

REFERENCES

1. Le Page, J.F. Applied Heterogeneous Catalysis, Imprimerier Nouvelle, Paris, 1987
2. Hughes, R., Deactivation of Catalysts, Academic Press Inc. Ltd., London, 1984
3. Aboul-Gheit, A.K., J. Inst. Petro. 58(564), 305-21, 1972. From Chem. Abstr. No.78:138523q.
4. Stren, E.W., J. Catal. 57(3), 390-6, 1979. From Chem. Abstr. No.91:76482h.
5. Rollmann, L.D., J.Catal. 46(3), 243-52, 1977. From Chem. Abstr. No.87:70643g.
6. Gupta, R.K., Mann, R.S., and Gupta, A.K.; J.Catal. 28(10), 641-8, 1978. From Chem. Abstr. No.90:120712p.
7. Badilla-Ohlbaum, R., Pratt, K.C., and Trimm, D.L., Fuel 58(4), 309-14, 1979. From Chem. Abstr. No.91:94148h.
8. Streitwieser, A., Jr., and Heathcock, C.H., Introduction to Organic Chemistry, Macmillan, New York, 1976.
9. McCullosh, D.C., Applied Industrial Catalysis, Academic Press Inc., London, 1983.
10. Gleezer, J.H.E., De Jong, K.P., and Romaers, E.J.G.M., Brit. UK. Pat. Appl. GB. 2189163. From Chem. Abstr. No.108:27507f.
11. Shabtai, J., Yeh, G.J.C., Russell, C., and Oblad, A.G., Fuel 67(3), 314-20, 1988. From Chem. Abstr. No.108:153377b.

12. Yang, H., Cuihua Xuebao 6(1), 79-81, 1985. From Chem. Abstr. No.103:177789k.
13. Satterfield, C. N.; Heterogeneous Catalysis in Practice, McGraw-Hill Inc., New York, 1980.
14. Ripperger, W., and Suam, W., J. Less Common Met. 54(2), 353-62, 1977. From Chem. Abstr. No.88:25296f.
15. Shih, S., Reiff, E., Zawadzki, R., and Katzer, J. R., Prep. Pap.-Am. Chem. Soc., Div. Fuel Chem. 23(1), 99-106, 1978. From Chem. Abstr. No.93:170637a.
16. Bhinde, J. R., Shih, M. V., Zawadzki, R., Kazer, J. R., and Kwart, H., Chem. Uses Molybdenum, Proc. Int. Conf., 3rd, 184-7, 1979. From Chem. Abstr. No.93:238127s.
17. Aboul-Gheit, A.K., Appl.Catal. 16(1), 39-47, 1985. From Chem. Abstr. No.103:8654g.
18. Lee, H.S., Koo, H.S., Shih, M.J., and Kim, K.L., Hwahak Konghak 27(2), 123-9, 1989. From Chem. Abstr. No.113:43577n.
19. Leduox, M.J., and Djellouli, B., Appl. Catal. 67(1), 81-91, 1990. From Chem. Abstr. No.114:85000v
20. Miga, K., and Kaernbach, W., Nafata (Katowice, Pol.) 45(7-9), 122-5, 1989. From Chem. Abstr. No.113:215126h.
21. Moore, H.J., and Tyler, A.L., AIChE Symp. Ser. 78(216), 56-67, 1982. From Chem. Abstr. No.97:130170u.
22. Aboul-Gheit, A.K., Prep.-Am. Chem. Soc., Div. Pet. Chem. 30(2), 94-100 1987. From Chem. Abstr.

No.106:179256v.

23. Krichko, A.A., Megad, N.F., Khorkova, N.N., Yulin, M.K., Galkina, A.A., and Mezhlumova, A.I., Khim. Tekhnol.Topl. Masel 6, 3-5, 1983.
From Chem. Abstr. No.99:56197f.
24. Tisher, R.E., Narain, N.K., Steigel, G.J., and Cillo, D.L., Report 1985, DOE/PETC/TR-86/1, Order No. DE86001861, 61 pp. From Chem. Abstr. No.105:194236m.
25. Mann, R.S., Sambhi, I.S., and Khulbe, K.C., Ind. Eng. Chem. Res. 26(3), 410-14, 1987.
26. Horita, Y., Togari, O., Komoto, T., Nagamura, M., and Tanji, H., Sekiyu Gakkaishi 30(2), 94-100, 1987. From Chem. Abstr. No.106:60777d
27. Hattori, H., Yamashita, K., Kobayashi, K., Tanabe, T., and Tanabe, K., Coal Sci. Technol. (Int. Conf. Coal Sci., 1987),11, 285-8, 1987
From Chem. Abstr. No.108:153361s.
28. Hattori, H., Yamashita, K., Tanabe, T., and Tanabe, K., Proc.-Int. Congr. Catal., 9th, 1, 27-34, 1988. From Chem. Abstr. No.111:60777d.
29. Cutis, C.W., and Pellogrino, J.L., Energy Fuel 3(2), 160-8, 1989. From Chem. Abstr. No.110:118066u.
30. Sajkowski, D.J., and Oyama, S.T., Prep. Am. Chem. Soc., Div. Pet. Chem. 35(2), 233-6, 1990.
From Chem. Abstr. No.113:153493k.
31. Harvey, T.G., and Matheson, T.W., J. Catal. 101(2), 253-61, 1986.
32. Hirschon, A.S., Wilson, R.B., Jr., and Lain, R.M.,

- Appl.Catal. 34(1-2), 311-16, 1987.
33. Sudhakar, C., Eijsbout, S., De Beer, V.H.L., and Prins, R., Bull. Soc. Chim. Belg. 96(11-12), 885-90, 1987. From Chem. Abstr. No.109:95665b.
34. Eijsbouts, S., De Beer, V.H.L., and Prins, R., J. Catal. 109(1), 217-20, 1988.
35. Eijsbouts, S., Sudhaka, C., De Beer, V.H.L., and Prins, R., J. Catal. 127(2), 605-18, 1991.
36. Ledoux, M.J., and Djellouli, B., J. Catal. 115(2), 580-90, 1989.
37. Van der Eijk, J.M., Colijn, H.A., and Van Veen, J.A.R., Proc.-Int. Congr. Catal., 9th, 1, 50-7, 1988. From Chem. Abstr. No.111:60686.
38. Vit, Z., and Zdrzil, M., J. Catal. 119(1), 1-7, 1989.
39. Hillerova, E., Vit, Z., Zdrzil, M., Shkuropat, S. A., Bogdanets, E.N., and Startsev, A.N., Appl. Catal. 67(2), 231-6, 1991.
40. Drahoradova, A., Vit, Z., and Zdrzil, M., Fuel 1(4), 455-8, 1992.
41. Moreau, C., Begakra, L., Geneste, P., Olive, J.L., Duchet, J.C., Tilliette, M.J., and Grimblot, J., Bull. Soc. Chim. Belg. 100(11-12), 841-7, 1991. From Chem. Abstr. No.116:63043a.
42. Ocampo, A., Schrodj, J.T., and Kovach, S.M., Ind. Eng. Chem. Prod. Res. Dev. 17(1), 56-61, 1978
43. Newson, E.J., Ind. Eng. Chem. Process Des. Dev. 14, 27, 1975.

44. Katzer, J.R., Gates, B.C., Olson, J.H., Kwart, H., and Stiles, A.B.; Report, FE-2028-1, 50 pp, 1975. From Chem. Abstr. No.86:75694p.
45. Kovach, S.M., Cartie, L.J., Bennett, J.V., and Schrodtt, J.T., Ind. Eng. Chem. Prod. Res. Dev. 17(1), 62-7, 1987.
46. Karr, C., Jr., and McCaskill, K.B., Report, METC/RI-79/1, 34 pp, 1979. From Chem. Abtr. No.91:177831b.
47. Thomas, M.G., and Sample, D.G., Report, SAND-79-0085, 63 pp, 1979. From Chem. Abstr. No.92:44476p.
48. Thakar, D.S., and Thomas, M.G., Appl. Catal. 6(3), 283-92, 1983.
49. _____., Massoth, F.E., and Thomas, M.G., Chem Uses Molybdenum, Proc. Int. Conf., 4th, 187-91, 1982. From Chem. Abstr. No.99:178748g.
50. Crynes, B.L., and Seapan, M., Report, DOE/ET/14876-12; Order No.DE.8301667, 265 pp, 1983. From Chem. Abstr. No.100:70995k.
51. Tischer, R.E., Stiegel, G.L., Cillo, D.L., and Narian, N., Direct Coal Liquefaction Contract. Rev. Meet. (CONF-831109, DE 84-009374), 19/1-19/47, 1983. From Chem. Abstr. No.101:194902t.
52. Stiegel, G.J., Tischer, R.E., Cillo, D.L., and Narian, N., Ind. Eng. Chem. Prod Res. Dev. 24(2), 206-13, 1985.
53. Shimada, H., Sato, T., Yoshimaru, Y., Kubota, M., and

- Nishijima, A., Sekiyu Gakkaishi 30(4), 258-64, 1987. From Chem. Abstr. No.107:99534q.
54. Stolh, F.V., Prep.-Am. Chem. Soc., Div. Fuel Chem. 32(3) 325-31, 1987. From Chem. Abstr. No.107:158019a.
55. Hisamitsu, T., Gomyo, K., Maruyama, F., and Ozaki, H., Sekiyu Gakkaishi 30(6), 404-11, 1987. From Chem. Abstr. No.108:24343p.
56. Yoneda, N., Horita, Y., Togari, O., Nakamura, M., and Tanji, H., Sekiyu Gakkaishi 31(2), 126-32, 1988. From Chem. Abstr. No.108:170554z.
57. Horita, Y., Komoto, T., Tosu, T., Nakamura, M., and Tanji, H., Sekiyu Gakkaishi 31(2), 141-6, 1988. From Chem. Abstr. No.108:170556b.
58. Adkin, B.D., Milburn, D.R., and Davis, B.H., Prep.-Am. Chem. Soc., Div. Pet. Chem. 30(3), 438-45, 1985. From Chem. Abstr. No.109:213400m.
59. Fish, R.H., Michaels, J.N., Moore, R.S., and Heinemann, H., J. Catal. 123(1), 74-85, 1990.
60. Fitz, C.W., Jr., and Rase, H.F., Ind. Eng. Chem. Prod. Res. Dev. 22(1), 40-4, 1983.
61. Tischer, R.E., Narian, N.K., Steigel, G.J., and Cillo, D.L., Ind. Eng. Chem. Res. 26(3), 422-6, 1987.
62. Ramirez de Agudelo, M.M., and Morales, A., Proc.-Int. Congr. Catal., 9th, 1, 42-9, 1988. From Chem. Abstr. No.111:60685x.
63. Eijisbouts, S., Van Gestel, J.N.M., Van Veen, J.A.R., De Beer, V.H.J., and Prins, R., J. Catal.

- 131(2) 412-31, 1991.
64. Cerda, J.L.R., and Prins, R., Bull. Soc. Chim. Belg. 100(11-12), 815-21, 1991. From Chem. Abstr. No.116:150952q.
65. Song, C., Schobert, H.H., and Matsui, H., Prep.-Am. Chem. Soc., Div. Fuel Chem. 36(4), 1892-9, 1991. From Chem. Abstr. No.115:162866g.
66. Chan, W.S., Seapan, M., and Crynes, B.L., Prep.-Am. Chem. Soc., Div. Pet. Chem. 27(4), 816-25, 1982. From Chem. Abstr. No.100:177540k.
67. Tscheikuna, J., and Seapan, M., Prep.-Am. Chem. Soc., Div. Pet. Chem. 30(3), 438-45, 1985. From Chem Abstr. No.103:126251w.
68. Seapan, M., and Crynes, B.L., Report, DOE/PC60813-15, Order No. DE88008511, 406 pp, 1988. From Chem. Abstr. No.111:80985y.
69. Stranick, M.A., Houalla, M., and Hercules, D.M., J. Catal. 125(1), 214-26, 1990.
70. Yoshimura, Y., Furimsky, E., Sato, T., Shimada, H., Matsubayashi, N., and Nishijima, A., Proc. Int. Congr. Catal., 9th, 1, 136-43, 1988. From Chem. Abstr. No.111:60774e.
71. Rautinen, E.P.H., and Wei, J., Chem. Eng. Commun. 098, 113-27, 1990. From Chem. Abstr. No.114:85005a.
72. Yoshimura, Y., Endo, S., Yoshitomi, S., Sato, T., Shimada, H., Matsubayashi, N., and Nishijima, A., Fuel 70(6), 733-9, 1991.
73. Matsubayashi, N., Sato, T., Yoshimaru, H., Nishijima, A., Fukuda, T., Abe, Y., and Misonoo, T.,

- Sekiyu Gakkaishi 34(4), 322-6, 1991. From Chem. Abstr. No.115:53243f.
74. Monnier, J., Kritz, J.F., and Ternan, M., AIChE Symp. Ser. (Tar Sand Oil Upgrading Technol.), 87(282), 94-100, 1991, From Chem. Abstr. No.115:74995t.
75. Aboul-Geit, A.K., Can. J. Chem. 53(17), 2575-9, 1975. From Chem. Abstr. No.83:192155n.
76. _____, Abdou, I. K., and Mustafa, A., Egypt. J. Chem. 17(5), 631-44, 1974. From Chem. Abstr. No.86:155483j.
77. Cocchetto, J.F., and Satterfield, C.N., Ind. Eng. Chem. Process Des. Dev. 15, 272-7, 1976.
78. _____, Ind. Eng. Chem. Process Des. Dev. 20, 49-53, 1981.
79. Satterfield, C.N., Modell, M., Hites, R.A., and Declerk, C.J., Ind. Eng. Chem. Process Des. Dev. 17(2), 141-8, 1978.
80. Shih, S.S., Mathur, K.N., Katzer, J.R., Kwart, H., and Stiles, A.B., Prep.-Am. Chem. Soc., Div. Pet. Chem. 22, 919-40, 1977.
81. Satterfield, C.N., and Yang, S.H., Ind. Eng. Chem. Process Des. Dev. 23, 11-19, 1984.
82. Gioia, F., and Lee, V., Ind. Eng. Chem. Process Des. Dev. 25, 918-25, 1986.
83. Satterfield, C.N., and Cocchetto, J.F., Ind. Eng. Chem. Process. Des. Dev. 20, 53-61, 1981.
84. Sonnemans, J., van den Berg, G.H., and Mars, P., J. Catal. 31, 220-30, 1973.
85. Satterfield, C.N., and Gultekin, S., Ind. Eng. Chem.

- Process Des. Dev. 20, 62-8, 1981.
86. Yang, S.H., and Satterfield, C.N., Ind. Eng. Chem. Process Des. Dev. 23, 20-5, 1984.
87. Bhinde, M.V., Shin, S., Zawadski, R., Katzer, J.R., and Kwart, H., Chem. Uses Molybdenum, Proc. Int. Conf., 3rd, 184-7, 1979. From Chem. Abstr. No.93:238127s.
88. Satterfield, C.N., Smith, C.M., and Ingalls, M., Ind. Eng. Chem. Process Des. Dev. 24, 1000-4, 1985.
89. _____., and Smith, C. M., Ind. Eng. Chem. Process Des. Dev. 1986, 25, 942-9.
90. Gultekin, S., Khaleeq, M., and Al-Saleh, M. A., Ind. Eng. Chem. Res. 28, 729-38, 1989.
91. _____., Al-Ohali, M.S., and Al-Saleh, M.A., Arabian J. Sci. Eng. 10(3), 265-72, 1985.
92. _____., Arabian J. Sci. Eng. 10(3), 273-80, 1985.
93. Satterfield, C.N., Modell, M., and Mayer, J.F., AIChE J. 21, 1100-07, 1975.
94. _____., and Wilkens, J.A., Ind. Eng. Chem. Process Des. Dev. 19, 154-60, 1980.
95. _____., and Carter, D.L., Ind. Eng. Chem. Process Des. Dev. 20, 538-40, 1981.
96. Girgis, M.J., and Gates, B.C., Ind. Eng. Chem. Res. 30, 2021-58, 1991.
97. Miller, J.T., and Hineman, M.F., J. Catal. 85, 117-26, 1984.
98. Stanulonis, J.J., Gates, B.C., and Olson, J. H., AIChE J. 22, 576, 1979.

VITA

Mr. Sirisak Phaisalrattananukul was born on August 10, 1967 in Chaiyaphum, Thailand. He received his Bachelor of Science Degree in Biotechnology from the Faculty of Science at Mahidol University in 1988.

