8
Referências bibliográficas

1 MERCK S. A. INDÚSTRIAS QUÍMICAS. **Tabela periódica interativa: vanádio**. Disponível em: <http://www.merck.com.br/química/ >. Acesso em: 22 de julho de 2004.

2 CARLSON, O. N.; STEVENS, E. R. Vanadium and vanadium alloys. In: **Encyclopedia of Chemical Technology**. 2 ed. New York:, London, Sydney, Toronto: Interscience, Wiley, 1963-70. V. 21. p. 157-66.

3 PETRY,C.C. **Vanadium**. Disponíve em: <http://www.mtsc.unt.du/faculty/reide/metals /metal_profiles.htm>. Acesso em: 22 julho de 2004.

4 VANÁDIO: história. Disponível em: <http://www.if.ufrj.br/teaching/elem/e02310.html>. Acesso em: 22 julho de 2004.

5 BAUER, G. et al. Vanadium and vanadium compounds. In: **Ulmann's Encyclopedia of Industrial Chemistry**. 5 ed. Weinhelm: VCH, 1996. V. A27. p. 367-85.

6 MAGYAR, M. J. **Vanadium**. Disponível em http://www.minerals.usgs.gov/minerals>. Acesso em 08 de setembro de 2005. 14 p.

7 VANADIUM. Disponível em: <http://www.webelements.com>. Acesso em 22 julho de 2004.

8 GUPTA, C. K. Extractive metallurgy of niobium, tantalum and vanadium. **International Metals Reviews**, v.29, n. 6, p. 405-44. 1984.

9 GAMEIRO, D. H. **A cinética da carbocloração do dióxido de titânio**. Rio de Janeiro. Tese de Doutoramento – COPPE/UFRJ, 261 p.,1994..

10 KORSHUNOV, V. G.; KUTSENKO, S. A. Prospects for the use of chlorine in the metallurgy of vanadium. **Soviet Journal of Non-ferrous Metals**, v. 24, n. 10, p. 60-64, 1983.

11 GONZÁLEZ, J. et al. β-Ta_2O_5 Carbochlorination with different types of carbon. **Canadian Metallurgical Quartely**, v. 41, n. 1, p. 29-40, 2002.

12 CHLORINATION. In: HABASHI, F. **Principles of Extractive Metallurgy**. Langhorne, Pa: Gordon and Breach, V.3. Pirometallurgy. 1986. p. 217-39.

13 FOWLES, G. W. A. Vanadium compounds. In: **Encyclopedia of Chemical Technology**. 2 ed. New York, London, Sydney, Toronto: Interscience, Wiley, 1963-70. V. 21. p. 167-80.

14 SHINKO Chemical Co., Ltd. **Vanadium, chlorides & organic metal compounds**. Disponível em: <http://www.shinko-chem.co.jp/dv1_e/dv1_e.html>. Acesso em 22 de julho de 2004.

15 PERRY J. H. (Ed.). **Chemical Engineer's Handbook**. 4 ed. New York:, St. Louis, San Francisco, London, Mexico, Sydney, Toronto: McGraw-Hill Book Company, 1963.

16 MARYADALE, J. O. et al. (Ed.). **The Merck Index**. 13 ed., Whitehouse Station, NJ: Merck Research Laboratories Division of MERCK & CO., INC., 2001.

17 PERRY, D. L.; PHILLIPS, S. L. (Ed.). **Handbook of Inorganic Compounds**. Boca Raton, London, New York, Washington: CRC Press, 1995.

18 BROCCHI, E. A. **Reduction chlorination of niobium and tantalum oxide containing materials**. Londres. Tese de Doutoramento – Imperial College of Science and Technology, 1983

19 MOURA, F. J. **Estudo cinético da cloração redutora dos óxidos de Nb, Ta e Ti contidos em uma escória proveniente da metalurgia do estanho**. Rio de Janeiro. Tese de Mestrado – Pontifícia Universidade Católica do Rio de Janeiro, 132 p. 1986.

20 AMIROVA, S. A. et al. Preparation of vanadium tetrachloride from its oxytrichloride. **Izv. Vysshiskh Uchebn. Zavedenii, Tsvetnaya Metallugiya**, v.8, n. 6, p. 87-92, 1965. (Original em russo).

21 NATIONAL DISTILLERS AND CHEMICAL CORP. Thomas R. Carter et al. **Vanadium oxytrichloride**. PI n. US 3355244, 28 nov. 1967.

22 SHEKA, I. A.; YANKELEVICH, R. G. Chlorination of vanadium pentoxide in the presence of charcoal. **Ukr. Khim. Zhurnal**, v. 33, n.10, p. 1011-15, 1967. (Original em russo).

23 SAEKI, Y.; TAKASHI, O.; MATSUZAKI, R. Chlorination of vanadium pentoxide. **Kogyo Kagaku Zasshi**, v. 74, n. 5, p. 828-33, 1971. (Original em japonês).

24 STAUFFER CHEMICAL CO. **Preparation of vanadium tetrachloride and mixtures thereof with vanadium oxychloride**. PI n. GB 1308738, 07 mar. 1973.

25 STAUFFER CHEMICAL CO. John Thomas Cotter e Adam Edward Skrzec. **Vanadium chlorides.** Pedido de privilégio n. US 873297, 30 jan. 1978.

26 SUMITOMO CHEMICAL ENGINEERING CO. Mitsuo Kawabuchi e Hiraoca Yoshimitsu. **Vanadium oxychloride**. PI n. JP 20210, 13 fev. 1980.

27 STAUFFER CHEMICAL CO. Henry H. Feng et al. **Production of stable vanadium tetrachloride.** PI n. US 4202866, 13 mai. 1980.

28 UBE INDUSTRIES, LTD. T. Iwai; H. Mizuno; M. Miura. **Process for producing chloride of elements of Group III, IV or V of Periodic Table**. PI n. US 4327062, 27 abr. 1982.

29 STAUFFER CHEMICAL CO. Kiriyanthan A. Jacob. **Vanadium halides.** Pedido de privilégio do Escritório Europeu de Patentes n. EP 103940, 28 mar. 1984.

30 YAMASHITA, S.; HATA, K. Studies on chlorination of niobium pentoxide and vanadium pentoxide. **Kenkyu Hokoku – Chiba Kogyo Daigaku, Riko-hen**, v. 31, p. 177-84, 1986. (Original em japonês).

31 TIMOFEEV, S. I. et al. Chlorination of technical vanadium pentoxide. **Nauchn. Tr. Nauchno-Issled. Proektn. Inst. Redkomet. Promsti**, n. 42, p. 87-91, 1972. (Original em russo).

32 TIMOFEEV, S. I. et al. **Vanadium Tetrachloride**. PI n. U.S.S.R. 458512, 30 jan. 1975.

33 AMIROVA, S. A. et al. **Izv. Vuzov, Tsvetnaya Metallugiya**, n. 2, p. 79-84, 1965. (Original em russo).

34 AMIROVA, S. A. et al. Chlorination of technical vanadium pentoxide in alkali metal chloride melts. **Nauchn. Tr. Nauchno-Issled. Proektn. Inst. Redkomet. Promsti**, n. 42, p. 92 – 97, 1972.

35 AMIROVA, S. A.; KUTSENKO, S. A.; CHIZHOV, N. N., In : **Chemistry and Technology of Vanadium Compounds**. URSS: V. I. Spitsyn, Permskoe Kn. Izd-vo, p. 154 – 158, 1974.

36 INYUSHKINA, T. L. et al. Chlorination of vanadium pentoxide by hydrogen chloride. **Izv. Vyssh, Ucheb. Zaved., Khim. Tekhnol.**, v. 17, n. 3, p. 339-41, 1974. (Original em russo).

37 KUTSENKO, S. A.; CHIZHOV, N. N. In: **Chemistry and Technology of Processes Ocurring in a Molten Salts Medium.** Permskii Gosudarvstenny Un-t, p. 54–59, 1977.

38 VARHEGYI, G.; IVAN, L. Production of vanadium tetrachloride. **Proc. Res. Inst. Non-Ferrous Metals**, Budapeste: L. Gillemot. Akadémial. Kiadó, p. 157–65, 1968.

39 KUTSENKO, S. A. et al. Kinetics of chlorination of technical vanadium pentoxide in potassium chloride and sodium melts. **Sb. Nauch. Tr. Perm. Politekh. Inst.**, n. 71, p. 169-74, 1970. (Original em russo).

40 MINK, G.; PODOR, B.; BERTOTI, I. Mass-spectrometric studies on the kinetics of the vanadium oxide (V_2O_5) + carbon tetrachloride reaction. **Trav. Com. Int. Etude Bauxites, Alumine, Alum.,** n.17, p. 239-47, 1982.

41 MINK, G.; BERTOTI, I; PAP, I. S. Thermogravimetric, mass spectrometric and xps investigation on the chlorination reactions of vanadium pentoxide and titanium dioxide. **Thermochimica Acta**, Amsterdam: Elsevier, v. 85, p. 83-6, 1985.

42 MINK, G.; BERTOTI, I; SZÉKELY, T. Chlorination of V_2O_5 by CCl_4. Adsorption and steady-state reactions. **React. Kinet. Catal, Lett.** Budapeste. V.27, n.1, p. 33-8, 1985.

43 MINK, G.; BERTOTI, I; SZÉKELY, T. Chlorination of V_2O_5 by CCl_4. The proposed reaction mechanism. **React. Kinet. Catal, Lett.** Budapeste. V. 27, n.1, p. 39-45, 1985.

44 MINK, G. et al. Comparative kinetic and thermodynamic study on the chlorination of V_2O_5 with CCl_4, $COCl_2$ e Cl_2. **Journal of Thermal Analysis.**, Budapeste: John Wiley & Sons, Ltd. – Akadémial Kiadó. V. 35, p. 163-73, 1985.

45 PASQUEVICH, D. M.; GAMBOA, J. A.; CANEIRO, A. On the role of carbon in the carbochlorination of refractory oxides. **Thermochimica Acta**. Amsterdam: Elsevier, p. 209-22, 1992.

46 GABALLAH, I.; ALLAIN, E.; DJONA, M. Chlorination kinetics of refractory metal oxides (MoO_3, Nb_2O_5, Ta_2O_5 and V_2O_5). **Light Met.**, Warrendale, Pa. p. 1153- 61, 1994.

47 ALLAIN, E.; DJONA, M.; GABALLAH, I. Carbochlorination kinetics of refractory metal oxides (MoO_3, Nb_2O_5, Ta_2O_5 and V_2O_5). In: **Trace React. Met. Proc. Int. Symp. Extr. Process. Trace React. Met.**, Warrendale, Pa.: R. G. Reddy, B. Mishra. (ed.). Miner.Met. Mater. Soc., p. 251-67, 1994.

48 MANUKYYAN, N. V.; MARTIROSYAN, V. H. Investigation of the chlorination mechanism of metal oxides by chlorine. **Journal of Materials Processing Technology**, n. 142, p. 145-51, 2003.

49 CONTROL MEASURES OF THE MONTREAL PROTOCOL. Disponível em: <http://www.undp.org/seed/eap/montreal/montreal.htm>. Acesso em: 22 jul. 2004.

50 SAFETY (MSDS) DATA FOR CARBON TETRACHLORIDE. Disponível em: <http://www.physchem.ox.ac.uk./MSDS/CA/carbon_tetrachloride.html>. Acesso em 22 de julho de 2004.

51 ROINE, A. **HSC Chemistry for Windows**. Version 5. Pori, Finlândia: Outokumpu Research Oy, jun. 2002. 1 CD-ROM.

52 LEVENSPIEL, O. **Engenharia das Reações Químicas**. V. 2, São Paulo: Editora Edgard Blücher, 1983.

53 WEN, C. Y. Noncatalytic hetereogeneous solid fluid reaction models. **Industrial and Engineering Chemistry,** v. 60, n. 9, p. 34-54, 1968.

54 SZEKELY, J.; EVANS, J. W.; SOHN, H. Y. **Gas-solid reactions**. London: Academic Press, 1976.

55 DORAISWAMY, L. K.; SHARMA, M. M. **Heterogeneous reactions**. New York: John Wiley & Sons, 1984, V. 1.

56 SZEKELY, J. **Blast furnace technology, science and practice**. Marcel Dekker, Inc., 1972.

57 SPITZER, R. H.; MANNING, F. S.; PHILBROOK, W. O. Mixed control reaction kinetics in the gaseous reduction of hematite. **Transactions of the Metallurgical Society of AIME**, v. 236, p. 726, may 1966.

58 SZEKELY, J.; EVANS, J. W. Studies in gas-solid reactions: Part 1. A structural model for the reaction of porous oxides with a reducing gas. Part II. An experimental study of nikel oxide reduction with hydrogen. . **Metallurgical Transactions**, v.2, p. 1691, 1971.

59 HABASHI, F. **Principles of Extractive Metallurgy**. New York: Gordon and Breach Science Publishers, 1985.

60 LEVENSPIEL, O; KUNII, D. **Fluidization Engineering**. New York: John Wiley & Sons, 1969.

61 SZEKELY, J.; SOHN, H. Y. Effect of structure on the reaction between a porous solid and a gas. **Transactions of the Institute of Mining and Metallurgy, C**. p. 92, 1973.

62 GIDASPOW, D.; DHARIA, F.; LEUNG, L. Gas purification by porous solids with structural changes. **Chemical Engineering Science**, v. 31, p. 337, 1976.

63 WILLIAMS, D. T.; EL-RAHAIBY, S. K.; RAO, Y. K. Autocatalytic model for the reduction of nickel chloride with hydrogen gas. **Met. Trans. B**, v. 12B, p. 192-3, mar. 1981.

64 REIS, M. L. **Cinética da cloração de óxido de zircônio**. Rio de Janeiro, Dissertação de Mestrado – Pontifícia Universidade Católica do Rio de Janeiro, 155p., 1991.

65 JENA, P. K.; BROCCHI, E. A ; LIMA, M. P. A.C. Studies on the kinetics of carbon tetrachloride chlorination of tantalum pentoxide. **Met. Trans. B**, v. 32B, p 801-10. oct. 2001.

ANEXOS

ANEXO 1 - RESULTADOS EXPERIMENTAIS DOS ENSAIOS DE CLORAÇÃO

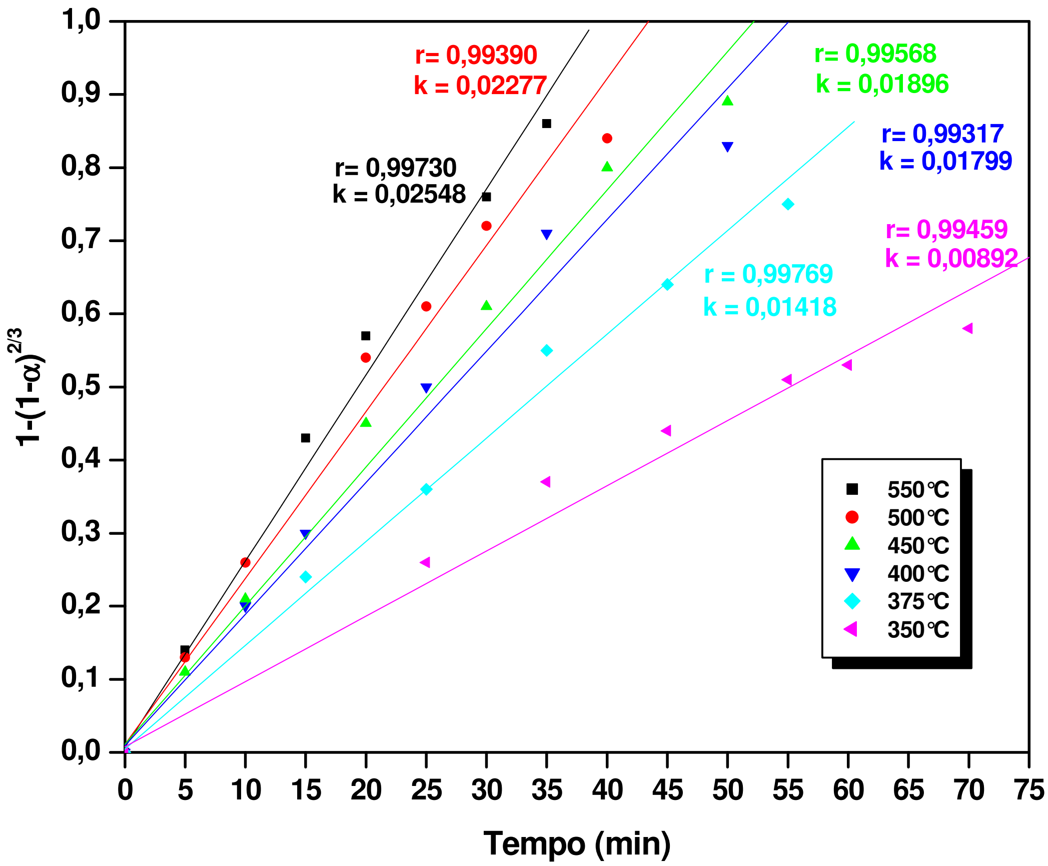
Am.	%C	T(°C)	t min	%PPT	%V2O5	Am.	%C	T(°C)	t min	%PPT	%V2O5	Am.	%C	T(°C)	t min	%PPT	%V2O5
1	20	500	10	35,24	34,13	35	18	450	10	19,92	-	55	16	500	30	60,26	70,63
2	20	500	10	37,25	40,25	35	18	450	15	27,67	-	56	15	500	40	83,12	91,29
3	20	500	10	37,07	-	35	18	450	20	34,91	36,95	57	18	350	15	23,31	-
4	20	500	10	31,30	-	36	18	350	15	23,05	-	57	18	350	20	29,48	-
5	20	500	15	41,03	-	36	18	350	20	24,75	-	57	18	350	25	34.96	-
6	20	500	20	56,29	-	36	18	350	25	27,66	-	57	18	350	30	39,74	45,61
7	20	500	25	67,81	-	36	18	350	30	29,66	32,44	57	18	350	15	23,31	-
8	20	500	10	30,92	-	36A	18	350	15	19,88	-	57	18	350	20	29,48	-
9	20	500	10	29,16	-	36A	18	350	20	22,48	-	58	17	500	30	84,91	84,91
10	20	500	30	63,45	-	36A	18	350	25	24,58	-	59	17	500	5	19,36	11,79
11	20	500	15	40,05	-	36A	18	350	30	27,67	27,93	60	17	500	25	71,96	75,38
12	20	500	20	54,27	-	37	18	350	30	51,85	-	61	17	550	5	18,44	-
13	20	500	25	61,83	-	37A	18	350	30	57,31	62,20	62	17	550	30	62,97	57,79
14	20	500	35	85,06	94,59	38	18	500	10	26,95	-	63	17	500	5	20,16	19,25
15	20	500	5	22,67	25,21	38	18	500	20	52,79	-	64	17	500	30	89,02	95,19
16	20	500	30	88,31	99,63	38	18	500	30	76,95	77,95	65	17	550	5	27,34	20,29
17	20	500	20	67,24	74,75	39	17	500	10	17,41	15,85	66	17	550	15	56,89	56,80
18	20	300	10	8,34	12,38	40	17	500	25	24,85	23,41	67	17	550	20	69,77	71,51
19	20	300	10	7,06	7,50	41	17	500	20	37,43	45,51	68	17	550	30	84,76	88,52
20	20	300	10	9,74	12,00	42	17	500	15	27,74	36,35	69	17	550	35	89,63	94,60
21	20	500	30	86,17	-	43	16	500	20	45,86	-	70	17	500	10	35,80	35,80
22	20	500	25	76,14	85,25	43	16	500	40	84,25	91,59	71	17	500	20	67,90	68,79
23	20	500	10	37,26	42,04	44	15	500	25	57,88	-	72	17	500	30	89,81	94,47
24	20	400	10	37,3	49,07	44	15	500	50	87,43	94,37	73	17	450	10	33,73	30,01
25	15	500	25	24,57	20,82	45	17	500	40	87,13	93,40	74	17	450	20	59,14	59,14
26	15	500	15	21,61	17,65	46	18	500	35	88,76	92,59	75	17	450	30	83,23	86,18
27	15	500	15	29,73	29,04	47	16	500	18	51,70	48,87	76	17	450	50	89,52	96,13
28	15	500	15	46,04	43,24	48	15	500	87	87,30	92,71	77	17	450	5	19,13	15,71
29	15	500	15	44,29	36,47	49	18	500	30	77,04	77,25	78	17	450	40	89,33	95,19
30	17	500	15	42,51	36,78	50	18	450	20	51,35	54,93	79	17	400	10	25,8	27,98
31	16	500	15	44,23	36,98	51	17	450	30	65,24	75,93	80	17	400	25	67,20	73,59
32	18	350	25	39,12	40,56	52	17	450	40	79,72	90,85	81	17	400	15	38,62	41,70
33	18	400	20	39,02	43,07	53	17	550	10	27,76	22,02	82	17	400	35	87,23	96,52
34	18	500	15	43,82	40,63	54	17	550	20	37,51	37,55	83	17	400	50	86,33	93,03

84	17	400	25	60,2	64,62	105	20	350	40	53,85	59,92	140	17	500	15	54,55	55,42
85	17	400	40	87,33	92,20	106	20	350	50	65,96	70,54	141	17	500	10	45,10	40,94
86	17	400	35	84,28	84,28	107	20	350	60	72,84	81,67	142	17	500	40	86,91	84,13
87	17	350	10	8,80	5,52	108	17	350	55	62,69	65,58	143	17	500	30	83,43	79,00
88	17	350	25	33,84	35,98	109	20	350	25	39,08	38,23	144	17	500	20	59,54	57,62
89	17	350	35	47,69	49,96	110	17	350	70	69,85	73,06	145	17	500	15	48,40	44,83
90	17	350	45	55,43	57,98	111	20	350	70	69,96	77,80	146	17	500	10	34,43	34,43
91	17	350	60	66,20	68,27	112	30	500	5	22,37	-	147	17	500	40	72,65	79,06
92	17	350	15	14,04	10,44	112	30	500	15	54,96	-	148	17	500	30	57,87	60,77
93	18	350	10	28,87	-	112	30	500	20	67,10	-	149	17	500	20	39,26	35,74
93	18	350	15	40,96	-	112	30	500	25	67,30	-	150	17	500	15	34,40	26,77
93	18	350	20	52,97	-	112	30	500	30	67,70	90,44	151	17	500	10	24,87	18,15
93	18	350	25	64,44	-	113	30	500	15	46,81	56,61	152	17	350	65	53,45	64,14
93	18	350	30	75,52	-	114	30	500	30	72,78	88,94	153	17	350	55	55,26	55,26
94	18	350	10	28,87	-	115	30	500	5	22,21	17,74	154	17	350	45	44,27	44,57
94	18	350	15	41,56	-	116	30	500	35	75,10	91,89	155	17	350	35	33,53	37,57
94	18	350	20	55,34	-	117	30	500	45	74,83	92,64	156	17	350	25	16,68	17,79
94	18	350	25	66,43	-	118	30	350	20	33,57	43,00	157	17	350	60	52,09	59,62
94	18	350	30	80,82	-	119	30	350	30	55,46	70,33	158	17	350	25	17,45	17,26
95	18	350	10	32,17	-	120	30	350	40	68,53	89,73	159	17	350	35	24,02	21,75
95	18	350	15	45,35	-	121	30	350	50	71,16	90,23	160	17	350	45	34,30	34,30
95	18	350	20	57,94	-	122	30	350	60	71,27	90,89	161	17	350	45	24,12	23,83
95	18	350	25	69,33	-	123	30	350	70	71,40	93,45	162	17	350	35	17,27	14,08
95	18	350	30	84,62	-	124	30	350	25	41,76	53,44	163	17	350	55	20,26	20,46
96	19	350	10	34,43	-	125	30	350	45	69,11	85,61	164	17	350	65	25,85	25,81
96	19	350	20	62,66	-	126	30	350	35	64,00	80,60	165	17	350	45	19,52	19,52
96	19	350	30	87,39	-	127	17	500	10	42,00	42,00	166	17	350	60	36,47	38,03
97	17	375	15	34,16	36,90	128	17	500	20	75,73	76,14	167	17	350	25	15,74	13,94
98	17	375	25	44,52	46,58	129	17	500	15	54,79	56,11	168	17	350	50	22,51	21,51
99	17	375	35	65,9	69,80	130	17	500	30	89,52	91,67	-	-	-	-	-	-
100	17	375	45	78,37	84,15	131	17	500	40	90,02	94,00	-	-	-	-	-	-
101	17	375	55	82,22	87,85	132	17	350	25	54,41	51,26	-	-	-	-	-	-
102	17	350	20	17,71	20,26	133	17	350	35	58,92	61,18	-	-	-	-	-	-
103	20	350	20	18,18	20,35	134	17	350	45	71,30	74,37	-	-	-	-	-	-
104	20	350	30	44,56	47,75	135	17	350	55	76,72	81,13	-	-	-	-	-	-
105	20	350	40	53,85	59,92	136	17	350	15	25,85	27,68	-	-	-	-	-	-
106	20	350	50	65,96	70,54	137	17	500	40	88,22	91,46	-	-	-	-	-	-
107	20	350	60	72,84	81,67	138	17	500	30	84,32	84,15	-	-	-	-	-	-
108	17	350	55	62,69	65,58	139	17	500	20	72,30	73,23	-	-	-	-	-	-

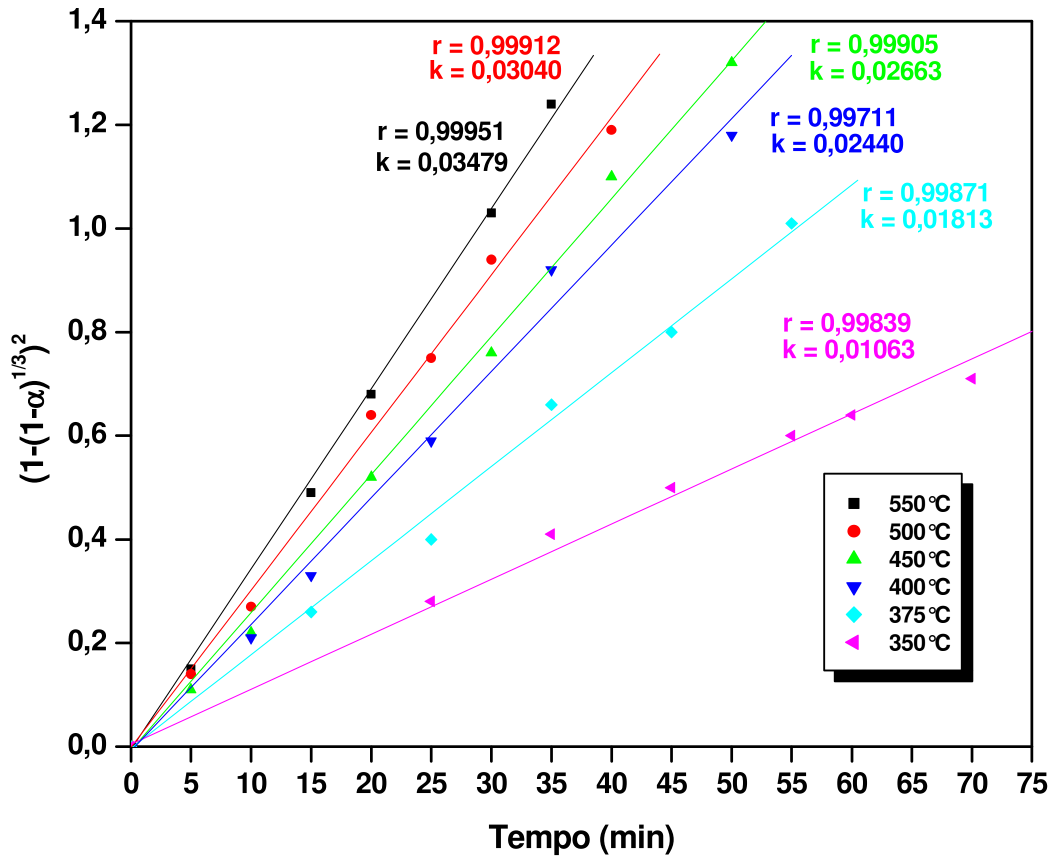
ANEXO 2 - INFLUÊNCIA DA TEMPERATURA PARA 17 % DE CARBONO

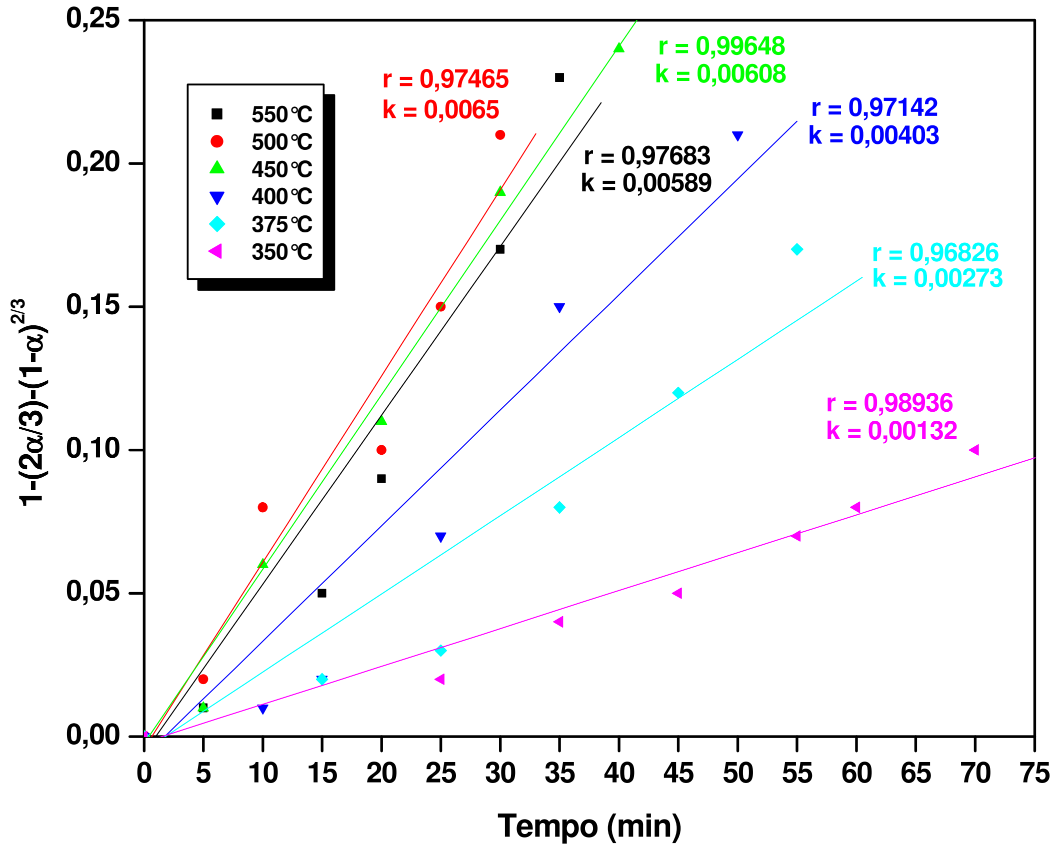
t(min)	550 ℃		500 ℃		450 ℃	
	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5	65	20,29	63	19,25	77	15,71
10			70	35,80	73	30,01
15	66	56,80				
20	67	71,51	71	68,79	74	59,14
25				75,38		
30	68	88,52	58	84,91	51	75,93
35	69	94,60				
40			45	93,40	52	90,85
45						
50					76	96,13
55						
60						
65						
70						
t(min)	400 ℃		375 ℃		350 ℃	
	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5						
10	79	27,98				
15	81	41,70	97	34,16		
20						
25	84	64,62	98	48,70	88	35,98
30						
35	86	84,28	99	69,8	89	49,96
40						
45			100	78,37	90	57,98
50	83	93,03				
55			101	87,85	108	65,58
60					91	68,27
65						
70						

ANEXO 3 - INFLUÊNCIA DA TEMPERATURA: AJUSTE DOS DADOS EXPERIMENTAIS POR OUTROS MODELOS

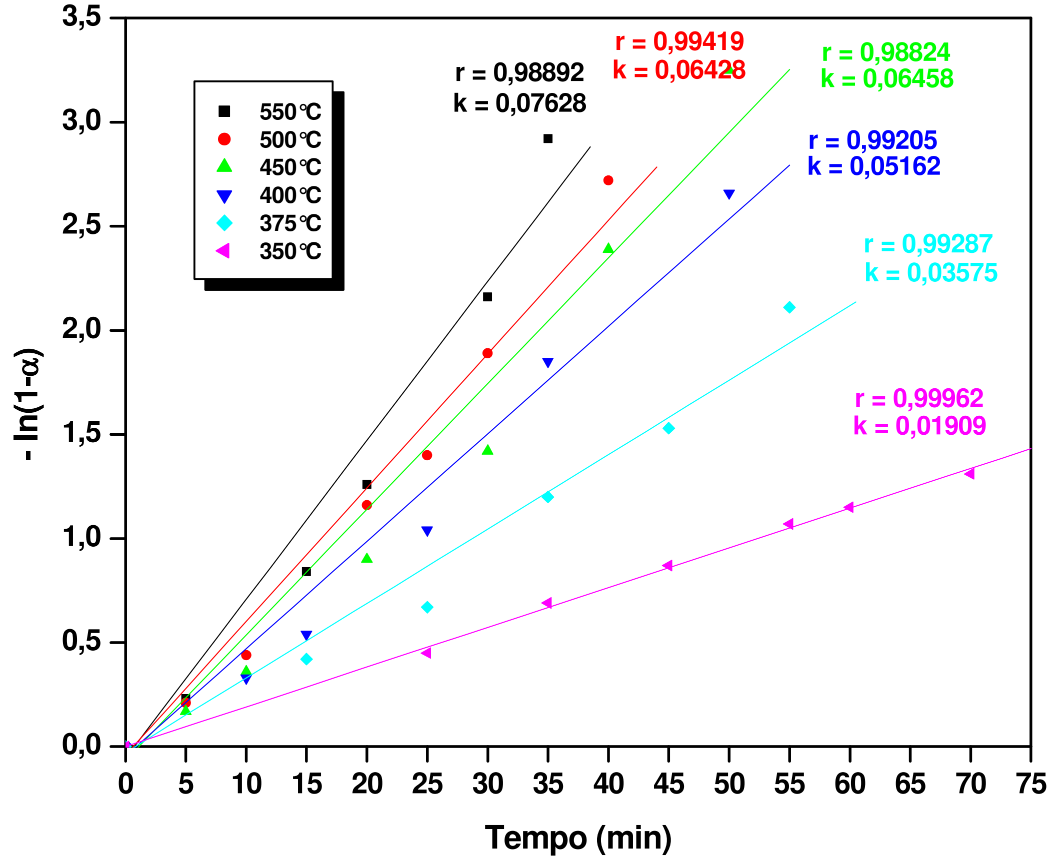


r= 0,99390
k = 0,02277
r= 0,99730
k = 0,02548
r= 0,99568
k = 0,01896
r= 0,99317
k = 0,01799
r= 0,99459
k = 0,00892
r = 0,99769
k = 0,01418
550°C
500°C
450°C
400°C
375°C
350°C
1-(1-α)^2/3
Tempo (min)


r = 0,99912
k = 0,03040
r = 0,99951
k = 0,03479
r = 0,99905
k = 0,02663
r = 0,99711
k = 0,02440
r = 0,99871
k = 0,01813
r = 0,99839
k = 0,01063
550°C
500°C
450°C
400°C
375°C
350°C
$(1-(1-\alpha)^{1/3})^2$
Tempo (min)



0,25
0,20
0,15
0,10
0,05
0,00
1-(2α/3)-(1-α)^{2/3}
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Tempo (min)
550°C
500°C
450°C
400°C
375°C
350°C
r = 0,97465
k = 0,0065
r = 0,99648
k = 0,00608
r = 0,97142
k = 0,00403
r = 0,97683
k = 0,00589
r = 0,96826
k = 0,00273
r = 0,98936
k = 0,00132


r = 0,98892
k = 0,07628
r = 0,99419
k = 0,06428
r = 0,98824
k = 0,06458
r = 0,99205
k = 0,05162
r = 0,99287
k = 0,03575
r = 0,99962
k = 0,01909
550°C
500°C
450°C
400°C
375°C
350°C
- ln(1-α)
Tempo (min)
0,0
0,5
1,0
1,5
2,0
2,5
3,0
3,5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

ANEXO 4 - INFLUÊNCIA DA PERCENTAGEM DE CARBONO

350°C	17%		20%		30%	
t(min)	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5						
10						
15						
20						
25	88	35,98	109	38,23	124	53,44
30			104	47,75	119	70,33
35	89	49,96				
40			105	59,92		
45	90	57,98			125	85,61
50			106	70,54	121	90,23
55	108	65,58				
60	91	68,27			122	90,89
65						
70			111	77,80	123	93,45
500°C	17%		20%		30%	
t(min)	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5	63	19,25	15	25,21	115	26,87
10	70	35,80	23	42,04	112A	42,97
15					113	56,61
20	71	68,79	17	74,75		
25		75,38	22	85,25	112B	81,43
30	58	84,91			114	88,94
35			14	94,59	116	91,89
40	45	93,40				
45						
50						
55						
60						
65						
70						

ANEXO 5 - INFLUÊNCIA DA PRESSÃO PARCIAL DO CLORO

350°C	pCl2 = 1,0 atm		pCl2 = 0,8 atm		pCl2 =0,6 atm		pCl2 =04 atm	
t(min)	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5								
10								
15	136	27,68						
20								
25	132	51,26	156	17,79	158	17,26		
30								
35	133	61,18	155	37,57	159	21,75	162	14,08
40								
45	134	74,37	154	44,57	160	34,30	165	19,52
50								
55	135	81,13	153	55,26			163	20,46
60			157	59,62	166	38,03		
65			152	64,14			164	25,81
70								
500°C	pCl2 = 1,0 atm		pCl2 = 0,8 atm		pCl2 =0,6 atm		pCl2 =04 atm	
t(min)	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5	Amostra	% V2O5
5								
10	127	42,00	141	40,94	146	34,43	151	18,15
15	129	56,11	140	55,42	145	44,83	150	26,77
20	128	76,14	139	73,23	144	57,62	149	35,74
25								
30	130	91,67	138	84,15	143	79,00	148	60,77
35								
40	131	94,00	137	91,46	142	84,13	147	79,06
45								
50								
55								
60								
65								
70								