

REFERENCES CITED

METAL STATISTICS

1. U.S. Bureau of Mines, "Minerals and Materials," a monthly survey, January 1980 - February 1982.
2. U.S. Bureau of Mines, "Mineral Industry Surveys," metals, monthly, January 1980 - February 1982.
3. U.S. Bureau of Mines, "Mineral Commodity Summaries 1981," U.S. Government Printing Office 1981-703-002/39, (1981).
4. U.S. Bureau of Mines, "1980 Minerals Yearbook," Vol. I, (1981).
5. U.S. Bureau of Mines, "Mineral Facts and Problems," 1980 edition, U.S. B.M. Bull. 671 (1981).
6. U.S. Bureau of Mines, "Reprint from the 1980 Bureau of Mines Mineral Yearbook," (1980-1981).

METAL SUPPLY PROBLEMS

7. Beizer, J., "Mineral Alarm Sounded at Congressional Hearing," Mining Cong. Jr., Vol. 67, 2 (1981) pp. 31-34.
8. Brown, G., editor, "Strategic Metals," Am. Met. Market, Fairchild Pub., February 18, (1982).
9. Corbett, J., "The Strategic Stockpile Grows Slowly," Chem. Bus., January 11, (1982) pp. 35-37.
10. Ember, L. R., "Many Forces Shaping Strategic Minerals Policy," C&EN, Vol. 59, May 11, (1981) pp. 20-25.
11. Lefond, S. J., ed., "A Disappointing Year for Industrial Minerals Production," Min. Eng., Vol. 32, 5, (1980) pp. 558-589.
12. Ibid, "Another Disappointing Year for Industrial Minerals," Min. Eng., Vol. 33, 6, (1981) pp. 562-592.
13. Meyer, H. E., "Russia's Sudden Reach for Raw Materials," Fortune, Vol. 96, 7, July 28, (1980) pp. 43-44.
14. News Feature, "Nonferrous Metals: High Cost, Tight Supplies Ahead," Chem. Eng., Vol. 87, 4 (1980) pp. 46-50.
15. Norman, L. "Strategic Mineral Dependence, Are We Addressing the Real Problems?," Min. Eng., Vol. 33, 6, (1981) pp. 661-663.

16. Strauss, S. D., "Role of Third World Countries in Mineral Supply," Min. Cong. Jr., Vol. 68, 2, (1982) pp. 33-49.
17. Wachtman, J. B., Jr., Ed., Proc. U.S. Dept. Comm. Pub. Workshop on "Critical Materials Needs in the Aerospace Industry," NBS1R81-2305, NTIS, February 9-10, (1981).

CATALYST DEACTIVATION

18. Polinski, L. M., G. J. Stiegel, and R. E. Tischer, "1980 Status Review - Hydroliquefaction of Coal with Supported Catalysts," DOE/PETC/TR-81/2, NTIS, (1981).
19. Mitchell, T. O., "Deactivation of Hydrotreating Catalysts during Coal Liquefaction," Coal Proc. Tech., Vol. VI, AICHE, New York, NY (1980) pp. 28-37.
20. Holloway, P. H., and D. K. Kramer, "Surface Analysis of a Deactivated Coal Liquefaction Catalyst," SAND77-1389, NTIS, (1977).
21. Holloway, P. H., "Chemical Studies of the Synthoil Process: Catalyst Deactivation," SAND78-0056, NTIS, (1978).
22. Cable, T. L., and F. E. Massoth, "Studies on an Aged H-Coal Catalyst," Fuel Proc. Tech., Vol. 4, (1981) pp. 265-275.
23. Berry, D. A., L. J. Hillenbrand, H. M. Grotta, D. H. Stewart, W. R. Alcorn, and G. E. Elliott, "Catalyst Development Program for Hydro-sulfurization and Liquefaction of Coal to Produce Clean Boiler Fuels," Final Rep., FE-2321-32, NTIS (1978).
24. Thomas, M. G., D. G. Sample, P. F. Hlava, D. H. Huskisson, and J. O. Young, "Coal Liquefaction Catalyst Characterization," SAND79-0085, NTIS (1979).
25. Rush, J. B., "Twenty Years of Heavy Oil Cracking," CEP, Vol., (1981) p. 29-32.
26. Finneran, J. A., J. R. Murphy, E. L. Whittington, "Heavy Oil Cracking Boosts Distillates," Oil and Gas Jr., January 14, (1974) pp. 51-55.
27. Shioir, T., "Catalytic Cracking of Residuals," Fuel Soc. of Japan, Jr., Vol. 57, 610, (1978) pp. 96-105.
28. Lundberg, W. C., "Extending Catalyst Life," CEP, 6, (1979) pp. 81-86.
29. Sherwin, M., and D. Blum, "Liquid Phase Methanol," EPRI Rep. AF-202, Project 317-1, NTIS, (1976).
30. Chem. System, Inc., "Liquid Phase Methanation/Shift Pilot Plant Operation and Laboratory Support Work," FE-2036-37, NTIS, (1979).

31. Cusumano, J. A. et al., "Evaluation of Sulfur-Tolerant Catalytic Processes for Producing Peak-Shaving Alcohol Fuels," AF-687, EPRI TPS76-649, NTIS (1928).
32. Wood, B. J., J. G. McCarty, D. Sheridan, C. M. Ablow, and H. Wise, "Shift Conversion and Methanation in Coal Gasification: Bench-Scale Evaluation of a Sulfur-Resistant Catalyst," Final Rep., DOE/ET/11030-T1, NTIS (1980).
33. Bartholomew, C. H., "Alloy Catalysts with Monolith Supports for Methanation of Coal-Derived Gases," FE-2729-11, NTIS (1980).
34. Happel, J., M. Huatow, and L. Bajars, "Development of Coal Conversion Catalysts," PB81-111395, NTIS, (1980).
35. Meyer, H. S., V. L. Hill, A. Flowers, J. Happel and A. Huatow, "Direct Methanation - A New Method of Converting Synthesis Gas to Substitute Natural Gas," prep., ACS meeting, Div. Fuel Chem., Vol 27, 1 (1982) pp. 109-115.
36. Mori, S., and T. O'Hara, "Upgrading of Coal Derived Liquids," Annual Report No. IMMR 45-PR8-74, Commonwealth of Kentucky, State Department, (1979).

COAL LIQUEFACTION

37. Adams, R. M., A. H. Knebel, and D. E. Rhodes, "Critical Solvent Reaching of Liquified Coal," CEP, Vol. 15, 6, June (1979), p. 44.
38. Apte, A. J., and H. L. Fein, "Optimum Gasifier Operating Pressure for Gasoline Production Using Texaco Gasification," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, Aug., (1981) p. 1126.
39. Baskind, M. M., and R. C. Hammersley, Phase A Report on Converting the Cresap Test Facility to a Two-Stage Coal Hydroliquefaction Process, ORNL/Sub-7240/5, NTIS Rep., (1979).
40. Blum, D. B., 6th Synthetic Pipeline Gas Sympo., Proc., AGA, OCR, DOI, (1974), p. 95.
41. Boudart, M., J. A. Cusumano, and R. B. Levy, "New Catalytic Materials for the Liquefaction of Coal," EPRI 415, Final Report (1975).
42. Bowden, J. R., and E. Gorin, Alternative Energy Sources, Part A, ed. by J. T. Manassah, Academic Press, (1981), pp. 147-250.
43. Carson, T. C., K. E. Hastings, and J. D. Potts, "Two-Step Coal Liquefaction is a Hydrogen Efficient Route to Distillate Fuels," CONF-790961-1, NTIS, (1979).

44. Chia, W. S., and G. E. Good, et al., Coal-to-Methanol via New Processes Under Development, EPRI-AF-1227, NTIS Rep., (1979).
45. Conn, A. L., "Conversion of Coal to Oil and Gas," CEP, Vol. 77, 5, May (1981), p. 11.
46. Cronauer, D. C., "Fundamentals of Coal Liquefaction," Proc. Governor's Conf. on Expanding Use of Coal in New York State, New York State Conso. Adv. Coal Res., Albany, NY (1981).
47. Eccles, R. M., and G. R. DeVaux, "Current Status of H-Coal Commercialization," Ibid., p. 80.
48. Epperly, W. R., and D. T. Wade, "Donor Solvent Coal Liquefaction," Ibid., p. 73.
49. Epperly, W. R., EDS Coal Conversion Process Development, Phase V, Vol. 1 - Main Rep., DOE/ET/10069-T1 (Vol. 1), NTIS Rep., (1981).
50. Franzen, J., 6th Synthetic Pipeline Gas Sympo., Proc., AGA, OCR, DOI, (1974) p. 95.
51. Freel, J., D. M. Jackson, and B. K. Schmid, "The SRC-II Demonstration Project," CEP, Vol. 77, 5, May (1981), p. 86.
52. Frumkin, A., R. F. Sullivan, and B. E. Stangeland, Coal Proc. Tech., Vol. V, (1980), p. 28.
53. Fryback, M. G., "Synthetic Fuels: Promises and Problems," CEP, Vol. 77, 5, May (1981), p. 39.
54. Gallagher, J. P., W. H. Humes, and J. O. Siemssen, "Cat Cracking to Upgrade Synthetic Crudes," Ibid., Vol. 75, 6, Nov. (1979), p. 46.
55. Haggin, J., "Fischer-Tropsch: New Life for Old Technology," Chem. & Eng. News, Vol. 59, 43 (1981), p. 22.
56. Haggin, J., C&EN, February 8, (1982) p. 13-21.
57. "Methanol Boom will Require New Technology," Ibid., 40 (1981), p. 32.
58. Harney, B. M., and G. A. Mills, Hydrocarbon Processing, Feb. (1980), p. 67.
59. H-Coal Integrated Pilot Plant, Phase 1, Final Report, Vol. II, Dec. 1973-June 1976, EX-76-C-01-1544, (1978).
60. Hinden, S. G., "Catalyst Development for Coal Liquefaction," Final Report, DOE Contract FE-76-C-01-2335-32 (1979).
61. Hoogendoorn, J. C., Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), P. 353.

62. Johnson, C. A., M. C. Chervenak, E. S. Johanson, H. H. Stotler, O. Winter, and R. H. Wolk, *Ibid.*, p. 549.
63. Kölling, G., I. Romey, and E. Wolowski, "Current German Developments in Coal Liquefaction Technology," *Energy Technology VI, Proc. Sixth Energy Fed. Conf., Gov. Inst., Inc., Washington, D. C., February (1979)*.
64. Landers, J. E., 6th Synthetic Pipeline Gas Sympo., Proc., AGA, OCR, DOE, (1974), p. 95.
65. Mode Operation Plan, H-Coal Pilot Plant, EX-76-C-01-2260, Dec. (1978).
66. Möll, N. G., and G. J. Quarderer, "The Dow Coal Liquefaction Process," CEP, Vol. 75, 11, Nov. (1979), p. 46.
67. Neavel, R. C., Exxon Doner Solvent Liquefaction Process, Royal Soc. Meeting for Discussion of New Coal Chemistry, London, May (1980).
68. News of the Week, Chem. & Eng. News, Vol. 58, 5 (1980), p. 7.
69. O'Leary, J. R., and G. C. Rappe, "Scale-up of an SRC Deashing Process," CEP, Vol. 77, 5, May (1981), p. 67.
70. Parsons, R. M., Company, Coal Liquefaction Process Research, Mobil M-Gasoline Process, R&D Interim Rep. 1, ORNL/Sub-7186/7, NTIS Rep., (1978).
71. Peluso, M., and D. F. Ogden, "Antisolvent Deashing," CEP, Vol. 75, 6, June (1979), p. 41.
72. Picture Tour of Sasol-II Coal Liquefaction Plant, CEP, Vol. 76, 3, March (1980), p. 85.
73. Raman, S. V., C. J. Martin, R. M. Thorogood, C. L. Yeh, and R. W. Skinner, Solid Product Solvent Refined Coal Process, Tech. Prog. Rep., DE-AC05-78-ORO-3054, (1980).
74. Riedl, R. J. and A. J. DeRosset, Hydrotreating and Reforming SRC II Process Derived Naphtha, FE-2566-27, NTIS Rep., (1979).
75. Salman, R., R. C. Forrester, III, S. P. N., Singh, J. F. Fisher, R. M. Wham, S. W. Thiel, and J. P. Meyer, Technical and Economic Evaluation of Selected Coal Liquefaction Process, Phase O: Preliminary Screening Evaluation, ORNL/TM-7581, NTIS Rep., (1981).
76. "Sasol Will Get Coal Liquefaction Catalyst from Local Industry," *SynFuel*, March 26, (1982) p. 2.
77. Schindler, H. D., and R. H. Long, "Developmental Research Programs for Clean Industrial and Transportation Fuels from Coal," FE-2514-M4, NTIS (1979).

78. Schreiner, M., Research Guidance Studies to Assess Gasoline from Coal by Methanol-to-Gasoline and Sasol-Type Fischer-Tropsch Technologies, FE-2447-13, NTIS Rep., (1979).
79. Scott, J., 6th Synthetic Pipeline Gas Sympo., Proc., AGA, OCR, DOE, (1974), p. 283.
80. Sullivan, R. F., B. E. Stangeland, C. E. Rudy, D. C. Green, and H. A. Franklin, Refining and Upgrading of Synfuels from Coal and Oil Shales by Advanced Catalytic Processes, FE-2315-25, NTIS Rep., (1978).
81. Technology, Chem. & Eng. News, Vol. 58, 32 (1980).
82. U.S. DOE, Coal Conversion, 1977, Technical Report, DOE/ET-0061/1, NTIS Rep., (1978).
83. U.S. DOE, Conceptual Design of a Coal-to-Methanol-to-Gasoline Commercial Plant, FE-2416-43, NTIS Rep., (1979).
84. Williams, D. F., and T. G. Martin, Gas Extraction of a Western Sub-Bituminous Coal, AF-699, NTIS Rep., (1978).

COAL GASIFICATION

85. Baglin, E. G., G. B. Atkinson, and L. J. Nicks, Ind. Eng. Chem. Prod. Res. Dev., Vol. 20, pp. 87-90 (1981).
86. Bair, W. G., and F. S. Lau, Coal Proc. Tech., Vol. VI, (1980), p. 166.
87. Banchik, I. N., "The Winkler Process for the Production of Low-Btu Gas from Coals," Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 163.
88. Bowden, J. R., and E. Gorin, Alternative Energy Sources, Part A, ed. by J. T. Manassah, Academic Press, (1981), pp. 147-250.
89. Catalytica Associates, Inc., "Evaluation of Sulfur-Tolerant Catalytic Processes for Producing Peak-Shaving Alcohol Fuels," EPRI-TPS76-649, NTIS, (1978).
90. Che, S. C., K. Duraiswamy, W. Deslate, and H. von Schonfeldt, "Accidental Controlled Flash Pyrolysis Process and Its Application to Power Generation," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, August, (1981), p. 1116.
91. Chem. System, "Liquid Phase Methanation/Shift Pilot Plant Operation and Laboratory Support Work," Final Rep., FE-2036-37, NTIS, (1979).
92. Coal Gasification Pilot Plant Support Studies, Subtask 3-1. Effect of Raw Product Gas Composition on Shift Catalysts, FE-2806-14, NTIS Rep., IGT, (1980).

93. Cohn, S.J., Large Pilot Plant Alternatives for Scaleup of the Catalytic Coal Gasification Process, FE-2480-20, NTIS Rep., (1979).
94. Conn, A. L., "Conversion of Coal to Oil and Gas," CEP, May (1981), p. 11.
95. Continental Oil Company, "Phase I: The Pipeline Gas Demonstration Plant," Vol. 1, Exec. Summary, FE-2542-10 (Vol. 1), NTIS (1979).
96. Continental Oil Company, "Phase I: The Pipeline Gas Demonstration Plant," Vol. 2, Process and Project Engineering Design, FE-2542-10 (Vol. 2), NTIS, (1980).
97. Continental Oil Company, "Phase I: The Pipeline Gas Demonstration Plant," Vol. 3, Design and Evaluation of Commercial Plant, FE-2542-10 (Vol. 3), NTIS, (1980).
98. Cornils, B., P. Ruprecht, and R. Durrfeld, "Energy from Coal: A Status Report on the Ruhrchemie/Ruhrkohle Version of Texaco Coal Gasification," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA., August (1981), p. 1050.
99. Dalla Betta, R. A., and K. K. Ushiba, Hydrocarbon Processing, Nov. (1980), pp. 157-160.
100. Dighe, S. V., M. B. Blinn, J. J. Buggy, B. R. Krasicki, and B. L. Pierce, "Westinghouse Fluidized Bed Coal Gasification Process," Ibid., p. 1059.
101. Erekson, E. J., E. L. Sughrue, and C. H. Bartholomew, Fuel Proc. Tech., Vol. 5; pp. 91-101 (1981).
102. Farnsworth, J. F., D. M. Mitsak, H. F. Leonard, and R. Wintrell, "SNG from Coal via Lurgi Gasification Process," Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 91.
103. Forney, A. J., W. P. Haynes, J. J. Elliott, S. J. Gasior, G. E. Johnson, and J. P. Strakey, Jr., Ibid., p. 199.
104. Gierlick, H. H., B. Hohleim, and J. Range, "Methanation of Synthesis Gas," Int. Gas Res. Conf. Prep., (1981), p. 201.
105. Gikis, B. J., W. E. Isakson, J. G. McCarty, K. M. Sancier, S. Schechter, P. R. Wentrcek, B. J. Wood, and H. Wise, "Sulfur Poisoning of Catalysts: A Study of Activity Decay in Methanol Synthesis and Fischer-Tropsch Catalysis," PERC-0060-8, NTIS. (1977).
106. Grace, R. J., Sympo. paps., "Development of the Bi-gas Process," Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 179.
107. Gray, J. A., "Synfuels Shorts," CEP, Vol. 77, 5, May (1981), pp. 25-33.
108. Haggin, J., C&EN, Oct. 26, (1981), pp. 22-32.

109. Hanson, D. J., "Synfuels Progress Likely to Remain Slow," Chem. & Eng. News, Vol. 59, 34 (1981), p. 13.
110. Happel, J., M. A. Hnatow, L. Bajars, 1981 Int. Gas Res. Conf., Prep., (1981), p. 211.
111. Happel, J., M. Hnatow, and L. Bajars, "Development of Catalysts for Coal Conversion," PB81-111395, NTIS, (1980).
112. Harms, H., B. Hohlein, E. Jorn, and A. Skov, Oil & Gas Journal, April 14, pp. 120-135, (1980).
113. Harney, B. M. and G. A. Mills, Hydrocarbon Processing, Feb. (1980), pp. 67-70.
114. Hirsch, R. L., J. E. Gallagher, Jr., and C. A. Euker, "Exxon's Catalytic Coal Gasification Process," 1981 Int. Gas Res. Conf. Prep., (1981), p. 42.
115. Hoogendoorn, J. C., "Gas from Coal with Lurgi Gasification at Sasol," Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 111.
116. Private communications with William Houle, March 1 (1982).
117. Il'ko, E. G., P. G. Bondar, and V. I. Atroschenko, Vkr. Khim. Zh., vol. 46, 2 (1980), pp. 1340-1.
118. Institute of Gas Technology, "Coal Gasification Pilot Plant Support Studies," FE-2806-14, NTIS, (1980).
119. Jalan, V., "High Temperature Desulfurization of Coal Gases by Regeneration Sorption," 1981 Int. Gas Res. Conf. Prepr., (1981), p. 128.
120. Klier, K., and R. G. Herman, "Study of the Deactivation of Methanol Synthesis Catalysts," EPRO-AF-694, NTIS, (1978).
121. Koucky, R. W., and H. E. Andrus, Jr., "Application of Test Experience from Combustion Engineers Process," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 1, (1981), p. 31.
122. Liquid Phase Methanation/Shift Pilot Plant Operation and Laboratory Support Work, Chem System, Inc., FE-2036-37, NTIS Rep., (1979).
123. Loeding, J. W., and C. L. Tsaros, "IGT U-Gas Process," Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 241.
124. Maddocks, R. R., "Supercritical Extraction of Coal," CEP, Vol. 75, 6, June (1979), p. 49.
125. Moe., J. M., Sympo. paps., "SNG from Coal via Lurgi Gasification Process," Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 91.
126. News of the Week, Chem. & Eng. News, Vol. 59, 8 (1980), p. 8.

127. Parsons, R. M., Co., "Coal Liquefaction Process Research Mobil M-Gasoline Process," R&D Interim Rep. No. 1, ORNL/Sub-7186/7, NTIS, (1978).
128. Patterson, R. C., and S. L. Darling, "A Low-Btu Coal Gasification Scheme," CEP, Vol. 76,3, March (1981), p. 55.
129. Pennline, H. W., R. R. Schehl, W. P. Haynes, and A. J. Forney, Methanation in Catalyst-Sprayed Tube Wall Reactors: A Review, DOE/PETC/TR-80/7, NTIS Rep., (1980).
130. Rostrup-Nielsen, J. R., and K. Pedersen, Journal of Catalysis, pp. 395-403 (1979).
131. Schemmann, P., and A. Meyer, "The Soarberg-Otto-Process," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, August, (1981), p. 1074.
131. Schora, F., Jr., B. S. Lee, and J. Huebler, "The HYGAS Process," Sympo. paps., Clean Fuels from Coal, IGT, Chicago, Ill., (1973), p. 219.
132. Schreiner, M., "Research Guidance Studies to Assess Gasoline from Coal by Methanol-to-Gasoline and Sasol-Type Fischer-Tropsch Technologies," FE-2247-13, NTIS (1978).
133. Sommers, H., and L. Werner, Gesammelte Ber. Betr. Forsch. Ruhrgas AG No. 19, (1971), p. 68.
134. Stephens, D. R., C. F. Brandenburg, and E. L. Burwell, "Underground Coal Gasification," CEP, Vol. 76, 4, April (1980), p. 89.
135. Streeter, R. C., "Combined Shift and Methanation in a Fluidized-Bed Reactor," Final Rep., DOE/ET.14815-20, NTIS, (1981).
136. Synfuel Shorts, CEP, Vol. 77, 5, May (1981), p. 25-33.
137. SynFuels, Dec. 21 (1979), p. 6.
138. Technology, Chem. & Eng. News, Vol. 58, 4 (1980), p. 40.
139. Ibid., 16 (1980), p. 33.
140. Technology, Chem. & Eng. News, Vol. 58, July 21 (1980), p. 37.
141. Ibid., 22 (1980), p. 6.
142. Ibid., 29 (1980), p. 17.
143. Ibid., 33 (1980), p. 32.
144. Ibid., 35 (1980), p. 39.
145. Ibid., 41 (1980), p. 21.

146. U.S. DOE, Coal Conversion, 1977 Technical Report, DOE/ET-0061/1, NTIS Rep., (1978).
147. Vogt, E. V., and M. J. van der Burgt, "Status of the Shell-Koppers Process," CEP, Vol. 76, 3, March (1980), p. 65.
148. Water, F. B., and H. C. Kaufman, "Cool Water Coal Gasification," Ibid., Vol. 77, 5, (1981) p. 61.
149. Weir, A., Jr., and P. K. Engel, Coal Proc. Tech., Vol. VI, (1980), p. 52.
150. Wood, B. J., W. E. Isakson, and H. Wise, Ind. Eng. Chem. Prod. Res. Dev., Vol. 19; pp. 197-204 (1980).
151. Wood, B. J., J. G. McCarty, D. Sheridan, C. M. Ablow, and H. Wise, Shift Conversion and Methanation in Coal Gasification, DOE/ET-11030-T1, NTIS Rep., (1980).

SHALE OIL

152. Allred, V. D., 12th Oil Shale Sympo., Golden Col., Col. School of Mines Press, April (1979), p. 241.
153. Booker, J. D., "Oil Shale Retorting in the First Commercial Plants," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 1, Atlanta, GA, August, (1981), p. 47.
154. Berry, K. L., "Combined Retorting Technique for Oil Shale," CEP, Vol 75, 9, p. 72.
155. Cane, R. F., 12th Oil Shale Sympo., Proc., April (1979), p. 17.
156. Dougan, P. M., "The BX In-Situ Oil Shale Project," CEP, Vol. 75, 9, Sept. (1979), p. 81.
157. Fox, J. P., K. K. Mason, and J. J. Duvall, Partitioning of Major, Minor, and Trace Elements During Stimulated In-Situ Oil Shale Retorting in a Controlled-State Retort, 12th Oil Shale Sympo., Proc., Colo. Scho. Mines, J. H. Gary, ed., April (1979), p. 58.
158. Frumkin, H. A., E. J. Owens, and R. B. Sutherland, CEP, "Alternative Routes for Refining Paraho Shale Oil," Sept. (1979), p. 64.
159. Fryback, M. G., "Synthetic Fuels: Promises and Problems," Ibid., Vol. 77, 5, May (1981), p. 39.
160. Gallagher, J. P., W. H. Hume, and J. O. Siemssen, "Cat Cracking to Upgrade Synthetic Crudes," Ibid., Vol. 75, 6, June (1979), p. 56.

161. Griswold, C. F., A. Ballut, H. R. Kavianian, P. F. Dickson, and V. F. Yesavage, "Light Olefins from Hydrogenated Shale Oil," CEP, Vol. 75, 9, Sept. (1979), p. 78.
162. Gumerman, R. J., "Igniting In-Situ Oil Shale Retort," Ibid., p. 85.
163. Hanson, D. J., "Synfuels Progress Likely to Review Slow," Chem. Eng. News, Vol. 59, 34 (1981), p. 13.
164. Crull, A. W., "Catalysts: New Directions," Business Comm. Co., Inc. 1981.
165. Jones, J. B., Jr., and R. N. Heistand, 12th Oil Shale Sympo., Proc., Golden, Col., Col. School of Mines Press, April (1979), p. 184.
166. Knight, J. H., and J. W. Fishback, "Superior's Circular Grate Oil Shale Retorting Proces," Ibid., p. 1.
167. Lekas, M. A., Ibid., p. 228.
168. McNamara, P. H., and J. P. Humphrey, "Hydrocarbons from Eastern Oil Shale," CEP, Vol. 75, 9, Sept. (1979), p. 87.
169. Ogden, G. E., and R. D. Ridley, "Refining Shale Oil in Conjunction with Crude Oil in a Typical Rocky Mountain Refinery," 12th Oil Shale Sympo., Proc., April (1979), p. 366.
170. Oil Shale Data Book, TRW, PB 80-12536, NTIS Rep., (1979).
171. Pelofsky, A. H., H. E. McCarthy, G. B. French, E. E. Wing, and C. J. Ladelfa, 12th Oil Shale Sympo., Proc., April (1979), p. 32.
172. Robinson, E. T., "Refinery of Paraho Shale Oil into Military Specification Fuels," Ibid., (1979), p. 195.
173. Russell, P. L., Oil Shale, Mining Engineering, Jan. (1981), pp. 29-47.
174. Simon, R., 12th Oil Shale Sympo., Proc., April (1979), p. 278.
175. Sullivan, R. F., B. E. Stangeland, C. E. Rudy, D. C. Green, and H. A. Frumkin, Refining and Upgrading of Synfuels from Coal and Oil Shales by Advanced Catalytic Processes, FE-2315-25, NTIS Rep., (1978).
176. Synfuels Shorts, CEP, Vol. 77, 5, May (1981), pp. 27-28.
177. TRW, Inc., "Oil Shale Data Book," PB81-125636, NTIS(1979).

TAR SAND AND HEAVY OIL

178. Aiba, T., and H. Kaji, "Residual Thermal Cracking by Eureka Process," CEP, Vol. 77, 2, Feb. (1981), p. 37.
179. Backman, W. A., and D. H. Stormont, "Plant Starts, Athabasca Now Yielding Its Hydrocarbons," Oil & Gas Jr., Oct. (1967), p. 69.
180. Bunger, J. W., S. Mori, and A. G. Oblad, ACS Meeting, Fuel Chem. Div., Prep., Vol. 21, (1976), p. 147.
181. Detamore, R. J., "An Overview of the Technology and Status of Oil Sands Development," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, August (1981), p. 1196.
182. Donaldson, A. B., R. L. Fox, and A. J. Mulac, Ibid., p. 1218.
183. Finnerran, J. A., J. R. Murphy, and E. L. Whittington, "Heavy-Oil Cracking Boosts Distillates," Oil and Gas Jr., January 14 (1974) p. 52-55.
184. Fryback, M. G., "Synthetic Fuels: Promises and Problems," CEP, Vol. 77, 5, May (1981), p. 39.
185. Gallagher, J. P., W. H. Humes, and J. O. Siemssen, "Cat Cracking to Upgrade Synthetic Crudes," CEP, Vol. 75, 6, June (1979), p. 56.
186. Johnson, L. A., Jr., L. J. Fahy and Romanowski, Jr., "A Steamflood Experiment in a Utah Tar Sand," 16th Intersoc., Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, Aug., (1981), p. 1212.
187. Oblad, A. G., J. D. Seader, J. D. Miller, and J. W. Bunger, AIChE. Sympo. Ser. 155, Vol. 72, (1979), p. 69.
188. Phillips, R. S. "Alberta's Oil Sands In-Situ Pilots," 16th Intersoc. Energy Conv. Eng. Conf., Vol. 2, Atlanta, GA, August (1981), p. 1222.
189. Rakow, M. S., and Calderson, "The Dynacracking Process-An Update," CEP, Vol. 77, 2, Feb. (1981), p. 31.
190. Rush, J. B., "Twenty Years of Heavy Oil Cracking," CEP, Vol. 77, 2, (1981) p. 29-32.
191. Sosnowski, J., D. W. Turner, and J. Eng, "Upgrading Heavy Crude to Clean Liquid Products," Ibid., p. 51.
192. Suzuki, S., "Utilization of Heavy Oil-Thermal Cracking of Vacuum Residue by Eureka Process," Chem. Eco. & Eng. Rev., Vol. 10, 2 (1978) pp. 30-39.
193. SynFuel, McGraw Hill, May 15 (1981) p. 7.

194. Synfuel Shorts, CEP, Vol. 77, 5, May (1981), pp. 25 and 29.
195. Thomas, J. R., Alternative Energy Sources, Part A, ed. by J. T. Manassah, Academic Press, (1981), pp. 99-146.
196. Wilkinson, J. M., "Introduction to Heavy Oil Upgrading," First Int. Conf. on the Future Heavy Crude Oils and Tar Sands, at Edmonton, Canada, June (1979) p. 591.

CURRENT COMMERCIAL CATALYST MARKET

197. Boudart, M., J. A. Cusumano, and R. B. Levy, "New Catalytic Materials for the Liquefaction of Coal," EPRI 415, Final Report (1975).
198. Crull, A. W., "Catalysts: New Direction," Business Communications Co., Inc., Stanford, CN (1981).
199. Happel, J., M. Hnatow, and L. Bajors, "Development of Catalysts for Coal Conversion," PB81-111395, NTIS (1980).
200. Hindin, S. G., "Catalyst Development for Coal Liquefaction," Final Report, FE-76-C-01-2335-32 (1979).
201. Molycorp, Inc., "A Bibliography; Catalysis with Rare Earth Elements," Vol. 1, Molycorp, White Plains, N.Y. (1970).
202. Ibid., Vol. 2 (1976).
203. Notari, B., "Catalysts as Fine Chemical Products," Chemica e L'industria (Milan), Vol. 54(4) (1977), pp. 265-70.
204. Rao, U. V., "Platinum Group Metals and Compounds," Adv. in Chem. Sers. 98, Am. Chem. Soc. (1971).
205. Sullivan, R. F., "Upgrading Coal Liquids," Am. Chem. Soc. Symposium, Ser. 156, edited by R. F. Sullivan, Am. Chem. Soc. (1981).
206. Swanson, W. W., "Molybdenum Catalyst Bibliography," Suppl. No. 6, Climax Molybdenum Corp., MI (1976).
207. Thomas C. L., "Catalytic Processes and Proven Catalysts," Academic Press, N.Y. (1970).
208. Tsigdinos, G. A., "Molybdenum Catalyst Bibliography," Suppl. No. 5, Climax Molybdenum Corp., MI (1978).
209. Boudart, M., J. A. Cusumano, and R. B. Levy, "New Catalytic Materials for the Liquefaction of Coal," EPRI 415, Final Rep., EPRI (1975).
210. Cusumano, J. A., R. A. Dalla Belta, and R. B. Levy, "Catalysis in Coal Conversion," Academic Press, New York, (1978).

211. Berry, D. A., L. J. Hillenbrand, H. M. Grotta, D. H. Stewart, W. R. Alcorn, and G. E. Elliott, "Catalyst Development Program for Hydrodesulfurization and Liquefaction of Coal to Produce Clean Boiler Fuels," FE-2321-32, NTIS (1978).
212. Johanson, E. S., and A. G. Comolli, "Laboratory Program to Support H-Coal Pilot Plant Operations," FE-2547-28, NTIS (1978).
213. Thomas, M. G., D. G. Sample, P. F. Hlava, D. H. Huskisson, and J. O. Young, "Coal Liquefaction Catalyst Characterization," SAND79-0085, NTIS, (1979).
214. Amoco Oil Company, R&D Dept. "Coal Liquefaction Catalyst Development," H-Coal TAC Meeting, June (1979).
215. Hinden, S. G., "Catalyst Development for Coal Liquefaction," Final Rep. FE-76-C-01-2335-32, NTIS (1979).
216. Haggin, J., "Fischer-Tropsch: New Life for Old Technology," C&EN, Oct. 26 (1981), p. 22-32.
217. Private communication with Dr. Sapienza.
218. Vannice, M. A., Jr. of Catal., Vol. 37, 449 (1975).
219. Happel, J., M. Huatow, and L. Bajars, "Development of Coal Conversion Catalysts," PB81-111395, NTIS (1980).
220. Meyer, H. S., V. L. Hill, A. Flowers, J. Happel, and M. A. Huatow, "Direct Methanation - A New Method of Converting Synthesis Gas to Substitute Natural Gas," Prep., ACS Meeting, Div. Fuel Chem., Vol. 27, 1, (1982), 109-115.
221. Lynch, J. R., L. D. Spaulding, and R. S. Sapienza, "An FeTi Methanation Catalyst," BNL-24477, CONF-780902-1, NTIS, (1978).
222. Wood, B. J., J. G. McCarty, D. Sheridan, C. M. Ablow, and H. Wise, "Shift Conversions and Methanation in Coal Gasification: Bench-Scale Evaluation of a Sulfur-Resistant Catalyst," Final Rep., DOE/ET/11030-T1, NTIS (1980).
223. Chem. Eng., Vol. 84, 8, (1977) 71.
224. Johnson, M. M., et al., U.S. 3, 711, 422.
225. Oil and Gas J., Vol. 75, 13 (1977) 43.