

Experimental Project Results from the Design Institute for Physical Properties (DIPPR) of the American Institute of Chemical Engineers. 5

This volume contains the fifth series of papers reporting experimental results from the various projects of the Design Institute for Physical Properties (DIPPR) of the American Institute of Chemical Engineers (AIChE). Previous data were published in **1996**, 41 (6), **1997**, 42 (6), **1999**, 44 (3), and **2000**, 45 (1). Before publication of DIPPR results began in this journal, they were published in *AIChE Symp. Ser.* **1985**, 81 (244); **1987**, 83 (256); **1989**, 85 (271); **1990**, 86 (275); **1990**, 86 (279) and *DIPPR Data Ser.* **1991**, No. 1; **1994**, No. 2.

Six papers in this volume are part of a series of papers that reported work performed by the Bartlesville Thermodynamics Group for DIPPR Projects 821 and 871. These projects have been in operation since 1982 and 1987, respectively.

In 1943 a laboratory was established in Bartlesville, OK, by Hugh M. Huffman to measure the thermophysical properties of components of petroleum, jet fuels, and other strategic chemicals. Over the next 55 years this laboratory established an undisputed world renowned reputation for the highest quality measurements on the thermochemical and thermophysical properties of organic and organometallic compounds. The Bartlesville Thermodynamics Group ceased to exist on Nov 8, 1998. The six papers published here represent some of the last experimental work emanating from that laboratory. In a tribute to all of those that contributed to its reputation and in recognition of the laboratory's contribution to science and engineering, we provide its list of publications.

Kenneth N. Marsh

Editor

George H. Thomson

Technical Director

Design Institute for Physical Properties
American Institute of Chemical Engineers

Bibliography of the Publications of the Bartlesville Thermodynamics Group

The Bartlesville Thermodynamics Facility closed on Nov 7, 1998.

1. Knowlton, J. W.; Huffman, H. M. The Heats of Combustion of Some Substituted Eicosanes, and Docosanes. *J. Am. Chem. Soc.* **1944**, 66, 1492–1494.

2. Douslin, D. R.; Huffman, H. M. The Heat Capacities, Heats of Transition, Heats of Fusion, and Entropies of Cyclopentane, Methylcyclopentane, and Methylcyclohexane. *J. Am. Chem. Soc.* **1946**, 68, 173–176.

3. Douslin, D. R.; Huffman, H. M. Low-Temperature Thermal Data on the Five Isomeric Hexanes. *J. Am. Chem. Soc.* **1946**, 68, 1704–1708.

4. Waddington, G.; Todd, S. S.; Huffman, H. M. An Improved Flow Calorimeter, Experimental Vapor Heat Capacities and Heats of Vaporization of *n*-Heptane and 2,3,3-Trimethylbutane. *J. Am. Chem. Soc.* **1947**, 69, 22–30.

5. Huffman, H. M. Low-Temperature Calorimetry at the Bartlesville Station of the Bureau of Mines. *Chem. Rev.* **1947**, 40, 1–14.

6. Todd, S. S.; Oliver, G. D.; Huffman, H. M. The Heat Capacities, Heats of Fusion, and Entropies of the Six Pentenes. *J. Am. Chem. Soc.* **1947**, 69, 1519–1525.

7. Waddington, G.; Douslin, D. R. Experimental Vapor Heat Capacities and Heats of Vaporization of *n*-Hexane and 2,2-Dimethylbutane. *J. Am. Chem. Soc.* **1947**, 69, 2275–2279.

8. Scott, D. W.; Waddington, G.; Smith, J. C.; Huffman, H. M. The Heat Capacity of Benzene Vapor. The Contribution of Anharmonicity. *J. Chem. Phys.* **1947**, 15, 565–568.

9. Oliver, G. D.; Eaton, M.; Huffman, H. M. The Heat Capacity, Heat of Fusion, and Entropy of Benzene. *J. Am. Chem. Soc.* **1948**, 70, 1502–1505.

10. Hubbard, W. N.; Knowlton, J. W.; Huffman, H. M. The Heat of Combustion of 2,2'-bis-(4-Hydroxyphenyl)propane. *J. Am. Chem. Soc.* **1948**, 70, 3259–3261.

11. Huffman, H. M.; Eaton, M.; Oliver, G. D. The Heat Capacities, Heats of Transition, Heats of Fusion, and Entropies of Cyclopentene and Cyclohexene. *J. Am. Chem. Soc.* **1948**, 70, 2911–2914.

12. Huffman, H. M.; Todd, S. S.; Oliver, G. D. Low-Temperature Thermal Data on Eight C₈H₁₆ Alkylcyclohexanes. *J. Am. Chem. Soc.* **1949**, 71, 584–592.

13. Waddington, G.; Knowlton, J. W.; Scott, D. W.; Oliver, G. D.; Todd, S. S.; Hubbard, W. M.; Smith, J. C.; Huffman, H. M. Thermodynamic Properties of Thiophene. *J. Am. Chem. Soc.* **1949**, 71, 797–808.

14. Scott, D. W.; Gross, M. E.; Oliver, G. D.; Huffman, H. M. Cyclooctatetraene: Low-Temperature Heat Capacity,

Heat of Fusion, Heat of Vaporization, Vapor Pressure, and Entropy. *J. Am. Chem. Soc.* **1949**, *71*, 1634–1636.

15. Scott, D. W.; Oliver, G. D.; Gross, M. E.; Hubbard, W. N.; Huffman, H. M. Hydrazine: Heat Capacity, Heats of Fusion and Vaporization, Vapor Pressure, Entropy, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1949**, *71*, 2293–2297.

16. Scott, D. W.; Waddington, G.; Smith, J. C.; Huffman, H. M. Thermodynamic Properties of Three Isomeric Pentenes. *J. Am. Chem. Soc.* **1949**, *71*, 2767–2773.

17. Waddington, G.; Smith, J. C.; Scott, D. W.; Huffman, H. M. Experimental Vapor Heat Capacities and Heats of Vaporization of 2-Methylpentane, 3-Methylpentane, and 2,3-Dimethylbutane. *J. Am. Chem. Soc.* **1949**, *71*, 3902–3906.

18. Scott, D. W.; Finke, H. L.; Gross, M. E.; Guthrie, G. B.; Huffman, H. M. 2,3-Dithiabutane: Low Temperature Heat Capacity, Heat of Fusion, Heat of Vaporization, Vapor Pressure, Entropy, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1950**, *72*, 2424–2430.

19. Scott, D. W.; Finke, H. L.; Hubbard, W. N.; McCullough, J. P.; Gross, M. E.; Williamson, K. D.; Waddington, G.; Huffman, H. M. Spiropentane: Heat Capacity, Heats of Fusion and Vaporization, Vapor Pressure, Entropy, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1950**, *72*, 4664–4668.

20. Scott, D. W.; Finke, H. L.; McCullough, J. P.; Gross, M. E.; Williamson, K. D.; Waddington, G.; Huffman, H. M. Thermodynamic Properties and Rotational Isomerism of 2-Thiabutane. *J. Am. Chem. Soc.* **1951**, *73*, 261–265.

21. Scott, D. W.; McCullough, J. P.; Williamson, K. D.; Waddington, G. Rotational Isomerism and Thermodynamic Functions of 2-Methylbutane and 2,3-Dimethylbutane. Vapor Heat Capacity and Heat of Vaporization of 2-Methylbutane. *J. Am. Chem. Soc.* **1951**, *73*, 1707–1712.

22. Scott, D. W.; Douslin, D. R.; Gross, M. E.; Oliver, G. D.; Huffman, H. M. 2,2,3,3-Tetramethylbutane: Heat Capacity, Heats of Transition, Fusion and Sublimation, Vapor Pressure, Entropy and Thermodynamic Functions. *J. Am. Chem. Soc.* **1952**, *74*, 883–887.

23. McCullough, J. P.; Pennington, R. E.; Waddington, G. A Calorimetric Determination of the Vapor Heat Capacity and Gas Imperfection of Water. *J. Am. Chem. Soc.* **1952**, *74*, 4439–4442.

24. Guthrie, G. B., Jr.; Scott, D. W.; Waddington, G. Thiacyclopropane (Ethylene Sulfide): Infrared Spectrum, Vapor Pressure, and Some Thermodynamic Properties. *J. Am. Chem. Soc.* **1952**, *74*, 2795–2800.

25. McCullough, J. P.; Scott, D. W.; Finke, H. L.; Gross, M. E.; Williamson, K. D.; Pennington, R. E.; Waddington, G.; Huffman, H. M. Ethanethiol (Ethyl Mercaptan): Thermodynamic Properties in the Solid, Liquid, and Vapor States. Thermodynamic Functions to 1000 K. *J. Am. Chem. Soc.* **1952**, *74*, 2801–2804.

26. Finke, H. L.; Scott, D. W.; Gross, M. E.; Waddington, G.; Huffman, H. M. The Entropy and Vapor Pressure of 1-Pentanethiol. *J. Am. Chem. Soc.* **1952**, *74*, 2804–2806.

27. Scott, D. W.; Finke, H. L.; McCullough, J. P.; Gross, M. E.; Pennington, R. E.; Waddington, G. 3,4-Dithiahexane: Heat Capacity, Heats of Fusion and Vaporization, Vapor Pressure, Entropy, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1952**, *74*, 2478–2483.

28. Guthrie, G. B., Jr.; Scott, D. W.; Hubbard, W. N.; Katz, C.; McCullough, J. P.; Gross, M. E.; Williamson, K. D.; Waddington, G. Thermodynamic Properties of Furan. *J. Am. Chem. Soc.* **1952**, *74*, 4662–4669.

29. Hubbard, W. N.; Katz, C.; Guthrie, G. B., Jr.; Waddington, G. The Heat of Combustion and Resonance Energy of Tropolone. *J. Am. Chem. Soc.* **1952**, *74*, 4456–4457.

30. Scott, D. W.; Finke, H. L.; Hubbard, W. N.; McCullough, J. P.; Oliver, G. D.; Gross, M. E.; Katz, C.; Williamson, K. D.; Waddington, G.; Huffman, H. M. 3-Thiapentane: Heat Capacity, Heats of Fusion and Vaporization, Vapor Pressure, Entropy, Heat of Formation, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1952**, *74*, 4656–4662.

31. Hubbard, W. N.; Finke, H. L.; Scott, D. W.; McCullough, J. P.; Katz, C.; Gross, M. E.; Messerly, J. F.; Pennington, R. E.; Waddington, G. Thiacyclopentane: Heat Capacity, Heats of Fusion and Vaporization, Vapor Pressure, Entropy, Heat of Formation, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1952**, *74*, 6025–6030.

32. Scott, D. W.; Waddington, G. Thermodynamic Functions of 2,2,3-Trimethylbutane. *J. Am. Chem. Soc.* **1953**, *75*, 2006–2007.

33. McCullough, J. P.; Scott, D. W.; Finke, H. L.; Hubbard, W. N.; Gross, M. E.; Katz, C.; Pennington, R. E.; Messerly, J. F.; Waddington, G. The Thermodynamic Properties of 2-Methyl-2-Propanethiol from 0 to 1000 K. *J. Am. Chem. Soc.* **1953**, *75*, 1818–1824.

34. Scott, D. W.; Finke, H. L.; Hubbard, W. N.; McCullough, J. P.; Katz, C.; Gross, M. E.; Messerly, J. F.; Pennington, R. E.; Waddington, G. Thiacyclobutane: Heat Capacity, Heats of Transition, Fusion, and Vaporization, Vapor Pressure, Entropy, Heat of Formation, and Thermodynamic Functions. *J. Am. Chem. Soc.* **1953**, *75*, 2795–2800.

35. Gross, M. E.; Oliver, G. D.; Huffman, H. M. Low-Temperature Thermal Data for Some C₇H₁₄ Alkylcyclopentanes. *J. Am. Chem. Soc.* **1953**, *75*, 2801–2804.

36. Finke, H. L.; Gross, M. E.; Waddington, G.; Huffman, H. M. Low-Temperature Thermal Data for the Nine Normal Paraffin Hydrocarbons from Octane to Hexadecane. *J. Am. Chem. Soc.* **1954**, *76*, 333–341.

37. Hubbard, W. N.; Katz, C.; Waddington, G. A Rotating Combustion Bomb for Precision Calorimetry. Heats of Combustion of Some Sulfur-Containing Compounds. *J. Phys. Chem.* **1954**, *58*, 142–152.

38. Hubbard, W. N.; Scott, D. W.; Waddington, G. Reduction to Standard States (at 25 °C) of Bomb Calorimetric Data for Compounds of Carbon, Hydrogen, Oxygen and Sulfur. *J. Phys. Chem.* **1954**, *58*, 152–162.

39. McCullough, J. P.; Sunner, S.; Finke, H. L.; Hubbard, W. N.; Gross, M. E.; Pennington, R. E.; Messerly, J. F.; Good, W. D.; Waddington, G. The Chemical Thermodynamic Properties of 3-Methylthiophene from 0 to 1000 K. *J. Am. Chem. Soc.* **1953**, *75*, 5075–5081.

40. McCullough, J. P.; Finke, H. L.; Hubbard, W. N.; Good, W. D.; Pennington, R. E.; Messerly, J. F.; Waddington, G. The Chemical Thermodynamic Properties of Thiacyclohexane from 0 to 1000 K. *J. Am. Chem. Soc.* **1954**, *76*, 2661–2669.

41. McCullough, J. P.; Scott, D. W.; Pennington, R. E.; Hossenlopp, I. A.; Waddington, G. Nitromethane: The Vapor Heat Capacity, Heat of Vaporization, Vapor Pressure, and Gas Imperfection; the Chemical Thermodynamic Properties from 0 to 1500 K. *J. Am. Chem. Soc.* **1954**, *76*, 4791–4796.

42. Guthrie, G. B., Jr.; Scott, D. W.; Waddington, G. Thermodynamic Functions and Heat of Formation of S₈ (Gas). *J. Am. Chem. Soc.* **1954**, *76*, 1488–1493.

43. Finke, H. L.; Gross, M. E.; Messerly, J. F.; Waddington, G. Benzothiophene: Heat Capacity, Heat of Transition, Heat of Fusion and Entropy. An Order-Disorder Transition. *J. Am. Chem. Soc.* **1954**, *76*, 854-857.
44. Hubbard, W. N.; Knowlton, J. W.; Huffman, H. M. Combustion Calorimetry of Organic Chlorine Compounds. Heats of Combustion of Chlorobenzene, the Dichlorobenzenes, and *o*- and *p*-Chloroethylbenzene. *J. Phys. Chem.* **1954**, *58*, 396-402.
45. Scott, D. W.; Waddington, G. Vapor Pressure of *cis*-2-Pentene, *trans*-2-Pentene, and 3-Methyl-1-butene. *J. Am. Chem. Soc.* **1950**, *72*, 4310.
46. McCullough, J. P.; Finke, H. L.; Scott, D. W.; Gross, M. E.; Messerly, J. F.; Pennington, R. E.; Waddington, G. 2-Propanethiol: Experimental Thermodynamic Studies from 12 to 500 K. The Chemical Thermodynamic Properties from 0 to 1000 K. *J. Am. Chem. Soc.* **1954**, *76*, 4796-4802.
47. Hubbard, W. N.; Waddington, G. The Heats of Combustion, Formation and Isomerization of Propanethiol-1, Propanethiol-2, and 2-Thiabutane. *Recl. Trav. Chim. Pays-Bas* **1954**, *73*, 910-923.
48. Scott, D. W.; Good, W. D.; Waddington, G. Heat of Formation of Tetrafluoromethane from Combustion Calorimetry of Polytetrafluoroethylene. *J. Am. Chem. Soc.* **1955**, *77*, 245.
49. Scott, D. W.; Finke, H. L.; McCullough, J. P.; Gross, M. E.; Messerly, J. F.; Pennington, R. E.; Waddington, G. 2,3-Dimethyl-2-butene: Thermodynamic Properties in the Solid, Liquid, and Vapor States. *J. Am. Chem. Soc.* **1955**, *77*, 4993-4998.
50. Hubbard, W. N.; Scott, D. W.; Frow, F. R.; Waddington, G. Thiophene: Heat of Combustion and Chemical Thermodynamic Properties. *J. Am. Chem. Soc.* **1955**, *77*, 5855-5886.
51. McCullough, J. P.; Finke, H. L.; Messerly, J. F.; Pennington, R. E.; Hossenlopp, I. A.; Waddington, G. 3-Methyl-2-thiabutane: Calorimetric Studies from 12 to 500 K; the Chemical Thermodynamic Properties from 0 to 1000 K. *J. Am. Chem. Soc.* **1955**, *77*, 6119-6125.
52. (a) Douslin, D. R.; Waddington, G. Intermolecular Potential Energy of Dipolar Gases from Heat Capacity Data. *J. Chem. Phys.* **1955**, *23*, 2453-2454. (b) Scott, D. W. Thermochemistry and the Thermodynamic Properties of Substances. *Ann. Rev. Phys. Chem.* **1955**, *6*, 1-24.
53. Finke, H. L.; Scott, D. W.; Gross, M. E.; Messerly, J. F.; Waddington, G. Cycloheptane, Cyclooctane and 1,3,5-Cycloheptatriene. Low-Temperature Thermal Properties, Vapor Pressure, and Derived Chemical Thermodynamic Properties. *J. Am. Chem. Soc.* **1956**, *78*, 5469-5476.
54. Pennington, R. E.; Finke, H. L.; Hubbard, W. N.; Messerly, J. F.; Frow, F. R.; Hossenlopp, I. A.; Waddington, G. The Chemical Thermodynamic Properties of 2-Methylthiophene. *J. Am. Chem. Soc.* **1956**, *78*, 2055-2060.
55. Pennington, R. E.; Scott, D. W.; Finke, H. L.; McCullough, J. P.; Messerly, J. F.; Hossenlopp, I. A.; Waddington, G. The Chemical Thermodynamic Properties and Rotational Tautomerism of 1-Propanethiol. *J. Am. Chem. Soc.* **1956**, *78*, 3266-3272.
56. Good, W. D.; Scott, D. W.; Waddington, G. Combustion Calorimetry of Organic Fluorine Compounds by a Rotating-Bomb Method. *J. Phys. Chem.* **1956**, *60*, 1080-1089.
57. Scott, D. W.; Good, W. D.; Waddington, G. Tetraethyllead: Heat of Formation by Rotating-Bomb Calorimetry. *J. Phys. Chem.* **1956**, *60*, 1090-1095.
58. Scott, D. W.; McCullough, J. P.; Good, W. D.; Messerly, J. F.; Pennington, R. E.; Kincheloe, T. C.; Hossenlopp, I. A.; Douslin, D. R.; Waddington, G. Fluorobenzene: Thermodynamic Properties in the Solid, Liquid, and Vapor States; A Revised Vibrational Assignment. *J. Am. Chem. Soc.* **1956**, *78*, 5457-5463.
59. Scott, D. W.; McCullough, J. P.; Hubbard, W. N.; Messerly, J. F.; Hossenlopp, I. A.; Frow, F. R.; Waddington, G. Benzenethiol: Thermodynamic Properties in the Solid, Liquid, and Vapor States; Internal Rotation of the Thiol Group. *J. Am. Chem. Soc.* **1956**, *78*, 5463-5468.
60. McCullough, J. P.; Finke, H. L.; Gross, M. E.; Messerly, J. F.; Waddington, G. Low-Temperature Calorimetric Studies of Seven 1-Olefins: Effect of Orientational Disorder in the Solid State. *J. Phys. Chem.* **1957**, *61*, 289-301.
61. McCullough, J. P.; Hubbard, W. N.; Frow, F. R.; Hossenlopp, I. A.; Waddington, G. Ethanethiol and 2-Thiapropene: Heats of Formation and Isomerization; The Chemical Thermodynamic Properties from 0 to 1000 K. *J. Am. Chem. Soc.* **1957**, *79*, 561-566.
62. McCullough, J. P.; Douslin, D. R.; Messerly, J. F.; Hossenlopp, I. A.; Kincheloe, T. C.; Waddington, G. Pyridine: Experimental and Calculated Chemical Thermodynamic Properties between 0 and 1500 K; A Revised Vibrational Assignment. *J. Am. Chem. Soc.* **1957**, *79*, 4289-4295.
63. McCullough, J. P.; Finke, H. L.; Messerly, J. F.; Todd, S. S.; Kincheloe, T. C.; Waddington, G. The Low-Temperature Thermodynamic Properties of Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene, 1,2,3,4-Tetrahydronaphthalene, *trans*-Decahydronaphthalene, and *cis*-Decahydronaphthalene. *J. Phys. Chem.* **1957**, *61*, 1105-1116.
64. Scott, D. W.; Finke, H. L.; McCullough, J. P.; Messerly, J. F.; Pennington, R. E.; Hossenlopp, I. A.; Waddington, G. 1-Butanethiol and 2-Thiapentane. Experimental Thermodynamic Studies Between 12 and 500 K; Thermodynamic Functions by a Refined Method of Increments. *J. Am. Chem. Soc.* **1957**, *79*, 1062-1068.
65. McCullough, J. P.; Waddington, G. Melting-Point Purity Determinations: Limitations Evidenced by Calorimetric Studies in the Melting Region. *Anal. Chim. Acta* **1957**, *17*, 80-96.
66. Scott, D. W.; McCullough, J. P.; Messerly, J. F.; Pennington, R. E.; Hossenlopp, I. A.; Finke, H. L.; Waddington, G. 2-Methyl-1-propanethiol: Chemical Thermodynamic Properties and Rotational Isomerism. *J. Am. Chem. Soc.* **1958**, *80*, 55-59.
67. Douslin, D. R.; Moore, R. T.; Dawson, J. P.; Waddington, G. The Pressure-Volume-Temperature Properties of Fluorobenzene. *J. Am. Chem. Soc.* **1958**, *80*, 2031-2038.
68. Hubbard, W. N.; Douslin, D. R.; McCullough, J. P.; Scott, D. W.; Todd, S. S.; Messerly, J. F.; Hossenlopp, I. A.; George, A.; Waddington, G. 2,3-Dithiabutane, 3,4-Dithiathexane, and 4,5-Dithiooctane: Chemical Thermodynamic Properties from 0 to 1000 K. *J. Am. Chem. Soc.* **1958**, *80*, 3547-3554.
69. Hubbard, W. N.; Good, W. D.; Waddington, G. The Heats of Combustion, Formation, and Isomerization of the Seven Isomeric C₄H₁₀S Alkane Thiols and Sulfides. *J. Phys. Chem.* **1958**, *62*, 614-617.
70. Scott, D. W.; McCullough, J. P. Characteristic Vibrational Frequencies of Organic Sulfur Compounds. *J. Am. Chem. Soc.* **1958**, *80*, 3554-3558.
71. Hubbard, W. N. On the Comparison of the Lower Decades of a Mueller Bridge. *Rev. Sci. Instrum.* **1958**, *29*, 784.
72. Hubbard, W. N.; Frow, F. R.; Waddington, G. The Heats of Combustion and Formation of Hexacyclo-

- [7,2,1,0,^{2,50,3,100,4,806,12}]dodecane. Two Techniques for the Combustion Calorimetry of Volatile Solids. *J. Phys. Chem.* **1958**, *62*, 821–823.
73. Good, W. D.; Fairbrother, D. M.; Waddington, G. Manganese Carbonyl: Heat of Formation by Rotating-Bomb Calorimetry. *J. Phys. Chem.* **1958**, *62*, 853–856.
74. McCullough, J. P.; Finke, H. L.; Scott, D. W.; Pennington, R. E.; Gross, M. E.; Messerly, J. F.; Waddington, G. 2-Butanethiol: Chemical Thermodynamic Properties Between 0 and 1000 K; Rotational Conformations. *J. Am. Chem. Soc.* **1958**, *80*, 4786–4793.
75. Scott, D. W.; Guthrie, G. B.; McCullough, J. P.; Waddington, G. Isomerization Equilibria: The C₂H₆S, C₃H₈S, and C₄H₁₀S Alkane Thiols and Sulfides and the Methylthiophenes. *J. Chem. Eng. Data* **1959**, *4*, 246–251.
76. McCullough, J. P. Pseudorotation in Cyclopentane and Related Molecules. *J. Chem. Phys.* **1958**, *29*, 966.
77. Scott, D. W.; Douslin, D. R.; Messerly, J. F.; Todd, S. S.; Hossenlopp, I. A.; Kincheloe, T. C.; McCullough, J. P. Benzotrifluoride: Chemical Thermodynamic Properties and Internal Rotation. *J. Am. Chem. Soc.* **1959**, *81*, 1015–1020.
78. Good, W. D.; Douslin, D. R.; Scott, D. W.; George, A.; Lacina, J. L.; Dawson, J. P.; Waddington, G. Thermochemistry and Vapor Pressure of Aliphatic Fluorocarbons. A Comparison of the C–F and C–H Thermochemical Bond Energies. *J. Phys. Chem.* **1959**, *63*, 1133–1138.
79. Good, W. D.; Scott, D. W.; Lacina, J. L.; McCullough, J. P. Tetramethyllead: Heat of Formation by Rotating-Bomb Calorimetry. *J. Phys. Chem.* **1959**, *63*, 1139–1142.
80. Douslin, D. R.; Moore, R. T.; Waddington, G. The Pressure–Volume–Temperature Properties of Perfluorocyclobutane: Equations of State, Virial Coefficients, and Intermolecular Potential Energy Functions. *J. Phys. Chem.* **1959**, *63*, 1959.
81. McCullough, J. P.; Scott, D. W. Thermodynamic Properties, Vibrational Assignment and Rotational Conformations of 2-Methyl-1-butene. *J. Am. Chem. Soc.* **1959**, *81*, 1331–1334.
82. McCullough, J. P. Transition Types in Hydrocarbons and Related Substances. *Pure Appl. Chem.* **1961**, *2*, 221–230.
83. Good, W. D.; Scott, D. W. Thermochemistry of Organic Fluorine Compounds and Carbon Compounds of Metals by Rotating-Bomb Calorimetry. *Pure Appl. Chem.* **1961**, *2*, 77–82.
84. McCullough, J. P.; Pennington, R. E.; Smith, J. C.; Hossenlopp, I. A.; Waddington, G. Thermodynamics of Cyclopentane, Methylcyclopentane, and *cis*-1,3-Dimethylcyclopentane: Verification of the Concept of Pseudorotation. *J. Am. Chem. Soc.* **1959**, *81*, 5880–5883.
85. McCullough, J. P.; Douslin, D. R.; Hubbard, W. N.; Todd, S. S.; Messerly, J. F.; Hossenlopp, I. A.; Frow, F. R.; Dawson, J. P.; Waddington, G. Pyrrolidine: Chemical Thermodynamic Properties Between 0 and 1500 K; Effect of Pseudorotation; and an Unusual Thermal Anomaly in the Liquid State. *J. Am. Chem. Soc.* **1959**, *81*, 5884–5890.
86. Scott, D. W.; Berg, W. T.; McCullough, J. P. Chemical Thermodynamic Properties of Methylcyclopentane and *cis*-1,3-Dimethylcyclopentane. *J. Phys. Chem.* **1960**, *64*, 906–908.
87. McCullough, J. P. Thermochemistry and Thermodynamic Properties of Substances. *Annu. Rev. Phys. Chem.* **1960**, *11*, 1–20.
88. Kharasch, N. Organic Sulfur Compounds. In *Thermodynamics of Organic Sulfur Compounds*; McCullough, J. P., Scott, D. W., Kharasch, N., Eds.; Pergamon Press: New York, 1961.
89. Coops, J.; Skinner, H. A. *Experimental Thermochemistry. Part I: Combustion Calorimetry. Chapter 2. Organic Fluorine Compounds*; Good, W. D., Scott, D. W., Skinner, H. A., Eds.; Interscience Publishers: London, 1962; Vol. 2.
90. Coops, J.; Skinner, H. A. *Experimental Thermochemistry. Part I: Combustion Calorimetry. Chapter 4. Organometallic Compounds*; Good, W. D., Scott, D. W., Skinner, H. A., Eds.; Interscience Publishers: London, 1962; Vol. 2.
91. Frenzel, C. A.; Scott, D. W.; McCullough, J. P. Infrared Spectra of Organic Compounds in the Region 15–35 Microns: Thirteen Organic Oxygen, Nitrogen, Sulfur, and Silicon Compounds. *U.S. Bur. Mines* **1960**, Report of Investigation 5658.
92. Good, W. D.; Lacina, J. L.; McCullough, J. P. Sulfuric Acid: Heat of Formation of Aqueous Solutions by Rotating-Bomb Calorimetry. *J. Am. Chem. Soc.* **1960**, *82*, 5589–5591.
93. Scott, D. W.; McCullough, J. P. The Chemical Thermodynamic Properties of Hydrocarbon and Related Substances. I. Properties of 100 Linear Alkane Thiols, Sulfides, and Symmetrical Disulfides in the Ideal Gas-State From 0 to 1000 K. *U.S. Bur. Mines* **1961**, Bulletin 595.
94. Huffman, H. M.; Gross, M. E.; Scott, D. W.; McCullough, J. P. Low-Temperature Thermodynamic Properties of Six Isomeric Heptanes. *J. Phys. Chem.* **1961**, *65*, 495–503.
95. Guthrie, G. B.; McCullough, J. P. Some Observations on Phase Transformations in Molecular Crystals. *Int. J. Phys. Chem. Solids* **1961**, *18*, 53–61.
96. Scott, D. W.; McCullough, J. P. Vibrational Assignment and Force Constants of S₈ From a Normal-Coordinate Treatment. *J. Mol. Spectrosc.* **1961**, *6*, 372–378.
97. McCullough, J. P.; Finke, H. L.; Hubbard, W. N.; Todd, S. S.; Messerly, J. F.; Douslin, D. R.; Waddington, G. Thermodynamic Properties of Four Linear Thiaalkanes. *J. Phys. Chem.* **1961**, *65*, 784–791.
98. McCullough, J. P.; Messerly, J. F. The Chemical Thermodynamic Properties of Hydrocarbon and Related Substances. II. The Use of *n*-Heptane as a Reference Substance for Low-Temperature Calorimetry. *U.S. Bur. Mines* **1961**, Bulletin 596, 15.
99. Good, W. D.; Lacina, J. L.; McCullough, J. P. Tetramethylthiuram Monosulfide and Tetramethylthiuram Disulfide: Heats of Formation by Rotating-bomb Calorimetry; The S–S Thermochemical Bond Energy. *J. Phys. Chem.* **1961**, *65*, 860–862.
100. Scott, D. W.; McCullough, J. P. Thermodynamic Functions for Internal Rotations That Involve Rotational Isomerism. *U.S. Bur. Mines* **1962**, Report of Investigation 5930.
101. Hubbard, W. N.; Frow, F. R.; Waddington, G. The Heats of Combustion and Formation of Pyridine and Hippuric Acid. *J. Phys. Chem.* **1961**, *65*, 1326–1328.
102. Douslin, D. R.; Harrison, R. H.; Moore, R. T.; McCullough, J. P. Tetrafluoromethane: *P–V–T* and Intermolecular Potential Energy Relations. *J. Chem. Phys.* **1961**, *35*, 1357–1366.
103. Lacina, J. L.; Good, W. D.; McCullough, J. P. The Heats of Combustion and Formation of Thiaadamantane. *J. Phys. Chem.* **1961**, *65*, 1026–1027.
104. Berg, W. T.; Scott, D. W.; Hubbard, W. N.; Todd, S. S.; Messerly, J. F.; Hossenlopp, I. A.; Osborn, A.; Douslin, D. R.; McCullough, J. P. The Chemical Thermodynamic

Properties of Cyclopentanethiol. *J. Phys. Chem.* **1961**, *65*, 1425–1430.

105. McCullough, J. P.; Good, W. D. Correlation of Heat of Formation Data for Organic Sulfur Compounds. *J. Phys. Chem.* **1961**, *65*, 1430–1432.

106. Scott, D. W.; Messerly, J. F.; Todd, S. S.; Guthrie, G. B.; Hossenlopp, I. A.; Moore, R. T.; Osborn, A.; Berg, W. T.; McCullough, J. P. Hexamethyldisiloxane: Chemical Thermodynamic Properties and Internal Rotation About the Siloxane Linkage. *J. Phys. Chem.* **1961**, *65*, 1320–1326.

107. Scott, D. W.; Good, W. D.; Todd, S. S.; Messerly, J. F.; Berg, W. T.; Hossenlopp, I. A.; Lacina, J. L.; Osborn, A.; McCullough, J. P. 3,3-Dimethyl-2-thiabutane: Chemical Thermodynamic Properties and Barriers to Internal Rotation. *J. Chem. Phys.* **1962**, *36*, 406–412.

108. Good, W. D.; Lacina, J. L.; McCullough, J. P. Methanethiol and Carbon Disulfide: Heats of Combustion and Formation by Rotating-Bomb Calorimetry. *J. Phys. Chem.* **1961**, *65*, 2229–2231.

109. Douslin, D. R. Pressure–Volume–Temperature Relations and Intermolecular Potentials for Methane and Tetrafluoromethane. *Progress in International Research on Thermodynamic and Transport Properties*; American Society of Mechanical Engineers: New York, 1962.

110. Waddington, G.; Smith, J. C.; Williamson, K. D.; Scott, D. W. Carbon Disulfide as a Reference Substance for Vapor-Flow Calorimetry; The Chemical Thermodynamic Properties. *J. Phys. Chem.* **1962**, *66*, 1074–1077.

111. Scott, D. W.; Guthrie, G. B.; Messerly, J. F.; Todd, S. S.; Berg, W. T.; Hossenlopp, I. A.; McCullough, J. P. Toluene: Thermodynamic Properties, Molecular Vibrations, and Internal Rotation. *J. Phys. Chem.* **1962**, *66*, 911–914.

112. Good, W. D. The Heat of Formation of Silica. *J. Phys. Chem.* **1962**, *66*, 380.

113. Scott, D. W.; Douslin, D. R.; Finke, H. L.; Hubbard, W. N.; Messerly, J. F.; Hossenlopp, I. A.; McCullough, J. P. 2-Methyl-2-butanethiol: Chemical Thermodynamic Properties and Rotational Isomerism. *J. Phys. Chem.* **1962**, *66*, 1334–1341.

114. Douslin, D. R.; McCullough, J. P. An Inclined-Piston Deadweight Pressure Gage. *U.S. Bur. Mines* **1963**, Report of Investigation 6149.

115. Good, W. D.; Lacina, J. L.; Scott, D. W.; McCullough, J. P. Combustion Calorimetry of Organic Fluorine Compounds. The Heats of Combustion and Formation of the Difluorobenzenes, 4-Fluorotoluene, and m-Trifluorotoluic Acid. *J. Phys. Chem.* **1962**, *66*, 1529–1532.

116. Good, W. D.; Douslin, D. R.; McCullough, J. P. 1,2-bis-Difluoroamino-4-methylpentane: Heats of Combustion, Formation, and Vaporization, and Vapor Pressure. *J. Phys. Chem.* **1962**, *66*, 958.

117. Scott, D. W.; Messerly, J. F.; Todd, S. S.; Hossenlopp, I. A.; Douslin, D. R.; McCullough, J. P. 4-Fluorotoluene: Chemical Thermodynamic Properties, Vibrational Assignments, and Internal Rotation. *J. Phys. Chem.* **1962**, *37*, 867–873.

118. Good, W. D.; Todd, S. S.; Messerly, J. F.; Lacina, J. L.; Dawson, J. P.; Scott, D. W.; McCullough, J. P. Perfluoropiperidine: Entropy, Heat of Formation, and Vapor Pressure; N–F Bond Energy; and Solid-State Transitions. *J. Phys. Chem.* **1963**, *67*, 1306–1312.

119. Good, W. D.; Douslin, D. R.; McCullough, J. P. 1,2-bis-Difluoroamino-4-methylpentane: Heats of Combustion, Formation, and Vaporization; Vapor Pressure; and N–F Thermochemical Bond Energy. *J. Phys. Chem.* **1963**, *67*, 1312–1314.

120. Scott, D. W.; Messerly, J. F.; Todd, S. S.; Hossenlopp, I. A.; Osborn, A.; McCullough, J. P. 1,2-Difluorobenzene: Chemical Thermodynamic Properties and Vibrational Assignment. *J. Chem. Phys.* **1963**, *38*, 532–539.

121. Scott, D. W.; Hubbard, W. N.; Messerly, J. F.; Todd, S. S.; Hossenlopp, I. A.; Good, W. D.; Douslin, D. R.; McCullough, J. P. Chemical Thermodynamic Properties and Internal Rotation of Methyl Pyridines: I. 2-Methylpyridine. *J. Phys. Chem.* **1963**, *67*, 680–685.

122. Scott, D. W.; Good, W. D.; Guthrie, G. B.; Todd, S. S.; Hossenlopp, I. A.; Osborn, A. G.; McCullough, J. P. Chemical Thermodynamic Properties and Internal Rotation of Methyl Pyridines: II. 3-Methylpyridine. *J. Phys. Chem.* **1963**, *67*, 685–689.

123. McCullough, J. P.; Messerly, J. F.; Moore, R. T.; Todd, S. S. Trimethylaluminum: Thermodynamic Functions in the Solid and Liquid States, 0–380 K; Vapor Pressure, Heat of Vaporization, and Entropy in the Ideal Gas State. *J. Phys. Chem.* **1963**, *67*, 677–679.

124. Westrum, E. F., Jr.; McCullough, J. P. Thermodynamics of Crystals. In *Physics and Chemistry of the Organic Solid State*; Fox, D., Labes, M. M., Weissberger, A., Eds.; Interscience Publishers: New York, 1963; Vol. 1, Chapter 1, pp 3–178.

125. Messerly, J. F.; Todd, S. S.; Guthrie, G. B.; McCullough, J. P. Study of the Calorimetric Method of Purity Measurement Using IUPAC Samples of Benzene. *U.S. Bur. Mines* **1963**, Report of Investigation 6273.

126. McCullough, J. P. Thermodynamic Research and Chemical Progress. Presented at the 28th Midyear Meeting of the American Petroleum Institute's Division of Refining on Fundamental Research, Philadelphia, PA, May 1963.

127. Scott, D. W.; McCullough, J. P.; Kruse, F. H. Vibrational Assignment and Force Constants of S₈ from a Normal-Coordinate Treatment. *J. Mol. Spectrosc.* **1964**, *13*, 313–320.

128. Douslin, D. R.; Harrison, R. H.; Moore, R. T.; McCullough, J. P. P–V–T Relations for Methane. *J. Chem. Eng. Data* **1964**, *9*, 358–363.

129. Good, W. D.; Lacina, J. L.; DePrater, B. L.; McCullough, J. P. A New Approach to the Combustion Calorimetry of Silicon and Organosilicon Compounds. Heats of Formation of Quartz, Fluorosilicic Acid, and Hexamethyldisiloxane. *J. Chem. Phys.* **1964**, *68*, 579–586.

130. Smith, N. K.; Scott, D. W.; McCullough, J. P. Combustion Calorimetry of Organic Chlorine Compounds. The Heat of Combustion of 2,3,5,6-Tetrachloro-*p*-xylene. *J. Phys. Chem.* **1964**, *68*, 934–939.

131. Smith, N. K.; Gorin, G.; Good, W. D.; McCullough, J. P. The Heats of Combustion, Sublimation, and Formation of Four Dihalobiphenyls. *J. Phys. Chem.* **1964**, *68*, 940–946.

132. Harrison, R. H.; Douslin, D. R. Perfluorocyclobutane: The Thermodynamic Properties of the Real Gas. *U.S. Bur. Mines* **1964**, Report of Investigation 6475.

133. Harrison, R. H. Gases: Thermodynamic Properties. In *Encyclopedia of Physics*; Besancon, R. M., Ed.; Reinhold Publishing Corp.: New York, 1966; pp 291–293.

134. Douslin, D. R.; Osborn, A. Pressure Measurements in the 0.01–30 mm Range with an Inclined-Piston Gauge. *J. Sci. Instrum.* **1965**, *42*, 369–373.

135. Messerly, J. F.; Todd, S. S.; Finke, H. L. Low-Temperature Thermodynamic Properties of *n*-Propyl-, *n*-Butyl-, and *n*-Decyl-Substituted Cyclopentane. *J. Phys. Chem.* **1965**, *69*, 353–359.

136. Crowder, G. A.; Scott, D. W. Infrared Spectra of 27 Compounds in the Regions 15–35 and 15–200 Microns. *U.S. Bur. Mines* **1965**, Report of Investigation 6630.
137. Crowder, G. A.; Gorin, G.; Kruse, F. H.; Scott, D. W. Tetramethyllead: Far Infrared Spectra, Molecular Vibrations, and Chemical Thermodynamic Properties. Resolution of an Entropy Discrepancy. *J. Mol. Spectrosc.* **1965**, *16*, 115–121.
138. Crowder, G. A.; Scott, D. W. Liquid–Vapor Frequency Shifts and Torsional Frequencies in Far Infrared Spectra. *J. Mol. Spectrosc.* **1965**, *16*, 122–129.
139. Finke, H. L.; Messerly, J. F.; Todd, S. S. Thermodynamic Properties of *n*-Propyl-, *n*-Butyl-, and *n*-Decyl-Substituted Cyclohexanes from 10 to 370 K. *J. Phys. Chem.* **1965**, *69*, 2094–2100.
140. Finke, H. L.; Hossenlopp, I. A.; Berg, W. T. 1-Pentanethiol: Heat of Vaporization and Heat Capacity of the Vapor. *J. Phys. Chem.* **1965**, *69*, 3030–3031.
141. Good, W. D.; Månsson, M. The Thermochemistry of Boron and Some of Its Compounds. The Enthalpies of Formation of Orthoboric Acid, Trimethylamineborane and Diammonium Decaborane. *J. Phys. Chem.* **1966**, *70*, 97–101.
142. Messerly, J. F.; Todd, S. S.; Finke, H. L. Low-Temperature Thermodynamic Properties of *n*-Propyl- and *n*-Butylbenzene. *J. Phys. Chem.* **1965**, *69*, 4304–4311.
143. Harrison, R. H.; Douslin, D. R. Tetrafluoromethane: The Thermodynamic Properties of the Real Gas. *J. Chem. Eng. Data* **1966**, *11*, 383–388.
144. Kruse, F. H.; Scott, D. W. Cyclopentane: Molecular Vibrational Analysis. *J. Mol. Spectrosc.* **1966**, *20*, 276–281.
145. Osborn, A. G.; Douslin, D. R. Vapor Pressure Relations of 36 Sulfur Compounds Present in Petroleum. *J. Chem. Eng. Data* **1966**, *11*, 502–509.
146. Good, W. D.; DePrater, B. L. The Enthalpies of Combustion and Formation of the 1-Alkanethiols. The Methylene Increment to the Enthalpy of Formation. *J. Phys. Chem.* **1966**, *70*, 3606–3609.
147. Scott, D. W.; Crowder, G. A. Cyclohexanethiol and 2,4-Dimethyl-3-thiapentane: Molecular Vibrations, Conformational Analyses, and Chemical Thermodynamic Properties. *J. Chem. Phys.* **1967**, *16*, 1054–1062.
148. Scott, D. W.; Berg, W. T.; Hossenlopp, I. A.; Hubbard, W. N.; Messerly, J. F.; Todd, S. S.; Douslin, D. R.; McCullough, J. P.; Waddington, G. Pyrrole: The Chemical Thermodynamic Properties. *J. Phys. Chem.* **1967**, *71*, 2263–2270.
149. Messerly, J. F.; Todd, S. S.; Guthrie, G. B., Jr. Cyclohexanethiol and 2,4-Dimethyl-3-thiapentane: Low-Temperature Thermal Properties. *J. Chem. Eng. Data* **1967**, *12*, 426–429.
150. Messerly, J. F.; Guthrie, G. B.; Todd, S. S.; Finke, H. L. Low-Temperature Thermal Data for *n*-Pentane, *n*-Heptadecane, and *n*-Octadecane: Revised Thermodynamic Functions for *n*-Alkanes C₅–C₁₈. *J. Chem. Eng. Data* **1967**, *12*, 338–345.
151. Smith, N. K.; Good, W. D. The Enthalpy of Formation of Triethylamineborane. *J. Chem. Eng. Data* **1967**, *12*, 570–572.
152. Smith, N. K.; Good, W. D. The Enthalpies of Combustion and Formation of Propylamine, Isopropylamine, and *tert*-Butylamine by. *J. Chem. Eng. Data* **1967**, *12*, 572–574.
153. Douslin, D. R.; Harrison, R. H.; Moore, R. T. *P–V–T* Relations in the System Methane–Tetrafluoromethane: Part 1. Gas Densities and the Principle of Corresponding States. *J. Phys. Chem.* **1967**, *71*, 3477.
154. Smith, D.; Devlin, J. P.; Scott, D. W. Conformational Analysis of Ethanethiol and 2-Propanethiol. *J. Mol. Spectrosc.* **1968**, *25*, 174–184.
155. Scott, D. W.; Crowder, G. A. Torsional Bands in Far-Infrared Spectra of Thiols and Amines. *J. Mol. Spectrosc.* **1968**, *26*, 477–484.
- 155 (a) Westrum, E. F., Jr.; Furukawa, G. T.; McCullough, J. P. Adiabatic Low-temperature Calorimetry. In *Experimental Thermodynamics*; McCullough, J. P., Scott, D. W., Eds.; Butterworths: London, 1968, pp 133–214. (b) McCullough, J. P.; Waddington, G. Vapor-Flow Calorimetry. In *Experimental Thermodynamics*; McCullough, J. P., Scott, D. W., Eds.; Butterworths: London, 1968, pp 369–394.
156. Osborn, A. G.; Douslin, D. R. Vapor Pressure Relations of 13 Nitrogen Compounds Related to Petroleum. *J. Chem. Eng. Data* **1968**, *13*, 534–537.
157. Good, W. D. The Enthalpies of Combustion and Formation of 11 Isomeric Nonanes. *J. Chem. Eng. Data* **1969**, *14*, 231–235.
158. Good, W. D.; Smith, N. K. The Enthalpies of Combustion of Toluene, Benzene, Cyclohexene, Cyclohexane, Methylcyclopentane, 1-Methylcyclopentene, and *n*-Hexane. *J. Chem. Eng. Data* **1969**, *14*, 102–110.
159. Scott, D. W.; El-Sabban, M. Z. A Valence Force Field for Aliphatic Sulfur Compounds: Alkanethiols and Thiaalkanes. *J. Mol. Spectrosc.* **1969**, *30*, 317–337.
160. Osborn, A. G.; Douslin, D. R. Vapor Pressure Relations for the Seven Pentadienes. *J. Chem. Eng. Data* **1969**, *14*, 208–209.
161. Green, J. H. S.; Harrison, D. J.; Kynaston, W.; Scott, D. W. The Vibrational Spectrum of 2,2,5,5-Tetramethyl-3,4-dithiahexane. *Spectrochim. Acta* **1969**, *25A*, 1313–1314.
162. Douslin, D. R.; Harrison, R. H.; Moore, R. T. Pressure–Volume–Temperature Relations of Hexafluorobenzene. *J. Chem. Thermodyn.* **1969**, *1*, 305–319.
163. Scott, D. W.; El-Sabban, M. Z. A Valence Force Field for Aliphatic Sulfur Compounds: Dithiaalkanes. *J. Mol. Spectrosc.* **1969**, *31* (3), 362–367.
164. Good, W. D.; Smith, N. K. The Enthalpies of Combustion and Formation of 1,1-bis(Difluoro-amino)-heptane. The N–F Thermochemical Bond Energy. *J. Chem. Eng. Data* **1970**, *15*, 147–150.
165. Good, W. D.; Moore, R. T. The Enthalpies of Formation of Ethylenediamine, 1,2-Propanediamine, 1,2-Butanediamine, 2-Methyl-1,2-propanediamine, and Isobutylamine. The C–N and N–F Thermochemical Bond Energies. *J. Chem. Eng. Data* **1970**, *15*, 150–154.
166. Good, W. D. 3-Methyl-1,2-butadiene: Enthalpies of Combustion and Formation. *J. Chem. Eng. Data* **1969**, *14*, 480–481.
167. Scott, D. W. A Valence Force Field for Thiophene and Its Deuterium and Methyl Derivatives. *J. Mol. Spectrosc.* **1969**, *31*, 451–463.
168. Moore, R. T.; Harrison, R. H.; Douslin, D. R. Methane: Bibliography of the Thermodynamic and Transport Properties Above 300 K. *U.S. Bur. Mines Open-File Report*, Aug 1969, p 133.
169. Finke, H. L.; McCullough, J. P.; Messerly, J. F.; Guthrie, G. B.; Douslin, D. R. Chemical Thermodynamic Properties for 1-Alkanethiols. *J. Chem. Thermodyn.* **1970**, *2*, 27–41.
170. Messerly, J. F.; Todd, S. S.; Guthrie, G. B. The Chemical Thermodynamic Properties of the Pentadienes: Third Law Studies. *J. Chem. Eng. Data* **1970**, *15*, 227–232.

171. Finke, H. L.; Todd, S. S.; Messerly, J. F. Trimethylamineborane and Triethylamineborane: Low-Temperature Thermodynamic Properties. *J. Chem. Thermodyn.* **1970**, *2*, 129–138.
172. El-Sabban, M. Z.; Scott, D. W. The Chemical Thermodynamic Properties of Hydrocarbons and Related Substances. 2. Properties of 25 Organic Sulfur Compounds in the Ideal Gas State from 0 to 1000 K. *Bull. U.S. Bur. Mines* **1970**, *654*, 26.
173. Green, J. H. S.; Harrison, D. J.; Kynaston, W.; Scott, D. W. Vibrational Spectra of Benzene Derivatives—VII. 4-Fluoro- and 4-Bromobenzenethiol, 4-Chloro- and 4-Bromophenylmethyl-sulfide. *Spectrochim. Acta* **1970**, *26A*, 1515–1521.
174. Good, W. D. The Enthalpies of Combustion and Formation of the Isomeric Pentanes. *J. Chem. Thermodyn.* **1970**, *2*, 237–244.
175. Good, W. D. The Enthalpies of Combustion and Formation of *n*-Propylcyclohexane and Six Methyleneethylcyclohexanes. *J. Chem. Thermodyn.* **1970**, *2*, 399–405.
176. Thomson, G. W.; Douslin, D. R. Determination of Pressure and Volume. In *Physical Methods of Organic Chemistry*, 4th ed.; Weissberger, A., Rossiter, B. W., Eds.; John Wiley & Sons, Inc.: New York, 1971; pp 23–104.
177. Scott, D. W. Tetrahydrofuran: Vibrational Assignment, Chemical Thermodynamic Properties, and Vapor Pressure. *J. Chem. Thermodyn.* **1970**, *2*, 833–837.
178. Scott, D. W. A Valence Force Field for Furan and Pyrrole and Their Deuterium and Methyl Derivatives. *J. Mol. Spectrosc.* **1971**, *37*, 77–91.
179. Douslin, D. R. Thermodynamic Research under API Project 62. *Proc. Div. Refining, API* **1970**, 189–211.
180. Messerly, J. F.; Finke, H. L. Hexafluorobenzene and 1,3-Difluorobenzene: Low-temperature Calorimetric Studies and Chemical Thermodynamic Properties. *J. Chem. Thermodyn.* **1970**, *2*, 867–880.
181. Good, W. D. The Enthalpies of Combustion and Formation of *n*-Propylcyclopentane and Five Methyleneethylcyclopentanes. *J. Chem. Thermodyn.* **1971**, *3*, 97–103.
182. Douslin, D. R. Vapor Pressure of Water from –2.5 to 20 °C. *J. Chem. Thermodyn.* **1971**, *3*, 187–193.
183. Gammon, B. E.; Douslin, D. R. A System for Measuring the Velocity of Sound in Compressed Fluids and Its Application to Helium between –175 and 150 °C. Proceedings of the Fifth Symposium on Thermophysical Properties, Sept 30–Oct 2, 1970; Standing Committee on Thermophysical Properties, Heat Transfer Division, American Society Mechanical Engineers: Newton, MA, 1970; pp 107–114.
184. Good, W. D. The Enthalpies of Combustion and Formation of Some Alkyl Cyclopropanes. *J. Chem. Thermodyn.* **1971**, *3*, 539–546.
185. Messerly, J. F.; Finke, H. L. Low-Temperature Thermal Properties of 2-Methylheptane and 2-Methyldecane. The Thermodynamic Properties of the 2-Methylalkanes. *J. Chem. Thermodyn.* **1971**, *3*, 675–687.
186. Scott, D. W. Piperidine: Vibrational Assignment, Conformational Analysis, and Chemical Thermodynamic Properties. *J. Chem. Thermodyn.* **1971**, *3*, 649–656.
187. Douslin, D. R. Prediction of Isomeric Equilibria. A Better Calorimetric Basis. *Proc. Div. Refining, API* **1971**, 361–375.
188. Scott, D. W. 1-Aminopropane, 2-Aminopropane, and 2-Methyl-2-aminopropane: Vibrational Assignments, Conformational Analyses, and Chemical Thermodynamic Properties. *J. Chem. Thermodyn.* **1971**, *3*, 843–852.
189. Good, W. D.; Moore, R. T. The Enthalpies of Combustion and Formation of Cyclopropylamine. The C–N Thermochemical Bond Energy. *J. Chem. Thermodyn.* **1971**, *3*, 701–705.
190. Good, W. D. The Enthalpies of Combustion and Formation of Indan and Seven Alkylindan. *J. Chem. Thermodyn.* **1971**, *3*, 711–717.
191. Scott, D. W. Tetraethyllead: Vibrational Assignment and Chemical Thermodynamic Properties. *J. Chem. Thermodyn.* **1972**, *4*, 99–104.
192. Good, W. D. Enthalpies of Combustion of 18 Organic Sulfur Compounds Related to Petroleum. *J. Chem. Eng. Data* **1972**, *17*, 158–162.
193. Finke, H. L.; Messerly, J. F.; Todd, S. S. Thermodynamic Properties of Acrylonitrile, 1-Aminopropane, 2-Aminopropane, and 2-Methyl-2-aminopropane. *J. Chem. Thermodyn.* **1972**, *4*, 359–374.
194. Good, W. D. The Enthalpies of Combustion of Nine Organic Nitrogen Compounds Related to Petroleum. *J. Chem. Eng. Data* **1972**, *17*, 28–31.
195. Finke, H. L.; McCullough, J. P.; Messerly, J. F.; Osborn, A.; Douslin, D. R. *cis*- and *trans*-Hexahydroindan. Chemical Thermodynamic Properties and Isomerization Equilibrium. *J. Chem. Thermodyn.* **1972**, *4*, 477–494.
196. Good, W. D. The Enthalpies of Combustion and Formation of *n*-Octane and 2,2,3,3-Tetramethylbutane. *J. Chem. Thermodyn.* **1972**, *4*, 709–714.
197. Finke, H. L.; Messerly, J. F. 3-Methylpentane and 3-Methylheptane: Low-Temperature Thermodynamic Properties. *J. Chem. Thermodyn.* **1973**, *5*, 247–257.
198. Harrison, R. H.; Moore, R. T.; Douslin, D. R. Thermodynamic Properties of Compressed Gaseous Methane. *J. Chem. Eng. Data* **1973**, *18*, 131–134.
199. Douslin, D. R.; Harrison, R. H. Pressure, Volume, Temperature Relations of Ethane. *J. Chem. Thermodyn.* **1973**, *5*, 491–512.
200. Good, W. D. The Enthalpies of Combustion and Formation of *n*-Butylbenzene, the Diethylbenzenes, the Methyl-*n*-propylbenzenes, and the Methyl-*iso*-propylbenzenes. *J. Chem. Thermodyn.* **1973**, *5*, 707–714.
201. Good, W. D. The Enthalpies of Combustion and Formation of 1,8-Dimethylnaphthalene, 2,3-Dimethylnaphthalene, 2,6-Dimethylnaphthalene, and 2,7-Dimethylnaphthalene. *J. Chem. Thermodyn.* **1973**, *5*, 715–720.
202. Good, W. D.; Moore, R. T.; Osborn, A. G.; Douslin, D. R. The Enthalpies of Formation of Ethylcyclobutane, Methylene-cyclobutane, and 1,1-Dimethylcyclopropane. *J. Chem. Thermodyn.* **1974**, *6*, 303–310.
203. Messerly, J. F.; Finke, H. L.; Todd, S. S. Low-Temperature Thermal Studies on Six Organo-Sulfur Compounds. *J. Chem. Thermodyn.* **1974**, *6*, 635–657.
204. Osborn, A. G.; Douslin, D. R. Vapor Pressure Relations for 15 Hydrocarbons. *J. Chem. Thermodyn.* **1974**, *19*, 114–117.
205. Scott, D. W. The Chemical Thermodynamic Properties of Hydrocarbons and Related Substances. III. Properties of the Alkane Hydrocarbons, C₁ Through C₁₀, in the Ideal Gas State from 0 to 1500 K. *Bull. U.S. Bur. Mines* **1974**, Bulletin 666, 187.
206. Scott, D. W. A Correlation of the Chemical Thermodynamic Properties of Alkane Hydrocarbons. *J. Chem. Phys.* **1974**, *60*, 3144–3165.
207. Good, W. D. The Standard Enthalpies of Combustion and Formation of *n*-Butylbenzene, the Dimethylenebenzenes, and the Tetramethylbenzenes in the Condensed State. *J. Chem. Thermodyn.* **1975**, *7*, 49–60.

208. Douslin, D. R. Pressure, Volume, Temperature Properties of Fluids. In *MTP International Review of Science, Thermodynamics, and Thermochemistry*; Skinner, H. A., Ed.; Butterworths: London, 1975; Vol. 10, Chapter 6.
209. Good, W. D.; Messerly, J. F.; Osborn, A. G.; Douslin, D. R. Enthalpies of Formation of Cyclopentylamine and Cyclobutylamine; Vapor Pressure of Cyclopentylamine. *J. Chem. Thermodyn.* **1975**, *7*, 285–291.
210. Osborn, A. G.; Douslin, D. R. Vapor Pressure and Derived Enthalpies of Vaporization for Some Condensed-Ring Hydrocarbons. *J. Chem. Eng. Data* **1975**, *20*, 229–231.
211. Messerly, J. F.; Finke, H. L.; Osborn, A. G.; Douslin, D. R. Low-Temperature Calorimetric and Vapor Pressure Studies on Alkanediamines. *J. Chem. Thermodyn.* **1975**, *7*, 1029–1045.
212. Gammon, B. E.; Douslin, D. R. The Velocity of Sound and Heat Capacity in Methane from Near-Critical to Subcritical Conditions and Equation-of-State Implications. *J. Chem. Phys.* **1976**, *64*, 203–218.
213. Good, W. D. The Enthalpies of Formation of Five Isomeric Heptenes. *J. Chem. Thermodyn.* **1976**, *8*, 67–71.
214. Douslin, D. R.; Harrison, R. H. Pressure, Volume, Temperature Relations of Ethylene. *J. Chem. Thermodyn.* **1976**, *8*, 301–330.
215. Gammon, B. E. The Velocity of Sound with Derived State Properties in Helium at -175° to 150°C with Pressure to 150 atm. *J. Chem. Phys.* **1976**, *64*, 2556–2568.
216. Good, W. D.; Lee, S. H. The Enthalpies of Formation of Selected Naphthalenes, Diphenylmethanes, and Bicyclic Hydrocarbons. *J. Chem. Thermodyn.* **1976**, *8*, 643–650.
217. Finke, H. L.; Messerly, J. F.; Douslin, D. R. Low-Temperature Thermal Quantities for Five Alky-Substituted Pentanes. *J. Chem. Thermodyn.* **1976**, *8*, 965–983.
218. Good, W. D.; Head, A. J.; Mosselman, C. General Techniques for Combustion of Liquid/Solid Organic Compounds by Oxygen Bomb Calorimetry. In *Combustion Calorimetry. Experimental Chemical Thermodynamics*; Sunner, S., Mansson, M., Eds.; Pergamon Press Ltd.: New York, 1978; Vol. 1, pp 8-1–8-17.
219. Head, A. J.; Good, W. D. Combustion of Liquid/Solid Organic Compounds with Non-Metallic Hetero-Atoms in Combustion Calorimetry. In *Experimental Chemical Thermodynamics*; Sunner, S., Mansson, M., Eds.; Pergamon Press Ltd.: New York, 1978; Vol. 1, pp 9-1–9-22.
220. Harrison, R. H.; Douslin, D. R. Derived Thermodynamic Properties of Ethylene. *J. Chem. Eng. Data* **1977**, *22*, 24.
221. Berg, R. L.; Good, W. D. ERDA In-House Research on Thermodynamics of Oil-Recovery Micellar Systems. *Proceedings of the 2nd ERDA Symposium on Enhanced Oil & Gas Recovery*, Tulsa, OK, Sept 9–10, 1976; Petroleum Publishing Co.: pp D-6/1–D-6/4.
222. Finke, H. L.; Messerly, J. F.; Lee, S. H.; Osborn, A. G.; Douslin, D. R. Comprehensive Thermodynamic Studies of Seven Aromatic Hydrocarbons. *J. Chem. Thermodyn.* **1977**, *9*, 937–956.
223. Berg, R. L. Thermodynamics of Aqueous Sodium Dodecyl Sulfate. *BERC/TPR-77/3* **1977**, 35.
224. Todd, S. S.; Hossenlopp, I. A.; Scott, D. W. Vapor-Flow Calorimetry of Benzene. *J. Chem. Thermodyn.* **1978**, *10*, 641–648.
225. Osborn, A. G.; Scott, D. W. Vapor Pressure and Enthalpy of Vaporization of Indan and Five Methyl-Substituted Indans. *J. Chem. Thermodyn.* **1978**, *10*, 619–628.
226. Berg, R. L.; Noll, L. A.; Good, W. D. ERDA In-House Research on Thermodynamics of Oil-Recovery Micellar Systems. *Proceedings of the 3rd ERDA Symposium on Enhanced Oil & Gas Recovery & Improved Drilling Methods*, Tulsa, OK, Aug 30–Sept 1, 1977; Petroleum Publishing Co.: pp B-10/1–B-10/8.
227. Good, W. D. The Enthalpies of Formation of Some Bridged-Ring Polynuclear Aromatic Hydrocarbons. *J. Chem. Thermodyn.* **1978**, *10*, 553–558.
228. Miller, A.; Scott, D. W. Chemical Thermodynamic Properties of Ethylbenzene. *J. Chem. Phys.* **1978**, *68*, 1317.
229. Berg, R. L.; Noll, L. A.; Good, W. D. Thermochemistry of Oil-Recovery Micellar Systems. In *Chemistry of Oil Recovery*; Johansen, R. T., Berg, R. L., Eds.; ACS Symposium Series 91; American Chemical Society: Washington, DC, 1979; pp 87–102.
230. Good, W. D.; Smith, N. K. The Enthalpies of Combustion of the Isomeric Pentenes in the Liquid State. A Warning to Combustion Calorimetrists About Sample Drying. *J. Chem. Thermodyn.* **1979**, *11*, 111–118.
231. Scott, D. W.; Osborn, A. G. Representation of Vapor-Pressure Data. *J. Phys. Chem.* **1979**, *83*, 2714–2723.
232. Lee-Bechtold, S. H.; Hossenlopp, I. A.; Scott, D. W.; Osborn, A. G.; Good, W. D. A Comprehensive Thermodynamic Study of 9,10-Dihydrophenanthrene. *J. Chem. Thermodyn.* **1979**, *11*, 469–482.
233. Noll, L. A.; Berg, R. L.; Good, W. D. DOE In-House Research on Thermodynamics of Oil-Recovery Micellar Systems. *Proceedings of the 4th DOE Symposium on Enhanced Oil & Gas Recovery & Improved Drilling Methods*, Tulsa, OK, Aug 29–31, 1978; Petroleum Publishing Co.: pp B-10/1–B-10/6.
234. Smith, N. K.; Good, W. D. Enthalpies of Combustion of Ramjet Fuels. *Am. Inst. Aeronaut. Astronaut. J.* **1979**, *17*, 905–907.
235. Smith, N. K.; Stewart, R. C., Jr.; Osborn, A. G.; Scott, D. W. Pyrene: Vapor Pressure, Enthalpy of Combustion, and Chemical Thermodynamics Properties. *J. Chem. Thermodyn.* **1980**, *12*, 919–926.
236. Osborn, A. G.; Scott, D. W. Vapor Pressure of 17 Miscellaneous Organic Compounds. *J. Chem. Thermodyn.* **1980**, *12*, 429–438.
237. Finke, H. L.; Messerly, J. F.; Lee-Bechtold, S. H. Thermodynamic Properties of Cyclopropylamine, Cyclopentylamine, and Methylene-cyclobutane. *J. Chem. Thermodyn.* **1981**, *13*, 345–355.
238. Lee-Bechtold, S. H.; Finke, H. L.; Messerly, J. F.; Scott, D. W. Thermodynamic Properties of Methyl-Substituted Indans. *J. Chem. Thermodyn.* **1981**, *13*, 213–228.
239. Noll, L. A.; Burchfield, T. E.; Good, W. D. DOE In-House Research on Thermodynamics of Oil-Recovery Micellar Systems. *Proceedings of the 5th DOE Symposium on Enhanced Oil & Gas Recovery & Improved Drilling Methods*, Tulsa, OK, Aug 22–24, 1979; Petroleum Publishing Co.: pp B-9/1–B-9/5.
240. Hossenlopp, I. A.; Scott, D. W. Vapor Heat Capacity and Enthalpy of Vaporization of Six Miscellaneous Organic Compounds. *J. Chem. Thermodyn.* **1981**, *13*, 405–414.
241. Hossenlopp, I. A.; Scott, D. W. Vapor Heat Capacity and Enthalpy of Vaporization of Five Alkane Hydrocarbons. *J. Chem. Thermodyn.* **1981**, *13*, 415–422.
242. Hossenlopp, I. A.; Scott, D. W. Vapor Heat Capacity and Enthalpy of Vaporization of Four Aromatic and/or Cycloalkane Hydrocarbons. *J. Chem. Thermodyn.* **1981**, *13*, 423–428.

243. Smith, N. K.; Lee-Bechtold, S. H.; Good, W. D. Thermodynamic Properties of Materials Derived from Coal Liquefaction. *BETC/TPR-79/2* **1980**, 25.
244. Dwiggin, C. W., Jr. Application of the Indirect Transform Method to Obtaining Distance Distribution Functions of Extremely Large Colloids and Emulsions Using Small-Angle X-ray Scattering Data Obtained with a Bonse-Hart Instrument. *J. Appl. Crystallogr.* **1980**, 13, 572–576.
245. Draeger, J. A.; Scott, D. W. Ideal Gas Thermodynamic Properties of 1,4-Dimethylbenzene. *J. Chem. Phys.* **1981**, 74, 4748–4749.
246. Draeger, J. A.; Scott, D. W. Chemical Thermodynamic Properties and Internal Rotation of Methylpyridines: III. 4-Methylpyridine. *J. Chem. Phys.* **1981**, 75, 2016–2018.
247. Thomas, R. H. P.; Harrison, R. H. Pressure, Volume, Temperature Relations of Propane. *J. Chem. Eng. Data* **1982**, 27, 1–11.
248. Draeger, J. A.; Scott, D. W. Chemical Thermodynamic Properties and Internal Rotation of Methylpyridines: IV. Ideal Gas Properties of the Dimethylpyridines. *J. Chem. Thermodyn.* **1982**, 14, 991–998.
249. Draeger, J. A. Methylpyridines: V. Vibrational Assignments and an Approximate Force Field. *Spectrochim. Acta* **1983**, 39A, 809–825.
250. Draeger, J. A. Chemical Thermodynamic Properties and Internal Rotation of Methylpyridines: V. Ideal Gas Properties of 2,4,6-Trimethylpyridine and 2,3,6-Trimethylpyridine. *J. Chem. Thermodyn.* **1982**, 14, 999–1002.
251. Burchfield, T. E.; Noll, L. A. Microcomputer-Based Data Acquisition System for LKB Sorption and Flow Microcalorimeters. *DOE/BETC Report of Investigation 8247* **1982**, 33.
252. Gammon, B. E.; Callanan, J. E.; Hossenlopp, I. A.; Osborn, A. G.; Good, W. D. Heat Capacity, Vapor Pressure, and Derived Thermodynamic Properties of Octahydroanthracene. Proceedings of the 8th Symposium on Thermophysical Properties, National Bureau of Standards, Gaithersburg, MD, June 1981.
253. Doughty, D. A. Effect of Impurities on Partial Molal Volume and Critical Micelle Concentration of Sodium Dodecyl sulfate. Correction of Micelle Aggregation Number. *J. Phys. Chem.* **1981**, 85, 3545–3546.
254. Draeger, J. A.; Harrison, R. H.; Good, W. D. Chemical Thermodynamic Properties of Molecules Which Undergo Inversion: I. Methylamine, Cyclopropylamine, Aniline, and Cyclopentene. *J. Chem. Thermodyn.* **1983**, 15, 367–376.
255. Noll, L. A.; Burchfield, T. E. Calculation of the Reduced Surface Excess From Continuous Flow Frontal Analysis Solid-Liquid Chromatography. *Colloids Surf.* **1982**, 5, 33–42.
256. Dwiggin, C. W., Jr. Aggregation of Clay Particles as Indicated by Distance Distribution Functions Obtained by Indirect Transformation of Small-Angle X-ray Scattering Data Obtained with a Bonse-Hart Instrument. *J. Appl. Crystallogr.* **1982**, 15, 564–566.
257. Doughty, D. A. Effect of Co-Ion on the Preferential Interaction Parameter and Micelle Aggregation Number. Sodium Dodecyl Sulfate in Aqueous Sodium Halide. *J. Phys. Chem. Lett.* **1983**, 87, 5286–5290.
258. Noll, L. A.; Burchfield, T. E. Silica Gel As a Model Surface for Adsorption Calorimetry of Enhanced Oil Recovery Systems. *DOE/BETC Report of Investigation 82/7* **1982**, 42.
259. Harrison, R. H.; Vogh, J. W.; Grizzle, P. L.; Thomson, J. S. Vapor-Liquid Equilibrium of H-Coal Liquids, Water, and a Nine-Component Light Gas Mixture. *Prepr. (Div. Fuel Chem., Am. Chem. Soc.)* **1982**, 27 (3–4), 98–103.
260. Woodbury, G. W., Jr.; Noll, L. A. Heat of Adsorption of Liquid Mixtures on Solid Surfaces: Comparison of Theory and Experiment. *Colloids Surf.* **1983**, 8, 1–15.
261. Noll, L. A.; Woodbury, G., Jr.; Burchfield, T. E. Dependence of Adsorption of Cosurfactant on Chain Length. *Colloids Surf.* **1984**, 9, 349–354.
262. Dwiggin, C. W., Jr. General Calculation of the Polarization Factor for Multiple Coherent Scattering of Unpolarized and Plane-Polarized X-rays. *Acta Crystallogr.* **1983**, A39, 773–777.
263. Burchfield, T. E.; Woolley, E. M. Model for Thermodynamics of Ionic Surfactant Solutions. I. Osmotic and Activity Coefficients. *J. Phys. Chem.* **1984**, 88, 2149–2154.
264. Woolley, E. M.; Burchfield, T. E. Model for Thermodynamics of Ionic Surfactant Solutions. II. Enthalpies, Heat Capacities and Volumes. *J. Phys. Chem.* **1984**, 88, 2155–2162.
265. Gammon, B. E. Thermodynamic and Thermochemical Studies at the Bartlesville Energy Technology Center. Proceedings of the American Institute of Chemical Engineers Symposium on Awareness of Information Sources, Part II- -Date Centers for Material Properties, Denver, CO, Aug 29–31, 1983.
266. Harrison, R. H.; Scheppele, S. E.; Sturm, G. P., Jr.; Grizzle, P. L. Solubility of Hydrogen in Well-Defined Coal Liquids. *J. Chem. Eng. Data* **1985**, 30, 183–189.
267. Burchfield, T. E.; Woolley, E. M. Model for Thermodynamics of Ionic Surfactant Solutions. Proceedings for the Thermochemistry of Surfactant Solutions Conference, Cadarache, France, Oct 19–21, 1983.
268. Woolley, E. M.; Burchfield, T. E. Model for Thermodynamics of Ionic Surfactant Solutions. III. Enthalpies, Heat Capacities, and Volumes of Other Surfactants. *J. Phys. Chem.* **1985**, 89, 714–722.
269. Burchfield, T. E.; Woolley, E. M. Model for Thermodynamics of Ionic Surfactant Solutions. Osmotic and Activity Coefficients. Proceedings of the 5th International Symposium on Surfactants in Solution, Bordeaux, France, July 9–13, 1984.
270. Burchfield, T. E.; Woolley, E. M. Calculation of Thermodynamic Properties for Micelle Formation. *Fluid Phase Equilib.* **1985**, 20, 207–214.
271. Draeger, J. A. Chemical Thermodynamic Properties of Molecules that Undergo Inversion. II. The Methyl-anilines. *J. Chem. Thermodyn.* **1984**, 16, 1067–1073.
272. Draeger, J. A. Chemical Thermodynamic Properties of Molecules that Undergo Inversion. III. The Aminopyridines. *J. Chem. Thermodyn.* **1984**, 16, 1075–1079.
273. Dwiggin, C. W., Jr. Intensity of Secondary Scattering of X-rays by Noncrystalline Materials. Transmission Geometry with an Incident-Beam Monochromator. *J. Appl. Crystallogr.* **1984**, 17, 134–139.
274. Draeger, J. A. The Methylbenzenes. I. Vapor-Phase Vibrational Fundamentals, Internal Rotations, and a Modified Valence Force Field. *Spectrochim. Acta* **1985**, 41A, 607–627.
275. Draeger, J. A. The Methylbenzenes. II. Fundamental Vibrational Shifts, Statistical Thermodynamic Functions, and Properties of Formation. *J. Chem. Thermodyn.* **1985**, 17, 263–275.
276. Steele, W. V.; Gammon, B. E.; Smith, N. K.; Chickos, J. S.; Greenberg, A.; Liebman, J. F. The Standard Molar

Enthalpy of Formation of 2,3-Diphenylcycloprop-2-en-1-one. *J. Chem. Thermodyn.* **1985**, *17*, 505–511.

277. Sivaraman, A.; Gammon, B. E. *Speed-of-Sound Measurements in Natural Gas Fluids. Speed of Sound Measurements on Methane*; GRI Final Report No. GRI-86/0043; Gas Technology Institute: Chicago, IL, Jan 1986. Ordering details available on the Web at griweb.gastech-nology.org/pub/abstracts/gri86_0043/html.

278. Steele, W. V.; Chirico, R. D.; Collier, W. B.; Harrison, R. H.; Gammon, B. E. *Assessment of Thermodynamic Data and Needs, Including Their Economic Impact for Development of New Fossil Fuel Refining Processes*; NIPER-159 (NTIS Report No. DE-86000298); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1986.

279. Harrison, R. H.; Gammon, B. E. *Thermodynamic Properties of Real and Synthetic Fluid Mixtures Derived from Fossil Substances. Pressure–Density–Temperature Properties of Methanol*; NIPER-139 (NTIS Report No. DE-86000307); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1986.

280. Steele, W. V.; Chirico, R. D.; Collier, W. B.; Hossenlopp, I. A.; Nguyen, A.; Strube, M. M. *Thermochemical and Thermophysical Properties of Organic Nitrogen Compounds Found in Fossil Materials. Status Report*; NIPER-188 (NTIS Report No. DE-87001204); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Nov 1986.

281. Messerly, J. F.; Todd, S. S.; Finke, H. L.; Good, W. D.; Gammon, B. E. *Thermodynamic Properties of Organic Nitrogen Compounds That Occur in Shale Oil and Heavy Petroleum. Condensed-Phase Heat Capacity Studies and Derived Thermodynamic Functions for Six Cyclic Nitrogen Compounds*; NIPER-83 (NTIS Report No. DE-87001213); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Jan 1987.

282. Steele, W. V.; Chirico, R. D. The Role of Thermodynamics in the Design of Future Jet Fuels. *Prepr.–Am. Chem. Soc., Div. Pet. Chem.* **1987**, *32* (2), 512–515.

283. Steele, W. V.; Chirico, R. D.; Strube, M. M. *Thermodynamics of Materials in the Range C₁₀–C₁₆. Identification of Data Gaps*; NIPER-243 (Report No. NACP-PE-164-C); Naval Air Propulsion Center: Trenton, NJ, Mar 1987.

284. Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Steele, W. V. *Thermochemical and Thermophysical Properties of Organic Substances Derived From Fossil Substances. Thermodynamic Studies Related to the Hydrogenation of Anthracene*; NIPER-239 (NTIS Report No. DE-87001235); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Feb 1987.

285. Messerly, J. F.; Todd, S. S.; Finke, H. L.; Good, W. D.; Gammon, B. E. Condensed-Phase Heat Capacity Studies and Derived Thermodynamic Functions for Six Cyclic Nitrogen Compounds. *J. Chem. Thermodyn.* **1988**, *20*, 209–223.

286. Messerly, J. F.; Finke, H. L.; Good, W. D.; Gammon, B. E. Condensed-Phase Heat Capacities and Derived Thermodynamic Properties of 1,4-Dimethylbenzene, 1,2-Diphenylethane, and 2,3-Dimethylnaphthalene. *J. Chem. Thermodyn.* **1988**, *20*, 485–501.

287. Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Strube, M. M.; Steele, W. V. *Thermochemical and Thermophysical Properties of Organic Compounds Derived From Fossil Substances. Thermodynamic Studies Related to the Hydrogenation of Phenanthrene*; NIPER-247 (NTIS Report No. DE-87001252); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Apr 1987.

288. Chirico, R. D.; Nguyen, A.; Steele, W. V.; Strube, M. M.; Tsonopoulos, C. The Vapor Pressure of *n*-Alkanes

Revisited. New Vapor Pressure Data on *n*-Decane, *n*-Eicosane and *n*-Octacosane. *J. Chem. Eng. Data* **1989**, *34*, 149–156.

289. Barber, S. A.; Kannel, J. W.; Steele, W. V.; Brinkman, D. W. High-Temperature Lubricant Assessment for Advanced Propulsion Systems. WPAFB Report on Contract No. F33615-86-C-2623, Aug 1987.

290. Steele, W. V.; Archer, D. G.; Chirico, R. D.; Strube, M. M. *Comparison of the Thermodynamics of Nitrogen and Sulfur Removal in Heavy Oil Upgrading. Part 1. Acyclic and Monocyclic Compounds*; NIPER-264 (NTIS Report No. DE89000747); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1989.

291. Chirico, R. D.; Steele, W. V.; Hossenlopp, I. A.; Nguyen, A.; Archer, D. G.; Strube, M. M. *The Thermodynamic Properties of Organic Oxygen Compounds*; NIPER-271 (NTIS Report No. DE88001208); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Jan 1988.

292. Steele, W. V.; Archer, D. G.; Chirico, R. D.; Collier, W. B.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K.; Gammon, B. E. The Thermodynamic Properties of Quinoline and Isoquinoline. *J. Chem. Thermodyn.* **1988**, *20*, 1233–1264.

293. Hossenlopp, I. A.; Archer, D. G. Enthalpies of Vaporization of Piperidine and 1,2-Dimethylbenzene; Gas-Phase Isobaric Heat Capacities for Piperidine. *J. Chem. Thermodyn.* **1988**, *20*, 1061–1068.

294. Steele, W. V.; Smith, N. K.; Wiberg, K. B.; Dailey, W. P.; Crocker, L. S. *The Standard Enthalpy of Formation of 3-Methylenecyclobutyl Acetate. A Derived Enthalpy of Formation of [1.1.1] Propellane*; Internal DOE Fossil Energy Report; Bartlesville Project Office: Bartlesville, OK, May 1988. Not available for distribution.

295. Collier, W. B. Vibrational Frequencies of Polyatomic Molecules. I. Indole and 2,3-Benzofuran Spectra and Analysis. *J. Chem. Phys.* **1988**, *88* (12), 7295–7305.

296. Steele, W. V.; Archer, D. G.; Chirico, R. D.; Collier, W. B.; Gammon, B. E.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K. *The Thermodynamic Properties of Quinoline and Isoquinoline*; NIPER-301 (NTIS Report No. DE88001218); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Nov 1987.

297. Steele, W. V.; Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K.; Gammon, B. E. Thermodynamic Properties of the Five Benzoquinolines. *J. Chem. Thermodyn.* **1989**, *21*, 81–107.

298. Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Steele, W. V.; Gammon, B. E. The Thermodynamic Properties of 4-Methylphenanthrene. *J. Chem. Thermodyn.* **1989**, *21*, 179–202.

299. Chirico, R. D.; Archer, D. G.; Hossenlopp, I. A.; Nguyen, A.; Steele, W. V. The Thermodynamic Properties of Chroman and Isochroman. *J. Chem. Thermodyn.* **1990**, *22*, 665–682.

300. Steele, W. V.; Archer, D. G.; Chirico, R. D.; Strube, M. M. *Thermodynamics of Materials in the Range C₁₀ to C₁₆. Data Base Description, Uses, and Future Work Recommendations*; NIPER-333 (NTIS Report No. DE88001243); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1988.

301. Strube, M. M.; Archer, D. G.; Chirico, R. D.; Steele, W. V. *Thermodynamics of Materials in the Range C₁₀ to C₁₆. Data Base Reference Manual*; NIPER-334 (NTIS Report No. DE88001244); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1988.

302. Steele, W. V.; Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A. *The Thermodynamic Properties of the Five Ben-*

zoquinolines; NIPER-337 (NTIS Report No. DE88001240); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1988.

303. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Smith, N. K. *High-Temperature Heat-Capacity Measurements Using a Differential Scanning Calorimeter (Development of Methodology and Application to Pure Organic Compounds)*; NIPER-360 (NTIS Report No. DE88001241); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Aug 1988.

304. Steele, W. V.; Chirico, R. D. *Preliminary Thermodynamic Studies on the Hydrodenitrogenation of Indole*; NIPER-379 (NTIS Report No. DE89000708); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Dec 1988.

305. Chirico, R. D.; Archer, D. G.; Hossenlopp, I. A.; Nguyen, A.; Steele, W. V. *The Thermodynamic Properties of Polycyclic Aromatic Oxygen-Containing Compounds. I. Chroman and Isochroman*; NIPER-380 (NTIS Report No. DE89000709); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Dec 1988.

306. Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Steele, W. V. *The Thermodynamic Properties of 4-Methylphenanthrene (Application of the Group-Contribution Methodology to Alkyl Aromatics)*; NIPER-345 (NTIS Report No. DE89000716); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Jan 1989.

307. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Smith, N. K. *High-Temperature Heat-Capacity Measurements and Critical Property Determination Using a Differential Scanning Calorimeter. Results of Measurements on Toluene, Tetralin, and JP-10*; NIPER-395 (NTIS Report No. DE89000749); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1989.

308. Steele, W. V.; Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K. *The Thermodynamic Properties of 1,2,3,4- and 5,6,7,8-Tetrahydroquinolines*; NIPER-399 (NTIS Report No. 89000729); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Dec 1988.

309. Steele, W. V.; Chirico, R. D. Accurate Measurements of Thermochemical and Thermophysical Properties of Future Jet Fuels. *Prepr.-Am. Chem. Soc., Div. Pet. Chem.* **1989**, 34 (4), 876–884.

310. Knipmeyer, S. E.; Archer, D. G.; Chirico, R. D.; Gammon, B. E.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K.; Steele, W. V.; Strube, M. M. High-Temperature Enthalpy and Critical Property Measurements using a Differential Scanning Calorimeter. *Fluid Phase Equilib.* **1989**, 52, 185–192.

311. Steele, W. V.; Chirico, R. D.; Hossenlopp, I. A.; Nguyen, A.; Smith, N. K.; Gammon, B. E. The Thermodynamic Properties of 1,2,3,4- and 5,6,7,8-Tetrahydroquinolines. *J. Chem. Thermodyn.* **1989**, 21, 1121–1150.

312 (a) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. *Thermodynamic Properties of Biphenyl*; NIPER-82 (NTIS Report No. 89000750); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1989. (b) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. Thermodynamic Properties of Biphenyl. *J. Chem. Thermodyn.* **1989**, 21, 1307–1331.

313 (a) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. *Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation*; NIPER-319 (NTIS Report No. 89000748); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1989. (b) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. Determination of Some Pure Compound Ideal-Gas

Enthalpies of Formation. *Experimental Results from the Design Institute for Physical Property Data: Phase Equilibria and Pure Component Properties Part II*; AIChE Symposium Series 271; AIChE: New York, 1989; Vol. 85, pp 140–162.

314. Steele, W. V.; Chirico, R. D. *Thermodynamics and the Hydrodenitrogenation of Indole. In three parts: Part I. Thermodynamic Properties of Indoline and 2-Methylindole, Part II. Gibbs Energies of Reaction in the Hydrodenitrogenation of Indole, Part III. Thermodynamic Equilibria and Comparison with Literature Kinetic Studies*; NIPER-415 (NTIS Report No. 89000751); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1989.

315. Steele, W. V.; Chirico, R. D. *Thermodynamic Equilibria in the Biphenyl/Hydrogen System (The Power and Limitations of Group Additivity Estimations)*; NIPER-403 (NTIS Report No. 89000754); DOE Fossil Energy: Bartlesville Project Office, July 1989.

316. Steele, W. V.; Chirico, R. D. *Thermodynamics and the Hydrodeoxygenation of 2,3-Benzofuran. In three parts: Part I. Thermodynamic Properties of 2,3-benzofuran and 4,5-Dihydro-2,3-benzofuran, Part II. Gibbs Energies of Reaction in the Hydrodeoxygenation of 2,3-Benzofuran, Part III. Thermodynamic Equilibria*; NIPER-457 (NTIS Report No. 90000218); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Nov 1989.

317. Steele, W. V.; Chirico, R. D.; Nguyen, A.; Knipmeyer, S. E. *The Thermodynamic Properties of 2-Methylaniline and trans-(R,S)-Decahydroquinoline*; NIPER-459 (NTIS Report No. 90000216); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Nov 1989.

318. Messerly, J. F.; Todd, S. S.; Finke, H. L.; Lee-Bechtold, S. H.; Guthrie, G. B.; Steele, W. V.; Chirico, R. D. Heat capacities of 1-pentene (10 to 320 K), *cis*-2-hexene (10 to 320K), 1-nonene (10 to 400 K) and 1-hexadecene (10 to 400 K). *J. Chem. Thermodyn.* **1990**, 22, 1107–1128.

319. Chirico, R. D.; Gammon, B. E.; Knipmeyer, S. E.; Nguyen, A.; Strube, M. M.; Tsonopoulos, C.; Steele, W. V. The Thermodynamic Properties of Dibenzofuran. *J. Chem. Thermodyn.* **1990**, 22, 1075–1096.

320. Steele, W. V.; Chirico, R. D. *Thermodynamics of the Hydrodenitrogenation of Quinoline*; NIPER-468 (NTIS Report No. 90000245); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1990.

321. Steele, W. V.; Knipmeyer, S. E.; Chirico, R. D.; *Critical Property and High-Temperature Heat-Capacity Measurements on Quinoline and 5,6,7,8-Tetrahydroquinoline*; NIPER-469 (NTIS Report No. 90000246); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, June 1990.

322. Steele, W. V.; Jones, D. K. Project 871: Determination of Ideal-Gas Enthalpies of Formation for Key Compounds. *Design Institute for Physical Property Data: Ten Years of Accomplishment*; AIChE Symposium Series 275; AIChE: New York, 1990; Vol. 86, pp 64–72.

323. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. The Thermodynamic Properties of Dibenzothiophene. *J. Chem. Thermodyn.* **1991**, 23, 431–450.

324 (a) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. *DIPPR Project 871 for 1988. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation*; NIPER-422 (NTIS Report No. 90000247); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, July 1990. (b) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. *DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas*

Enthalpies of Formation. The 1988 Project Results; NIPER-422 (NTIS Report No. 90000247); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, July 1990.

325 (a) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. *The Thermodynamic Properties of 2-Aminobiphenyl (An Intermediate in the Carbazole/Hydrogen Reaction Network)*; NIPER-482 (NTIS Report No. 91002209); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Dec 1990. (b) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. The Thermodynamic Properties of 2-Aminobiphenyl. *J. Chem. Thermodyn.* **1991**, *23*, 957–977.

326 (a) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. *The Thermodynamic Properties of 2,3-Benzothiophene*; NIPER-509 (NTIS Report No. 91002218); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Jan 1991. (b) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. The Thermodynamic Properties of Benzo[b]thiophene. *J. Chem. Thermodyn.* **1991**, *23*, 759–780.

327 (a) Steele, W. V.; Knipmeyer, S. E.; Nguyen, A.; Chirico, R. D. *The Thermodynamic Properties of 9-Methylcarbazole and 1,2,3,4-Tetrahydro-9-methylcarbazole*; NIPER-520 (NTIS Report No. 91002235); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Apr 1991. (b) Steele, W. V.; Knipmeyer, S. E.; Nguyen, A.; Chirico, R. D. The Thermodynamic Properties of 9-Methylcarbazole and 1,2,3,4-Tetrahydro-9-methylcarbazole. *J. Chem. Thermodyn.* **1992**, *24*, 245–271.

328 (a) Steele, W. V.; Knipmeyer, S. E.; Nguyen, A.; Chirico, R. D. *The Thermodynamic Properties of Benzothiazole and Benzoxazole*; NIPER-533 (NTIS Report No. 91002250); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Aug 1991. (b) Steele, W. V.; Knipmeyer, S. E.; Nguyen, A.; Chirico, R. D. The Thermodynamic Properties of Benzothiazole and Benzoxazole. *J. Chem. Thermodyn.* **1992**, *24*, 499–529.

329 (a) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. *DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1989 Project Results*; NIPER-514 (NTIS Report No. 91002256); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1991. (b) Steele, W. V.; Chirico, R. D.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1989 Project Results. *Experimental Results for Phase Equilibria and Pure Component Properties*; DIPPR Data Series No. 1; DIPPR: 1991; pp 101–134.

330. Steele, W. V.; Chirico, R. D. *Thermodynamic of the Hydrodenitrogenation of Carbazole*; NIPER-544 (NTIS Report No. 91002255); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Oct 1991.

331. Strube, M. M.; Laane, J. Reduced Mass Calculations, Low-Frequency Vibrations, and Conformations of 1,4-Cyclohexadiene, 1,4-Dioxacyclohexa-2,5-diene, and 9,10-Dihydro-anthracene. *Spectrochim. Acta* **1988**, *129*, 126–139.

332. Steele, W. V.; Chirico, R. D. *Hydrodenitrogenation. An Increasingly Important Part of Catalytic Hydroprocessing. Interlocking of Thermodynamics and Kinetics*; NIPER-570 (NTIS Report No. 92001040); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Apr 1992.

333. Steele, W. V.; Chirico, R. D.; Smith, N. K.; Billups, W. E.; Elmore, P. R.; Wheeler, A. E. The Standard Enthalpy of Formation of Buckminsterfullerene C₆₀. *J. Phys. Chem.* **1992**, *96*, 4731–4733.

334. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. DIPPR Project 821. Vapor Pressure of Organic Compounds of Industrial Interest. The 1991 Project Results. *Experimental Results for DIPPR 1990–91 Projects on Phase Equilibria and Pure Component Properties*; DIPPR Data Series No. 2; DIPPR: 1994; pp 154–173.

335 (a) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. *DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1990 Project Results*; NIPER-660 (NIST Report No.); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Sept 1992. (b) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Hossenlopp, I. A.; Smith, N. K. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1990 Project Results. *Experimental Results for DIPPR 1990–91 Projects on Phase Equilibria and Pure Component Properties*; DIPPR Data Series No. 2; DIPPR: 1994; pp 188–215.

336 (a) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Smith, N. K.; Steele, W. V. *The Thermodynamic Properties of 4,5,9,10-Tetrahydropyrene and 1,2,3,6,7,8-Hexahydropyrene*; NIPER-598 (NTIS Report No. 93000102); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Dec 1992. (b) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Smith, N. K.; Steele, W. V. The Thermodynamic Properties of 4,5,9,10-Tetrahydropyrene and 1,2,3,6,7,8-Hexahydropyrene. *J. Chem. Thermodyn.* **1993**, *25*, 729–761.

337. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. DIPPR Project 821. Vapor Pressure of Organic Compounds of Industrial Interest. The 1992 Project Results. Vapor pressure of Acetophenone, (±)-1,2-Butanediol, (±)-1,3-Butanediol, Diethylene glycol monopropyl ether, 1,3-Dimethyladamantane, 2-Ethoxyethyl acetate, Ethyl octyl sulfide, and Pentyl acetate. *J. Chem. Eng. Data* **1996**, *41*, 1255–1268.

338 (a) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. *The Thermodynamic Properties of Thianthrene and Phenoxathiin*; NIPER-659 (NTIS, Report No. 93000124); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Apr 1993. (b) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. The Thermodynamic Properties of Thianthrene and Phenoxathiin. *J. Chem. Thermodyn.* **1993**, *25*, 965–992.

339. Steele, W. V.; Chirico, R. D. Thermodynamic Properties of Alkenes (Mono-olefins Larger than C₄). *J. Phys. Chem. Ref. Data* **1993**, *22*, 377–430.

340 (a) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. *The Thermodynamic Properties to 700 K of Naphthalene and 2,7-Dimethylnaphthalene*; NIPER-678 (NTIS Report No. 93000160); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Aug 1993. (b) Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. The Thermodynamic Properties to 700 K of Naphthalene and 2,7-Dimethylnaphthalene. *J. Chem. Thermodyn.* **1993**, *25*, 1461–1494.

341. Chirico, R. D.; Steele, W. V. Reconciliation of calorimetrically and spectroscopically derived thermodynamic properties at pressures greater than 0.1 MPa for benzene and methylbenzene: the importance of the third virial coefficient. *Ind. Eng. Chem. Res.* **1994**, *33*, 157–167.

342. Steele, W. V.; Chirico, R. D.; Nguyen, A.; Knipmeyer, S. E. The Thermodynamic Properties of 2-Methylaniline and *trans*-(*R,S*)-Decahydroquinoline. *J. Chem. Thermodyn.* **1994**, *26*, 515–544.

343. Chirico, R. D.; Gammon, B. E.; Hossenlopp, I. A.; Steele, W. V. Heat capacities of 1,2,3,4-Tetrahydrophenan-

threne at Temperatures between 5 K and 430 K and revised heat capacities for 9,10-Dihydrophenanthrene at Temperatures between 10 K and 350 K. *J. Chem. Thermodyn.* **1994**, *26*, 469–481.

344. Klots, T. D.; Chirico, R. D.; Steele, W. V. Complete Vapor Phase Assignment for the Fundamental Vibrations of Furan, Pyrrole, and Thiophene. *Spectrochim. Acta* **1994**, *50A*, 765–795.

345. Klots, T. D.; Collier, W. B. Vibrational Assignment and Analysis for 2,3-Dihydrofuran and 2,5-Dihydrofuran. *Spectrochim. Acta* **1994**, *50A*, 1725–1748.

346. Chirico, R. D.; Hossenlopp, I. A.; Gammon, B. E.; Knipmeyer, S. E.; Steele, W. V. Heat capacities of the six dimethylpyridines between the temperatures 10 K and 445 K and methyl-group rotation barriers in the solid state. *J. Chem. Thermodyn.* **1994**, *26*, 1187–1218.

347. Chirico, R. D.; Hossenlopp, I. A.; Gammon, B. E.; Knipmeyer, S. E.; Steele, W. V. Heat capacities between 10 K and 445 K for 2,4-dimethylpyrrole and barriers to methyl-group rotation in the solid state for 2,4- and 2,5-dimethylpyrrole. *J. Chem. Thermodyn.* **1994**, *26*, 1219–1230.

348 (a) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Tasker, I. R. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1991 Project Results, NIPER-716 (NTIS Report No.); DOE Fossil Energy, Bartlesville Project Office: Bartlesville, OK, Sept 1993. (b) Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Tasker, I. R. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1991 Project Results. Thermodynamic Properties and Ideal-Gas Enthalpies of Formation of Cyclohexene, Phthalan (2,5-Dihydrobenzo-3,4-furan), Isoxazole, Octylamine, Dioctylamine, Trioctylamine, Phenyl Isocyanate, and 1,4,5,6-Tetrahydropyrimidine. *J. Chem. Eng. Data* **1996**, *41*, 1269–1284.

349. Steele, W. V.; Chirico, R. D.; Nguyen, A.; Knipmeyer, S. E. Vapor pressures, high-temperature heat capacities, critical properties, derived thermodynamic functions, and barriers to methyl-group rotation for the six dimethylpyridines. *J. Chem. Thermodyn.* **1995**, *27*, 311–334.

350. Steele, W. V. 50 Years of Thermodynamics Research at Bartlesville. The Hugh M. Huffman Legacy. The 42nd Huffman Memorial Lecture. *J. Chem. Thermodyn.* **1995**, *27*, 135–162.

351. Klots, T. D.; Collier, W. B. Heteroatom derivatives of indene: I. Vibrational frequencies and a refined scaled overlay of the AM1 force field of indole, benzofuran, benzothiophene, benzoxazole and benzothiazole. *Spectrochim. Acta* **1995**, *51A*, 1255–1272.

352. Klots, T. D.; Collier, W. B. Heteroatom derivatives of indene: II. Vibrational spectra of benzothiophene, and benzothiazole. *Spectrochim. Acta* **1995**, *51A*, 1273–1290.

353. Klots, T. D.; Collier, W. B. Heteroatom derivatives of indene: III. Vibrational spectra of benzoxazole, benzofuran, and indole. *Spectrochim. Acta* **1995**, *51A*, 1291–1316.

354. Steele, W. V.; Chirico, R. D.; Smith, N. K. The standard enthalpies of formation of 2-methylbiphenyl and diphenylmethane. *J. Chem. Thermodyn.* **1995**, *27*, 671–678.

355. Klots, T. D. Vibrational Spectra of Indene: IV. Calibration, Assignment, and Ideal-Gas Thermodynamics. *Spectrochim. Acta* **1995**, *51A*, 2307–2324.

356. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Nguyen, A.; Knipmeyer, S. E. Possible precursors and products of deep hydrodesulfurization of distillate fuels. I. The thermodynamic properties of diphenylsulfide and revised val-

ues for dibenzothiophene. *J. Chem. Thermodyn.* **1995**, *27*, 1407–1428.

357. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Nguyen, A.; Klots, T. D.; Knipmeyer, S. E. Thermodynamic properties of pyridine. I: Vapor pressures, high-temperature heat capacities, densities, critical properties, derived thermodynamic functions, vibrational assignment, and derivation of recommended values. *J. Chem. Thermodyn.* **1996**, *28*, 797–818.

358. Chirico, R. D.; Steele, W. V. Thermodynamic properties of pyridine: II. Comparison of new recommended values with the literature. *J. Chem. Thermodyn.* **1996**, *28*, 819–841.

359. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Smith, N. K. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1992 Project Results. Thermodynamic Properties and Ideal-Gas Enthalpies of Formation of Butyl vinyl ether, 1,2-Dimethoxyethane, Methyl glycolate, Bicyclo[2.2.1]hept-2-ene, 5-Vinylbicyclo[2.2.1]hept-2-ene, *trans*-Azobenzene, Butyl acrylate, Di-*tert*-butyl ether, and Hexane-1,6-diol. *J. Chem. Eng. Data* **1996**, *41*, 1285–1302.

360. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. Thermodynamic Equilibria in Xylene Isomerization. 1. The Thermodynamic Properties of *p*-Xylene. *J. Chem. Eng. Data* **1997**, *42*, 248–261.

361. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Reynolds, J. W.; Steele, W. V. Thermodynamic Equilibria in Xylene Isomerization: 2. The Thermodynamic Properties of *m*-Xylene. *J. Chem. Eng. Data* **1997**, *42*, 475–487.

362. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Cowell, A. B.; Reynolds, J. W.; Steele, W. V. Thermodynamic Equilibria in Xylene Isomerization. 3. The Thermodynamic Properties of *o*-Xylene. *J. Chem. Eng. Data* **1997**, *42*, 758–771.

363. Klots, T. D.; Collier, W. B. Vibrational Spectra, Structure, Assignment, and Ideal-Gas Thermodynamics of a Three-Ring Molecule: Dibenzofuran. *J. Mol. Struct.* **1996**, *380*, 1–14.

364. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. Thermodynamic Equilibria in Xylene Isomerization. 4. The Thermodynamic Properties of Ethylbenzene. *J. Chem. Eng. Data* **1997**, *42*, 772–783.

365. Chirico, R. D.; Steele, W. V. Thermodynamic Equilibria in Xylene Isomerization. 5. Xylene Isomerization Equilibria from Thermodynamic Studies and Reconciliation of Calculated and Experimental Product Distributions. *J. Chem. Eng. Data* **1997**, *42*, 784–790.

366. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. DIPPR Project 821. Vapor Pressure of Organic Compounds of Industrial Interest. The 1993 Project Results. Vapor pressure, heat capacity, and density along the saturation line measurements for dimethyl isophthalate, dimethyl carbonate, 1,3,5-triethylbenzene, pentafluorophenol, 4-*tert*-butylcatechol, α -methylstyrene, and *N,N*-bis-(2-hydroxyethyl)-ethylenediamine. *J. Chem. Eng. Data* **1997**, *42*, 1008–1020.

367. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Smith, N. K. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1993 Project Results. Thermodynamic Properties and ideal-gas enthalpies of formation for dicyclohexyl sulfide, diethylenetriamine, di-*n*-octyl sulfide, dimethyl carbonate, piperazine, hexachloroprop-1-ene, tetraakis(dimethylamino)-ethylene, *N,N*-bis-(2-hydroxyethyl)-ethylenediamine and 1,2,4-triazolo[1,5-*a*]pyrimidine. *J. Chem. Eng. Data* **1997**, *42*, 1037–1052.

368. Klots, T. D.; Devlin, P.; Collier, W. B. Heteroatom derivatives of indene: V. Vibrational spectra of benzimidazole. *Spectrochem. Acta* **1997**, *53A*, 2445–2456.
369. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. DIPPR Project 821. Vapor Pressure of Organic Compounds of Industrial Interest. The 1994 Project Results. Vapor pressure, heat capacity, and density along the saturation line measurements for cyclohexanol, 2-cyclohexen-1-one, 1,2-dichloro-propane, 1,4-di-*tert*-butylbenzene, (\pm)-2-ethylhexanoic acid, 2-(methylamino)-ethanol, perfluoro-*n*-heptane and sulfolane. *J. Chem. Eng. Data* **1997**, *42*, 1021–1036.
370. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Knipmeyer, S. E.; Nguyen, A. DIPPR Project 871. Determination of Some Pure Compound Ideal-Gas Enthalpies of Formation. The 1994 Project Results. Thermodynamic Properties and ideal-gas enthalpies of formation for 2-aminoisobutyric acid (2-methylalanine), acetic acid, (*Z*)-5-ethylidene-2-norbornene, mesityl oxide (4-methyl-3-penten-2-one), 4-methylpent-1-ene, 2,2'-bis(phenylthio)propane and glycidyl phenyl ether (1,2-epoxy-3-phenoxypropane). *J. Chem. Eng. Data* **1997**, *42*, 1053–1066.
371. Klots, T. D. Raman vapor spectrum and vibrational assignment for pyridine. *Spectrochim. Acta* **1998**, *54A*, 1481–1498.
372. Chirico, R. D.; Klots, T. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. Reconciliation of calorimetrically and spectroscopically derived standard entropies for the six dimethylpyridines between the temperatures 250 K and 650 K; a stringent test of thermodynamic consistency. *J. Chem. Thermodyn.* **1998**, *30*, 535–556.
373. Chirico, R. D.; Collier, W. B.; Cowell, A. B.; Good, W. D.; Klots, T. D.; Knipmeyer, S. E.; Nguyen, A.; Rau, A. P.; Reynolds, J. W.; Smith, N. K.; Steele, W. V. Heat capacities, enthalpy increments, phase transitions, and derived thermodynamic functions for the condensed phases of bicyclohexyl between the temperatures 6 K and 440 K. *J. Chem. Thermodyn.* **1998**, *30*, 1423–1439.
374. Klots, T. D.; Sakurai, S.; Laane, J. Far-Infrared and combination-band spectra of the ring-puckering and ring-flapping vibrations of phthalan: A failure of the one-dimensional model. *J. Chem. Phys.* **1998**, *108*, 3531–3536.
375. Chirico, R. D.; Knipmeyer, S. E.; Steele, W. V. Thermodynamic properties of the methylpyridines. Part 1: Heat-capacity measurements for 4-methylpyridine between the temperatures $T = 6.4$ K and $T = 18.6$ K, resolution of low-temperature contributions, and reconciliation of calorimetrically and spectroscopically derived standard entropies. *J. Chem. Thermodyn.* **1999**, *31*, 323–337.
376. Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A.; Steele, W. V. Thermodynamic properties of the methylpyridines. Part 2: Vapor pressures, heat capacities, critical properties, derived thermodynamic functions between the temperatures $T = 250$ K and $T = 560$ K, and equilibrium isomer distributions for all temperatures $T = 250$ K. *J. Chem. Thermodyn.* **1999**, *31*, 339–378.
377. Collier, W. B.; Magdó, I.; Klots, T. D. Infrared and Raman Spectra of bicyclic molecules using scaled noncorrelated and correlated ab initio force fields. *J. Chem. Phys.* **1999**, *110*, 5710–5720.
378. Klots, T. D.; Lee, S.; Laane, J. Far-infrared spectra and two-dimensional potential energy surfaces involving the ring-puckering vibration of 2,5-dihydrothiophene. *J. Phys. Chem.* **1999**, *A103*, 833–837.
379. Laane, J.; Sakurai, S.; Klots, T. D. Vibrational potential energy surfaces for phthalan and 1,3-benzodioxole in their *S*-0 and *S*-1 (*p,p**) states. *J. Mol. Struct.* **1999**, *481*, 189–196.
380. Klots, T. D.; Bondoc, E.; Laane, J. Far-infrared and Raman spectra of the ring-puckering vibration of 2,3-dihydrothiophene. One- and two-dimensional potential energy surfaces and the barrier to planarity. *J. Phys. Chem.* **1999**, *A103*, 8772–8776.
381. Bondoc, E.; Klots, T. D.; Laane, J. Far-infrared and Raman spectra and vibrational potential energy for the ring-puckering and ring-flapping of coumaran. *J. Phys. Chem.* **2000**, *A104*, 275–279.
382. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. Vapor pressure, heat capacity, and density along the saturation line measurements for benzenamine, butylbenzene, *sec*-butylbenzene, *tert*-butylbenzene, 2,2-dimethylbutanoic acid, tridecafluoroheptanoic acid, 2-butyl-2-ethyl-1,3-propanediol, 2,2,4-trimethyl-1,3-pentanediol, and 1-chloro-2-propanol. *J. Chem. Eng. Data* **2002**, *47*, 648–666.
383. Steele, W. V.; Cowell, A. B.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. Thermodynamic properties and ideal-gas enthalpies of formation for methyl benzoate, ethyl benzoate, (*R*)-(+)-limonene, *tert*-amyl methyl ether, *trans*-crotonaldehyde, and diethylene glycol. *J. Chem. Eng. Data* **2002**, *47*, 667–688.
384. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. Vapor pressure, heat capacity, and density along the saturation line measurements for ϵ -caprolactam, pyrazine, 1,2-propanediol, triethylene glycol, phenyl acetylene and diphenyl acetylene. *J. Chem. Eng. Data* **2002**, *47*, 689–699.
385. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. Thermodynamic properties and ideal-gas enthalpies of formation for *trans*-methyl cinnamate, α -methyl cinnamaldehyde, methyl methacrylate, 1-nonyne, trimethylacetic acid, trimethylacetic anhydride, and ethyl trimethyl acetate. *J. Chem. Eng. Data* **2002**, *47*, 700–714.
386. Steele, W. V.; Chirico, R. D.; Knipmeyer, S. E.; Nguyen, A. Vapor pressure, heat capacity, and density along the saturation line measurements for cyclopropane carboxylic acid, *N,N*-diethyl-ethanolamine, 2,3-dihydrofuran, 5-hexen-2-one, perfluorobutanoic acid, and 2-phenylpropionaldehyde. *J. Chem. Eng. Data* **2002**, *47*, 715–724.
387. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Knipmeyer, S. E.; Nguyen, A. Thermodynamic properties and ideal-gas enthalpies of formation for 1,4-diisopropylbenzene, 1,2,4,5-tetraisopropylbenzene, cyclohexanone oxime, dimethyl malonate, glutaric acid, and pimelic acid. *J. Chem. Eng. Data* **2002**, *47*, 725–739.
388. Chirico, R. D.; Knipmeyer, S. E.; Steele, W. V. Heat capacities, enthalpy increments, and derived thermodynamic functions for benzophenone between the temperatures of 5 K and 440 K. Submitted to *J. Chem. Thermodyn.*
389. Chirico, R. D.; Knipmeyer, S. E.; Steele, W. V. Heat capacities, enthalpy increments, and derived thermodynamic functions for naphthalene between the temperatures of 5 K and 440 K. Submitted to *J. Chem. Thermodyn.*
390. Steele, W. V.; Chirico, R. D.; Cowell, A. B.; Nguyen, A.; Knipmeyer, S. E. Possible precursors and products of deep hydrodesulfurization of gasoline and distillate fuels. II. The thermodynamic properties of 2,3-dihydrobenzo[*b*]thiophene. To be submitted to *J. Chem. Thermodyn.*

Supplied by William V. Steele and Robert D. Chirico.