Experiments and Modeling of Fire Spread in Big Sagebrush and Chamise Shrubs in a Wind Tunnel," presented at the 9<sup>th</sup> U.S. National Combustion Meeting, Cincinnati, OH (May 17-20, 2015).

198. Josephson, A. J., B. Isaac, D. O. Lignell, and T. H. Fletcher, "Large eddy simulation of an oxy-coal combustor," presented at the 9<sup>th</sup> U.S. National Combustion Meeting, Cincinnati, OH (May 17-20, 2015).
199. Laycock, R. and T. H. Fletcher, "Independent effects of surface and gas temperature on coal flyash deposition in gas turbines at temperatures up to 1400°C," paper GT2015-43575, presented at the ASME Turbo Expo, Montreal, Canada (June 15-19, 2015).
200. Fletcher, T. H., "High Temperature, High Pressure Gasification of Coal Chars Prepared at High Heating Rates," presented at the Storch Symposium, 250th American Chemical Society National Meeting, Boston, Massachusetts (August 16-20, 2015).
201. Shen, C., M. E. Fletcher, J. R. Gallacher, D. R. Prince, and T. H. Fletcher, "Experiments and Modeling of Fire Spread in Big Sagebrush and Chamise Shrubs in a Wind Tunnel," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
202. Shen, C., D. O. Lignell, and T. H. Fletcher, "Flame Merging Experiments in Low Speed, Non-Premixed Natural Gas Flames," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
203. Gallacher, J. R., V. Lansinger, S. Smith, A. Doll, D. R. Weise and T. H. Fletcher, "The Ignition and Burning of Live Fuels Studied Using Natural Variation in Fuel Characteristics," submitted for presentation at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
204. Gallacher, J. R., V. Lansinger, S. Hansen, S. Smith, D. R. Weise and T. H. Fletcher, "The Effect of Heating Mode on the Ignition and Burning Behavior of 10 Live Shrub Fuels," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
205. Holland, T. and T. H. Fletcher, "Comprehensive Char Conversion Global Sensitivity Analysis," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
206. Richards, A. and T. H. Fletcher, "A Comparison of Global Kinetic Models for Coal Devolatilization," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
207. Kimball, D. C., B. W. Butler, and T. H. Fletcher, "Attachment of Flames on Slopes," presented at the Western States Section of the Combustion Institute, Brigham Young University, Provo, UT (October 5-6, 2015).
208. Fletcher, T. H. and R. J. Pugmire, "Using <sup>13</sup>C NMR Chemical Structure Data to Model Oil Shale Pyrolysis for Green River and Estonian Oil Shale," presented at the 35<sup>th</sup> Oil Shale Symposium, Salt Lake City, Utah (October 5-6, 2015).
209. Fletcher, T. H., B. Adams, and C. Adams, "The CHESS Process: Environment Friendly, Low Cost Shale Oil Recovery," presented at the 35<sup>th</sup> Oil Shale Symposium, Salt Lake City, Utah (October 5-6, 2015).
210. Fletcher, T. H., "How Did a Trombone Player End Up Doing Research on Coal Combustion?" Izatt-Christensen Excellence in Research Award Presentation, Brigham Young University, Provo, UT (October 29, 2015).
211. Smith, S. A., J. R. Gallacher, and T. H. Fletcher, "Effects of Season and Heating Mode on Ignition and Burning Behavior of Ten Species of Live Fuel Measured in a Flat-flame Burner System," presented at the undergraduate research session of the Annual AIChE Meeting, Salt Lake City, UT (November 9, 2015).

212. Shen, C., M. E. Fletcher, J. R. Gallacher, D. R. Prince, and T. H. Fletcher, “Experiments and Modeling of Fire Spread in Big Sagebrush and Chamise Shrubs in a Wind Tunnel,” presented at the 6<sup>th</sup> International Fire Ecology and Management Congress, San Antonio, Texas (November 16-20, 2015).
213. Gallacher, J. R., V. Lansinger, S. Smith, A. Doll, D. R. Weise and T. H. Fletcher, “The Ignition and Burning of Live Fuels Studied Using Natural Variation in Fuel Characteristics,” presented at the 6<sup>th</sup> International Fire Ecology and Management Congress, San Antonio, Texas (November 16-20, 2015).
214. Gallacher, J. R., V. Lansinger, S. Hansen, S. Smith, D. R. Weise and T. H. Fletcher, “The Effect of Heating Mode on the Ignition and Burning Behavior of 10 Live Shrub Fuels,” presented at the 6<sup>th</sup> International Fire Ecology and Management Congress, San Antonio, Texas (November 16-20, 2015).
215. Holland, T., S. Bhat, P. Marcy, J. Gattiker, J. D. Kress, and T. H. Fletcher, “Calibration and Extension of a Coal Char Annealing Model,” presented at the Western States Section of the Combustion Institute, University of Washington, Seattle, WA (March 21-22, 2016).
216. Richards, A. P. and T. H. Fletcher, “Elemental Analysis of Coal Combustion: Coal, Char, and Volatiles,” presented at the Western States Section of the Combustion Institute, University of Washington, Seattle, WA (March 21-22, 2016).
217. Gallacher, J. R., B. Ripa, B. Butler, and T. H. Fletcher, “The Influence of the Coanda Effect on Flame Attachment to Slopes and Firefighter Safety Zone Considerations,” presented at the Western States Section of the Combustion Institute, University of Washington, Seattle, WA (March 21-22, 2016).
218. Ripa, B., J. R. Gallacher, D. Kimball, B. Clark, B. Butler, and T. H. Fletcher, “Modeling the Coanda Effect for Fires on Slopes Using FDS, with Implications for Wildland Firefighter Safety,” presented at the Western States Section of the Combustion Institute, University of Washington, Seattle, WA (March 21-22, 2016).
219. Holland, T., S. Bhat, P. Marcy, J. Gattiker, J. D. Kress, and T. H. Fletcher, “Bayesian Uncertainty Quantification and Calibration of a Clean Coal Design Code,” presented at CO2 Summit II: Technologies and Opportunities, Santa Ana Pueblo, NM (April 10-14, 2016).
220. Holland, T., S. Bhat, J. D. Kress, and T. H. Fletcher, “Extension and Calibration of Coal Combustion Models,” poster presented at the Los Alamos National Laboratory Student Symposium, Los Alamos, NM (Aug. 3, 2016).
221. Safdari, S., H. R. Kariminia, and T. H. Fletcher, “Natural Attenuation and Biostimulation of Petroleum-Hydrocarbon Contaminated Soil in a Simulated Column,” presented at the 2016 AIChE Meeting, San Francisco, CA (November 13-17, 2016).
222. Holland, T. and T. H. Fletcher, “A Comprehensive Model of Single Particle Pulverized Coal Combustion Extended to Oxy-coal Conditions,” presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
223. Shen, C., D. Prince, J. Gallacher, M. E. Fletcher, and T. H. Fletcher, “Semi-empirical Model for Fire Spread in Chamise and Big Sagebrush Shrubs with Spatially-Defined Fuel Elements and Flames,” presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
224. Josephson, A. J., T. H. Fletcher, and D. O. Lignell, “Modeling Soot in Coal Systems,” presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).

225. Rahmati, M., M-S. Safdari, E. Amini, T. H. Fletcher, "Investigation of Merging Flames in Horizontal and Vertical Geometries," presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
226. Richards, A., T. Shutt, T. H. Fletcher, "A Comprehensive Model for Predicting Elemental Composition of Coal Pyrolysis Products," presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
227. Safdari, M.-S., M. Rahmati, E. Amini, and T. H. Fletcher, "Analysis of Pyrolysis Products from Live Shrub Fuels," presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
228. Weise, D., T. H. Fletcher, B. Shotorban, B. Butler, M. Princevac, T. J. Johnson, M. Diitenberger, W. Mell, R. Ottmar, A. Hudak, S. McAllister, W. M. Hao, J. O'Brien, S. Mahalingham, and J. Reardon, "Measuring and Modeling Pyrolysis to Improve Prediction of Prescribed Fire Behavior," poster presented at the 10<sup>th</sup> National Combustion Institute Meeting, University of Maryland (April 23-26, 2017).
229. Laycock, R. G. and T. H. Fletcher, "Formation of Deposits from Heavy Fuel Oil Ash in an Accelerated Deposition Facility at Temperatures up to 1206°C," paper GT2017-63724, presented at the ASME Turbo Expo, Charlotte, North Carolina (June 26-30, 2017).
230. Fletcher, T. H. and R. G. Laycock, "Particle Deposition Behavior of Ash from Various Fuels in Gas Turbine Environments at Temperatures up to 1400°C," Invited presentation at the Workshop on Ash-related Issues in Gas Turbines, Center for Advanced Studies, Ludwig Maximilians University, Munich, Germany (July 3-5, 2017).
231. Weise, D. R., T. H. Fletcher, S. Mahalingham, Z. Zhou, and L. Sun, "Fire Spread in Chaparral: Comparison of Data with Flame-Mass Loss Relationships," to be presented at the Eighth International Symposium on Scale Modeling (ISSM-8), Portland, Oregon (Sept 12-14, 2017).
232. Holland, T. and T. H. Fletcher, "Modeling Effects of Annealing on Coal Char Reactivity to O<sub>2</sub> and CO<sub>2</sub> Based on Preparation Conditions," to be presented at the Western States Section of the Combustion Institute, University of Wyoming, Laramie, WY (October 2-3, 2017).
233. Billings, B., M. Roberts, B. Butler, and T. H. Fletcher, "Modeling the Coanda Effect with FDS and STARCCM+ to Predict the Effect of Fires on Slopes for Implications of Wildland Firefighter Safety," to be presented at the Western States Section of the Combustion Institute, University of Wyoming, Laramie, WY (October 2-3, 2017).
234. Rhamati, M., C. Harper, M. Butler, and T. H. Fletcher "Investigation of Merging Flames in Horizontal and Vertical Geometries," to be presented at the Western States Section of the Combustion Institute, University of Wyoming, Laramie, WY (October 2-3, 2017).
235. Amini, E., M.-S. Safdari, M. Rahmati, J. Howarth, J. DeYoung, T. H. Fletcher "Pyrolysis of Live Vegetation at Slow Heating Rates," to be presented at the Western States Section of the Combustion Institute, University of Wyoming, Laramie, WY (October 2-3, 2017).
236. Safdari, M.-S., J. Howarth, M. Rahmati, and T. H. Fletcher, "Study of Pyrolysis Products of Live and Dead Shrub Fuels from the Forest in the Southeastern United States," to be presented at the 2017 AIChE Annual Meeting, Minneapolis, MN (October 29-November 3, 2017).