

9 Referências Bibliográficas

1. STEVENSON, R.L.; SMAILER, R.M.; Eds., **Direct Reduced Iron – Technology and Economics of Produced and Use**, ISS, 1980, pp. 109.
2. TAYLOR, C.R.; CUSTER, C.C.; Eds., **Electric Furnace Steelmaking**, ISS, 1985, pp, 124.
3. World Steel Association. Disponível em: www.worldsteel.org. Acesso em fevereiro 2011.
4. MIDREX. **2009 World Direct Reduction Statistic**. Disponível em: <http://www.midrex.com> , acesso em janeiro 2011.
5. KOBAYASHI, I. et al. ; **Direct Ironmaking Process using fine Ore and Coal**, ASIA STEEL 200, vol. B, 2000, pp. 132.
6. TANIGAKI, Y.; KOBAYASHI, I. **New ironmaking technology and Environmental Contribution**, ICSS, 2000, pp. 55.
7. SHARMA, T. ISIJ International , 34, 1994, PP. 960-963.
8. CHEELEY, ROB. **Gasification and the Midrex Direct Reduction Process**. Gasification Technologies Conference, San Francisco, California, USA, October 1999.
9. PANTKE, HEINZ; QUEENS, CHRISTIAN. **Requisitos de calidad relacionados con el fierro-esponja para la producción de acero**. Seminario de Reducción Directa, ILAFA, 1975, pp. 517-533.
10. ANDERSON, SARA, H. **Educated Use of DRI/HBI: EAF energy efficiency and Yield**. Direct from Midrex 3rd Quarter, 2002, pp. 3-7.
11. DRESSEL, G.L. **Use of DRI in EAFs**. ASM, October 1998 – January 1999, Part I – Part IV.

12. LULE, R.; LOPEZ, R.; CONEJO, A.; MORALES, R. **Operational results during the melting of 100% DRI of high carbon/high metallization at IMEXSA.** 58th Electric Furnace Conference-ISS, Orlando, November 2000.
13. MIDREX TECHNOLOGIES, INC. Site desenvolvido pela MIDREX. Disponível em: <http://www.midrex.com> , acesso em maio de 2009.
14. FEINMAN JEROME; MAC RAE, DONALD. **Direct Reduced Iron, Technology and Economics of Production and Use.**
15. ENERGIRON. **High carbon DRI - The future for both captive and merchant DRI Plants.** 11th Middle East Iron & Steel Conference, Dubai, December, 2007.
16. COLPAERT, HUBERTUS. **Metalografia dos produtos siderúrgicos comuns.** Editora Edgar Blucher Ltda, 3ra ed., 1974.
17. WIPP, ROY. **Direct Reduction Fundamentals and Applications.** AISTech 2007, Indianapolis, USA.
18. ANDERSON, SARA. **DRI – The EAF energy source of the future.** Midrex, 2000.
19. KOBAYASHI, I.; TANIGAKI, Y.; URAGAMI, A. **A new process to produce iron directly from fine ore and coal.** Kobe Steel Ltd, 1998.
20. SELAN, M. LEHRHOFER, J.; FRIEDRICH, K. **Sponge iron: economic, ecological, technical and process-specific aspects.** Journal of Power Source, Vol. 61, 1996, pp.247-253.
21. TENNIES, W.; METIUS, G.; KOPFLE, J. **Direct reduction technology for the new millenium.** 4th European Coke and Ironmaking Congress, Paris, June 2000, pp. 60- 65.
22. KEMPEN, J.; KLEINSCHMIDT, G.; SCHMALE, K. **Short route – Long term success: Integrated mini-mill solutions by Midrex and SMS DEMAG.** Archives of Metallurgy and Materials, Krótka Linia Technologiczna, Vol. 53, 2008, pp.331-336.
23. BONESTELL, JOHN E. **Midrex Hot Briquetted Iron – A direct reduction iron product for oxygen steelmaking.** Publicação interna da Bradford G. True, April 1983.

24. WHITTEN, GILBERT. **Hot Transport – Midrex Style**. Direct from Midrex 3rd Quarter, 1998, pp. 3-5.
25. METIUS, GARY E. **Increasing product carbon**. Direct from Midrex 1st Quarter, 2000, pp. 3-5.
26. MIDREX TECHNOLOGIES, INC. **Shaft furnace technologies**. Disponível em: <http://www.midrex.com>
27. KELLEY, BRUCE. **Natural gas and reformer catalyst**. Disponível em: [http://www.midrex.com/uploads/documents/Catalyst\(1\)1.pdf](http://www.midrex.com/uploads/documents/Catalyst(1)1.pdf) Acesso em 19 maio 2009, 26 pag.
28. ROSS, J.; VAN KEULEN, A.; HEGARTY, M. **The catalytic conversion of natural gas to useful products**. Catalysis Today, Vol. 30, 1996, pp.193-199.
29. NARKIEWICZ, U.; ARABCZYK, W.; KONICKI, W. **Studies of the Kinetics of methane decomposition on the nanocrystalline iron to carbon deposition formation**. Rev. Adv. Material Science 8, 2004, pp.53-58.
30. BOBROVA, I.; CHESNOKOV, V.; BOBROV, N.; ZAIKOVSKII, V. **New data on gas-phase radical reactions in the steam reforming of methane in the presence of catalysts: Nickel catalysts**. Kinetics and Catalysis, Vol.41, Nro 1, 2000, pp.19-24.
31. ERMAKOVA, M.; ERMAKOV, D. YU; KUVSHINOV, G. **New nickel catalysts for the formation of filamentous carbon in the reaction of methane decomposition**. Journal of Catalysis, Vol. 187, 1999, pp.77-84.
32. VAKHSHOURI, K.; MOTAMED HASHEMI, M. **Simulation study of radial heat and mass transfer inside a fixed bed catalytic reactor**. World Academy of Science, Engineering and Technology, Vol. 34, 2007, pp.180-187.
33. GALLEGO, G.; MONDRAGON, F.; TATIBOUET, JEAN; BARRAULT, J. **Carbon dioxide reforming of methane over La₂NiO₄ as catalyst precursor – Characterization of carbon deposition**. Catalysis Today, Vol.133-135, 2008, pp.200-209.
34. RODRIGUES, D. **Desenvolvimento de um modelo computacional de otimização e predição do valor de uso de pelotas de minério de ferro na rota redução direta – aciaria elétrica**. Tese de Doutorado, Departamento de Ciência dos Materiais e Metalurgia, PUC- Rio. Rio de Janeiro, 2007.

35. BISWAS, A.K.; BASHFORTH, R. **The physical chemistry of metallurgical processes**. Chapman&Hall Ltd, London, 1962.
36. EVANS, JAMES. W.; DE JONGHE, L. **The production of inorganic materials**. Macmillan Publishing Company, USA, 1991.
37. MONDALL, K.; LORETHOVA, H.; HIPPO, E.; WILTOWSKI, T. **Reduction of iron oxide in carbon monoxide atmosphere-reaction controlled kinetics**. Fuel processing Technology, 2004.
38. NOLDIN, J. **Modelo termoquímico da auto-redução em fornos de cuba**. Tese de Doutorado, Departamento de Ciência dos Materiais e Metalurgia, PUC- Rio. Rio de Janeiro, 2007.
39. ROSENQVIST, TERKEL. **Principles of extractive metallurgy**. Second edition. McGraw-Hill, 1983.
40. BELISARIO, FERRY. **Contribuição à auto-redução carbotérmica de aglomerados contendo óxidos de manganês**. Dissertação de Mestrado, Departamento de Ciência dos Materiais e Metalurgia, PUC- Rio. Rio de Janeiro, 2007.
41. BOBOGDANDY, L.; ENGELL, H. J. **The Reduction of Iron Ores**. Scientific Basis and Technology, New York, 1971. pp.19-39.
42. SAWAI, Y. et al. Journal Iron Steel Inst Japan, 84, 1998, pp.844.
43. SHIMOKAWABE, M. Thermochem. Acta, 28, 1979, PP. 287.
44. WIMMERS, O. J. Phys. Chem. 90, 1986, pp. 1331.
45. JANKOWSKI, J. SADOWSKI, A. Ironmaking and Steelmaking, 23, 1986, pp. 479.
46. MOON, I. J.; RHEE, D.J. Steel Research, 69, 1998, pp.302
47. KANG, H.W. ; CHUNG, W.S. ISIJ Internat, 38, 1998, pp.109.
48. TIERNAN, M. J. BARNES, P.A. Physical Chemistry, B, 105, 2001, pp. 220.
49. BARON, R.E; PORTER, J. H. **Chemical Equilibria in Carbon-Hydrogen-Oxygen System**. The MIT Press Energy Lab., Cambridge, MA, Series, 1976.

50. YIN, R. **Thermodynamic roles of metallic elements in carburization and metal dusting.** Oxidation of Metals, Vol. 61, Nro 314, 2004, pp.323-337.
51. GRABKE, HANS. **Carburization, carbide formation, metal dusting, coking.** Materiali in Tehnologije, Vol. 36, Nro 6, 2002, pp. 297-305.
52. CARPIO V. J. **Carburização de ferro esponja na zona de redução de um forno de cuba.** Dissertação de Mestrado, Departamento de Ciência dos Materiais e Metalurgia, PUC- Rio. Rio de Janeiro, 2005.
53. CONEJO, A. N.; MARTINS, G. P. **Equilibrium reactor performance analysis for production of iron carbide.** Ironmaking and Steelmaking, Vol. 26, Nro 2, 1999, pp. 111-116.
54. PACO, LESLY. **Cinética da redução de pelotas de minério de ferro em condições simuladas de um reator Midrex.** Dissertação de Mestrado, Departamento de Ciência dos Materiais e Metalurgia, PUC- Rio. Rio de Janeiro, 2005.
55. CONEJO, A.; LOPEZ, J.; MARTINS, G. **Phase stability and kinetics of gas-phase conversion of hematite to cementite.** ICSTI / Ironmaking conference proceedings, 1998, pp. 847-859.
56. TURKDOGAN, E. T. **Physical chemistry of high temperature technology.** Academic Press, NewYork, 1980.
57. RODRIGUEZ, R.A.D.; CONEJO, A.; BEDOLLA, E. **Kinetics of reduction of Fe₂O₃ particles with H₂-CO mixtures at low temperatures.** 61st Ironmaking Conference – ISS, Nashville, March 2002.
58. LU, Q.; JIANG, W.; LU, C.; ZHAO, L. **Carbonising mechanism and carbon distribution behaviour during direct reduction in shaft furnace.** Ironmaking and steelmaking, Vol. 26, Nro 2, 1999, pp.122-126.
59. WANG, X. **Ironmaking and Steelmaking Principles,** 178, 1981, Beijing, Metallurgy Industry Publishing House.
60. CONEJO, A. **Review and Analysis of Alternative Process to the BlastFurnace.** Revista Metalurgia, Vol. 36, Nro 6 , 2000, pp. 420-434.
61. SHEHATA, K. A; EZZ, S.Y. Trans. Inst. Min. Met.; Vol. 82, 1937, C38.

62. EL-GEASSY, A.A. et al. ; **Mechanism of iron oxide reduction with Hydrogen/Carbon monoxide mixtures.** Trans. ISIJ, Vol. 17; 1977, pp.629-635
63. DAVIS, C.G, et al. Ironmaking Steelmaking, 9, 1982, Nro 3, pp. 93.
64. DARKEN, L. and GURRY,r., **Physical Chemistry of Metals.** McGraw Hill, New York, 1953.
65. SHEHATA, K. A. et al. iron Steel Int., 55, 1982, pp. 45.
66. MOUKASSI, M. et al. Metall. Trans. B, 14B, 1983, pp. 125.
67. IGUCHI, Y. ENDO, S. ISIJ Int, 44, 2004, pp,1991.
68. EL-GEASSY, A.; NASR, M. **Influence of the original structure on the kinetics of hydrogen reduction of hematite compacts.** ISIJ, Vol. 28, 1988, pp.650-658.
69. IGUCHI, YOSHIAKI; ENDO, SATOSHI. **Reactions, Coalescence of reduced iron particles, and liberation of carbon particles in carbon composite iron ore pellets.** ISIJ International, Vol.44, Nro 12, 2004, pp.1999-2007.
70. PIOTROWSKI, K; MONDAL, K; WILTOWSKI, T. **Topochemical approach of kinetics of the reduction of hematite to wustite.** Chemical Engineering Journal, Vol. 131, 2007, pp.73-82.
71. BARRÓN, MIGUEL; GONZÁLEZ, JESUS. **Análisis de la carburización del hierro de reducción directa con CO mediante modelo matemático.** Departamento de Materiales, Universidad Autónoma Metropolitana – Azcapotzalco, México.
72. TOWHIDI, N.; SZEKELY, J. **Reduction kinetics of commercial low-silica hematite pellets with CO-H₂ mixtures over temperature range 600° – 1234°C.** Ironmaking and Steelmaking, Nro 6, 1981, pp. 237-249.
73. OTAVIANO, M.M. **Estudo Fenomenológico da Deposição de Carbono no Ferro Esponja Produzido a Partir de Pelotas de Minério de Ferro.** Dissertação de Mestrado, Universidade Federal de Ouro Preto. 2004.
74. AZEVEDO, F; GUDENAU, H. **Estudo da influência da pressão na redução com H₂ e CO.** 43º Congresso Anual da ABM, Belo Horizonte, Outubro 1988, pp. 378-383.

75. TOWHIDI, N.; SZEKELY, J. **The influence of carbon deposition on the reduction kinetics of commercial grade hematite pellets with CO, H₂ and N₂.** Metallurgical Transactions B, Vol. 14B, September 1983, 359-367.
76. PROCTOR, M.; HAWKINS, R.; SMITH, D. **Reduction of iron ore pellets in CO-CO₂- H₂- H₂O mixtures.** Ironmaking and Steelmaking, Vol. 19, Nro 3, 1992, pp. 194-200.
77. HAYASHI, SHOJI; IGUCHI, YOSHIAKI. **Synthesis of iron carbide by reaction of iron ores with H₂ – CO gas mixtures bearing traces sulfur.** ISIJ International, Vol. 37, Nro 1, 1997, pp.16-20.
78. IGUCHI, Y.; SAWAI, S.; OHIWA, K. **Kinetics of carbide formation from reduced iron in CO-H₂-H₂S mixtures.** Metallurgical and Materials Transactions B, Vol. 32B, December 2001, pp. 1161-1170.
79. MOTLAGH, M. **The influence of H₂S on simultaneous reduction and carburization of iron ore using low volatile coal gas.** I&SM, September 2002, pp. 19-28.
80. GRABKE, H.; MOSZYNSKI, D.; MULLER-LORENZ, E.; SCHNEIDER, A. **Role of sulphur in carburization, carbide formation and metal dusting of iron.** Surface and Interface Analysis, Vol. 34, 2002, pp. 369-374.
81. OSTROVSKI O.; ZHANG, G. **Reduction and carburization of metal oxides by methane containing gas.** American Institute of Chemical Engineers, Vol. 52, Nro 1, 2006, pp. 300-310.
82. PARK, E.; ZHANG, J.; THOMSON, S.; OSTROVSKI, O. **Characterization of phases formed in the iron carbide process by X-ray diffraction, Mossbauer, X-ray photoelectron spectroscopy and Raman spectroscopy analyses.** Metallurgical and Materials Transactions B, Vol. 32 B, October 2001, pp. 839-845.
83. TURKDOGAN E.T.; VINTERS, J.V. **Catalytic effect of iron on decomposition of carbon monoxide. Part I. Carbon deposition in H₂-Co mixtures.** Metallurgical Transactions, Vol. 5, january 1974, pp. 11-19.
84. AKAMUTU, H.; SATÔ, K. **On the catalytic decomposition of carbon monoxide by iron.** Faculty of Science, Tokyo University- Japan, Vol. 22, Nro 3, 1949, pp.127-131.

85. NARÇIN, N.; AYDIN, S.; SESEN, K.; DIKEC, F. **Reduction of iron ore pellet with domestic lignite coal in a rotary tube furnace.** Int. J. miner. Process, Vol. 43, 1995, pp.49-59.
86. DONSKOL, E.; McELWAIN, D.; WIBBERLEY, L. **Estimation and modeling of parameters for direct reduction in iron ore/coal composites: Part II. Kinetic Parameters.** Metallurgical and Materials Transactions B, Vol. 34B, april 2003, pp.255-266.
87. MOTLAGH, M. **Effect of gas flow on simultaneous carburisation and reduction of iron ore.** Ironmaking and Steelmaking, Vol. 21, Nro 4, 1994, pp. 297-302.
88. TEIXEIRA, F.; AGASAWARA, T.; MANNHEIMER, W. **Deposição de carbono em pelotas de minério de ferro durante a redução gasosa.** XXX Congresso Anual da ABM, Rio de Janeiro, 1975, PP.465-471.
89. BONALDE, A; HENRIQUEZ, A; MANRIQUE, M. **Kinetic analysis of the iron oxide reduction using hydrogen – carbon monoxide mixtures as reducing agent.** ISIJ International, Vol. 45, Nro 9, 2005, pp.1255-1260.
90. HASS, L. A. et. al. Rep. Invest. U.S. Bur. Mines, 8997, 1985, pp. 14
91. YANG, J.J.; LU, W.K. Proc. Of the 44th Ironmaking Conf., Vol. 44, ISS-AIME, Warrendale, 1985, 111.
92. ARABCZYK, W.; KONICKI, W.; NARKICWICZ, U. **Kinetics of the iron carbide formation in the reaction of methane with nanocrystalline iron catalyst.** Applied Catalysis A: General 266, 2004, pp. 135-145.
93. MATAMALA, GUILLERMO; CAÑETE, PEDRO. **Carburization and decarburization kinetics of iron in CH₄ – H₂ mixtures between 1000 – 1100oC.** Materials Chemistry and Physics, Vol. 12, 1985, pp. 313-319.
94. ZHANG, J.; OSTROVSKI, O. **Iron ore reduction/cementation: experimental results and kinetic modelling.** Ironmaking and Steelmaking, Vol. 29, Nro 1, 2002, pp. 15-21.
95. ZHANG, J.; OSTROVSKI, O. **Cementite formation in CH₄-H₂-Ar gas mixture and cementite stability.** ISIJ International, Vol. 41, Nro 4, 2001, pp. 333-339.
96. ZHANG, J.; OSTROVSKI, O.; SUZUKI, K. **Effect of temperature on cementite formation by reaction of iron ore with H₂-CH₄-Ar gas.**

Metallurgical and Materials Transactions B, Vol. 31B, October 2000, pp. 1139-1142.

97. OLSSON, R.; TURKDOGAN, E. **Catalytic effect of iron on decomposition of carbon monoxide: Part II. Effect of additions of H₂, H₂O, CO₂, SO₂ and H₂S.** Metallurgical Transactions, Vol. 5, January 1974, pp. 21-26.
98. MOTLAGH, M. **Catalytic activity of carbon-free iron.** I&SM, February 2000, pp.31-38.
99. D'ABREU, J. C.; VERA, J.; KOHLER, HÉLIO; ARAUJO R., DENILSON. **Contribution on DRI Carburization Kinetics in the Reduction Zone of a Shaft Furnace.** 15° Conferencia de Acería – 5° Conferencia de Reducción; 5th Ironmaking Conference. San Nicolás : Instituto Argentino de Siderurgia, 2005. v. 1. p. 39-46.
100. D'ABREU, J.C.; KOHLER, H.; ARAUJO R., DENILSON; VERA, J. **DRI Carburization in the Reduction Zone of a Shaft Furnace.** Samarco's Technical Seminar III: The Global Experience, 2008, Vitoria, Brazil.
101. BELISARIO, FERRY; D'ABREU, JOSE C.; OTAVIANO, MAURICIO; KOHLER, HÉLIO. **Simulação experimental da carburização de DRI em reator de cuba tipo Midrex.** 40° Seminário de Redução de Minério de Ferro e Matérias Primas e 11° Seminário Brasileiro de Minério de Ferro, Belo Horizonte – MG, setembro 2010.
102. OMORI, Y.; YAGI, I.; YANAGIYA, TOSHIO. **Theoretical and experimental study on the reduction of iron oxide pellets in shaft furnace.** Research Institute of Mineral Dressing and Metallurgy, Tohoku University, Sendai, Japan, 1980.
103. ALAMSARI, B.; TORII, S.; TRIANTO, A.; BINDAR, Y. **Numerical simulation of iron ore reactor isobaric and cooling zone to investigate total carbon formation in sponge iron.** World Academy of Science, Engineering and Technology, Vol. 53, 2009, pp. 88-92.
104. PARISI, D.; LABORDE, M. **Modeling of counter current moving bed gas-solid reactor used in direct reduction of iron ore.** Chemical Engineering Journal, 104, 2004, pp. 35-43.
105. TAKENAKA, Y.; KIMURA, Y. **Mathematical model of direct reduction shaft furnace and its application to actual operations of a model plant.** Computers and Chemical Engineering, Vol. 10, Nro 1, 1986, pp. 67-75.

106. VALIPOUR, M. S. **Mathematical modeling of a non-catalytic gas-solid reaction: Hematite pellet reduction with syngas.** Chemistry and Chemical Engineering, Vol. 16, Nro 2, 2009, pp. 108-124.
107. GORDON, Y.; SHVIDKIY, V.; YAROSHENKO, Y. **Modeling of heat and mass transfer and gas dynamics of shaft furnaces to optimize their design and operating parameters.** Urals State Technical University, Russia.
108. AGUILAR, J.; FUENTES, R.; VIRAMONTES, R. **Simulation of iron ore reduction in a fixed bed.** Modelling Simul. Mater. Science Eng., Vol. 3, 1995, pp.131-147.
109. TOWHIDI, NASSER. **Influence of direct reduction condition of hematite pellets with H₂/CO on the oxidation behavior of DRI in Air.** Steel Research, Vol. 74, Nro 10, 2003, pp.595-600.
110. BANDOPADHYAY, A.; GANGULY, A.; GUPTA, K.; RAY, H. **Investigations on the anomalous oxidation behavior of high-carbon gas-based direct reduced iron (DRI).** Thermochemica Acta, Vol. 276, 1996, pp. 199-207.
111. LEMUS, J.; MENDOZA, G.; BEDOLLA, E. **Estudio de la reoxidación y carburización de pelets reducidos de mineral de hierro.** Rev. Metal. Madrid, Vol. 34, Nro 6, 1998, pp. 459-468.