

## References

1. Brecher L.E, Spewock S, Warde C.J. The Westinghouse sulfur cycle for the thermochemical decomposition of water. *Int J Hydrogen Energy* 1977; 2:7-15.
2. Lee S-K, Kim C-H, Cho W-C, Kang K-S, Park C-S, Bae K-K. The effect of Pt loading amount on SO<sub>2</sub> oxidation reaction in an SO<sub>2</sub>-depolarized electrolyzer used in the hybrid sulfur (HyS) process. *Int J Hydrogen Energy* 2009; 00:1-7.
3. Scott K, Taama W.M, Cheng H. Towards an electrochemical process for recovering sulphur dioxide. *Chemical Engineering Journal* 1999; 73:101-111.
4. Spotnitz R.M, Colluci J.A, Langer S.H. The activated electro-oxidation of sulphur dioxide on smooth platinum. *Electrochimica Acta* 1983; 28(8): 1053-1062.
5. Seo E.T, Sawyer D.T. Electrochemical oxidation of dissolved sulphur dioxide at platinum and gold electrodes. *J. of Electrochimica Acta* 1965; 10: 239-252.
6. Seo E.T, Sawyer D.T. Determination of sulfur dioxide in solution by anodic voltammetry and by UV Spectrophotometry. *J. of electroanalytical chemistry* 1964; 7(3): 184-189.
7. Staser J, Ramasamy R.P, Sivasubramanian P, Weidner J.W. Effect of water on the electrochemical oxidation of gas-phase SO<sub>2</sub> in a PEM electrolyzer for H<sub>2</sub> production. *Electrochemical and solid-state letters* 2007; 10(11): E17-E19.
8. Staser J, Weidner J.W. Effect of water transport on the production of hydrogen and sulfuric acid in a PEM electrolyzer. *J. of Electrochemical society* 2009; 156(1): B16-B21.
9. Struck B.D, Junginger R, Boltersdorf D, Gehrman J. The anodic oxidation of sulfur dioxide in the sulfuric acid hybrid cycle. *Int J Hydrogen energy* 1980; 5: 487-497.
10. Un U.T, Koparal A.S, Ogutveren U.B. Sulfur dioxide removal from flue gases by electrochemical absorption. *Separation and purification technology* 2007; 53:57-63.
11. Appleby A.J. Electrochemical aspects of the H<sub>2</sub>SO<sub>4</sub> - SO<sub>2</sub> thermoelectrochemical cycle for hydrogen production. *Int. J. Hydrogen Energy* 1980; 5: 253-267.
12. Scott K, Taama W.M. An investigation of anode materials in the anodic oxidation of sulphur dioxide in sulphuric acid solutions. *Electrochimica acta* 1999; 44:3421-3427.
13. Summers W.A, Gorensiek M.B, Buckner M.R. The hybrid sulfur cycle for nuclear hydrogen production; WSRC-MS-2005-00509(097): 2005 October 9-13.

14. Summers W.A, Hybrid sulfur electrolyzer development. Savannah River National Laboratory. NHI Work package N-SR07TC0301. FY07 First Quarter Report; WSRC-STI-2006-00393(097): 2006 October 1- 2006 December 31.
15. Sivasubramanian P, Ramasamy R.P, Freire F.J, Holland C.E, Weidner J.W. Electrochemical hydrogen production from thermochemical cycles using a proton exchange membrane electrolyzer. *Int J Hydrogen Energy* 2007; 32:463-468.
16. Shaw A.C, Ewan B.C.R, Allen R.W.K, Sulphuric acid decomposition reactions in the sulphur iodine and Westinghouse processes for hydrogen generation. WHEC- Lyon France 16; Department of chemical & processes engineering, University of Sheffield, Mappin street, Sheffield S1 3JD, UK: 2006 June 13-16.
17. Robin R, Gruet N. Characterization and optimization of materials for hybrid sulfur cycle electrolyser; CEA Saclay. Laboratory of Non Aqueous corrosion. DEN/DPC/SCCME. Hybrid sulfur electrolyzer workshop: 2009 April 20, 21.
18. Colon-Mercado H.R, Ekechukwu A, Coleman D, Hobbs D.T. Electrolyzer component development for hybrid sulfur process. Savannah River National Laboratory 2006 August 22; SRNL-ESD-2006-00237.
19. Colon-Mercado H.R, Elvington M.C. Hobbs D.T. Catalyst characterization for sulfur dioxide depolarized electrolyzer. Savannah River National Laboratory 2009 April 21; SRNL-STI-2009-00263.
20. O'Brien J.A, Hinkley J.T, Donne S.W, Lindquist S-E. The electrochemical oxidation of aqueous sulfur dioxide: A critical review of work with respect to the hybrid sulfur cycle. *Electrochimica Acta* 2010; 55: 573-591.
21. Colon-Mercado H.R, Hobbs D.T. *Electrochemistry Communications* 9(2007)p2649-2653
22. Samec Z, Weber J. Study of the oxidation of SO<sub>2</sub> dissolved in 0.5M H<sub>2</sub>SO<sub>4</sub> on a gold electrode- I stationary electrode. *J. of Electrochimica Acta* 1975; 20: 403-412.
23. Quijida C, Vazquez J.L. Electrochemical reactivity of aqueous SO<sub>2</sub> on glassy carbon electrodes in acidic media. *J. of Electrochimica Acta* 2005; 50: 5449-5457.
24. Quijida C, Rodes A, Vazquez J.L, Perez J.M, Aldaz A. Electrochemical behavior of aqueous sulphur dioxide at Pt in acidic medium. A voltammetric and in situ Fourier transform IR study. Part I. Oxidation of SO<sub>2</sub> on Pt electrodes with sulphur –oxygen adsorbed species. *J. of Electroanalytical Chemistry* 1995; 394: 217-227.
25. Charton S, Janvier J, Rivalier P, Chaînet, Caire J. Hybrid sulfur cycle for H<sub>2</sub> production: A sensitivity study of the electrolysis step in a filter-press cell. . *Int J of Hydrogen Energy* 2010; 35:1537-1547.

26. Gorensek M.B, Staser J.A, Stanford T.G, Weidner J.W. A thermodynamic analysis of the SO<sub>2</sub>/H<sub>2</sub>SO<sub>4</sub> system in SO<sub>2</sub>-depolarised electrolysis. Int. J. of hydrogen energy 2009; 34: 6089-6095.
27. Gorensek M.B, Summers W.A, Hybrid sulfur flowsheets using PEM electrolysis and a bayonet decomposition reactor. Int. J. of hydrogen energy 2009; 34: 4097-4114.
28. Jomard F, Feraud J.P, Caire J.P, Numerical modeling for preliminary design of hydrogen production electrolyzer in the Westinghouse hybrid cycle. Int J Hydrogen Energy 2008; 33:1142-1152.
29. Chettiar M, Co-Production of hydrogen and sulfuric acid by electrolysis. University of South Florida, College of Engineering; 2004-06-14.
30. Jeong Y.H, Kazimi M.S, Hohnholt K.J, Yildiz B. Optimization of the hybrid sulfur cycle for hydrogen generation. Nuclear energy and sustainability (NES) program May 2005; MIT-NES-TR-004, nuclear Technology 159(2) p147-151.
31. Yong Hoon Jeong. Estimation of the thermal efficiency of hybrid sulfur cycle for hydrogen generation using gas cooled reactor. Korea Advanced Institute of Science and technology. 333 Gwahangno, Yuseong-gu, Daejeon 305-701, Republic of Korea.
32. Lahoda E.J. Estimated costs for the improved HyS flowsheet. Proceedings HTR2006: 3<sup>rd</sup> International Topical Meeting in High Temperature Reactor Technology; 2006-10-1, 6: Johannesburg, South Africa.
33. Lee K.Y, Gong G.T, Song K.H, Kim H, Jung K, Kim C.S. Use of ionic liquids as adsorbents to separate SO<sub>2</sub> in SO<sub>2</sub>/O<sub>2</sub> in thermochemical processes to produce hydrogen. Int J Hydrogen Energy 2008; 33:6031-6036.
34. Lee M.S, Koo I.G, Kim J.H. Lee W.M. Electrochemical hydrogen pumping from high temperature plasma-chemical reactor involving H<sub>2</sub>O/SO<sub>2</sub> gas mixture. Int J Hydrogen Energy 2009; 34: 40-47.
35. Leybros J, Saturnin A, Mansilla C, Gilardi, Carles P. Plant sizing and evaluation of hydrogen production costs from advanced processes coupled to a nuclear heat source: Part II: Hybrid-Sulfur cycle 2010; 35:1019-1028.
36. Graf D, Monnerie N, Roeb M, Schmitz, Sattler C. Economic comparison of solar hydrogen generation by means of thermochemical cycles and electrolysis. Int. J. of hydrogen energy 2008; 33: 4511-4519.
37. Ginosar D.M, Petkovic L.M, Glenn A.W, Burch K.C. Stability of supported platinum sulfuric acid decomposition catalysts for use in thermochemical water splitting cycles. Int. J. of Hydrogen Energy 2007; 32: 482-488.

38. O'Brien J.A, Hinkely J.T, Donne S.W. SO<sub>2</sub> Oxidation mechanism in acidic solutions on noble metal surfaces with applications relevant to the hybrid sulfur cycle. CSIRO Energy Centre, 10 Murray Dwyer Circuit, Steel River Industrial Estate Mayfield West NSW 2304 Australia.
39. Jung Y.H, Shin B. S, Jeong Y.H. Nuclear hydrogen production by the SO<sub>2</sub> Depolarized water electrolysis using PEMFC. Transactions of the Korean Nuclear Society Autumn meeting; Pyeong Chang; Korea: 2008 October 30
40. O'Brien J.A, Hinkely J.T, Donne S.W. A systematic approach to the anodic oxidation of aqueous sulfur dioxide at platinum, gold and glassy carbon electrode: investigation of the electrooxidation mechanism using cyclic voltammetry and EQCM techniques. CSIRO Energy Centre, 10 Murray Dwyer Circuit, Steel River Industrial Estate Mayfield West NSW 2304 Australia.
41. Norman K, Hibbs M.R, Staser J.A, Weidner J.W, Hicker M.A. Novel SO<sub>2</sub> electrolysis membranes for hydrogen production by the hybrid sulfur thermochemical cycle; The Electrochemical Society: 215<sup>th</sup> ECS Meeting, Abstract #397.
42. Quijida C, Rodes A, Morallon E, Vazquez J.L, Berlouis L.E.A. Electrochemical behavior of aqueous sulphur dioxide at gold in acidic medium. A voltammetric and in situ vibrational study. Part II. Oxidation of SO<sub>2</sub> on bare and sulphur-modified electrodes. J. of Electroanalytical Chemistry 1995; 394: 217-227
43. Beuschlein W.L, Simenson L.O, Chemistry department, University of Washington 1940; 62: 610-612.
44. Audry C. and Voinov M. inhibitions of the SO<sub>2</sub> electrochemical oxidation reactions on platinum sulfuric acid solutions. Electrochimica Acta. 1980; 25: 299-301.
45. Dunn J.P, Stenger H.G, Jr., Wachs I.E. Oxidation of SO<sub>2</sub> over supported metal oxide catalysts. Journal of catalysis 1999; 181: 233-243.
46. Darling H.E. Conductivity of sulfuric acid solutions, J. of Chemical and Engineering data 07-1964; 9:3
47. Suzuki C, Nakagiri T, Aoto K. The refinement of the rate rate determining process in sulfur trioxide electrolysis using the electrolysis cell. Int. J Hydrogen energy 2007; 32: 1771-1781.
48. Xue E, Seshan K, Ross J.R.H. Roles of supports , Pt loading and Pt dispersion in the oxidation of NO to NO<sub>2</sub> and SO<sub>2</sub> to SO<sub>3</sub>. Applied catalysis B: Environmental 1996; 11:65-79.

49. Zhang Q, Wang H, Dalla Lana I.G, Chuang K.T. Solubility of sulfur dioxide in sulfuric acid of high concentrations. *Ind. Eng. Chem. Res* 1998; 37: 1167-1172.
50. Steimke J.L. Test plan for characterization testing of the SO<sub>2</sub>-Depolarized electrolyzer cell designs. Task Technical & QA Plan. Testing of electrolyzer for hydrogen production. WSRC-TR-2006-00069; pp1-12: 2006 February 15.
51. Stone S.G, Gestaut L.J. Electrolysis cell comprising sulfur dioxide-depolarized anode and method of using the same in hydrogen generation. Soutborough, MA US. AC25B102FI-205638: 2009 May 29.
52. Koutsopoulos S, Johannessen T, Eriksen K.M, Fehrman R. Titania-supported Pt and Pt-Pd nanoparticle catalysts for the oxidation of sulfur dioxide. *J Catalysis* 2006; 238:206-213.
53. Koutsopoulos S, Rasmussen S.B, Eriksen K.M, Fehrman R. the role of support and promoter on the sulfur dioxide using platinum based catalysts. *Applied catalysis A: General* 2006; 306:142-148.
54. Koutsopoulos S, Eriksen K.M, Rasmussen S.B. Synthesis and characterization of supported Pt and Pt alloys nanoparticles used for the catalytic oxidation of sulfur dioxide. *J catalysis* 2006; 238: 270-276.
55. Quijida C, Vazquez J.L, Aldaz A. Study of sulphur adlayers on polyoriented electrodes: influence on the electrocatalysis of the SO<sub>2</sub> oxidation reaction. *J Electroanalytical chemistry* 1996; 414:229-233.
56. Quijida C, Rodes A, Vazquez J.L, Perez J.M, Aldaz A. Electrochemical behavior of aqueous sulphur dioxide at polycrystalline Pt electrodes in acidic medium. A voltammetric and in-situ FT-IR study Part2. Promoted oxidation of sulphur dioxide. Reduction of dioxide. *J Electroanalytical Chemistry* 1995; 398:105-115.
57. Orme C.J, Klaehn J.R, Stewart F.F. Membrane separation processes for the benefit of the sulfur-iodine and hybrid sulfur thermochemical cycles. *Int. J of hydrogen energy* 2009; 34:4088-4096.
58. Bukun N, Vinokurov A, Vinokurova M, Derlyukova L, Doband rovolsky Yu, Levchenko A. Chemisorption and electrochemical reactions of SO<sub>2</sub> on modified SnO<sub>2</sub>. *Sensors and Actuators B* 2005; 106: 153-157.
59. Brodzinsky R, Chang S.G, Markowitz S.S, Novakov T. J. Kinetics and mechanism for the catalytic oxidation of sulphur dioxide on carbon in aqueous suspensions. *Phys. Chem* 1980; 84: 3354-3358.

60. Card J.C, Foral M.J, and Langer S.H. Electronegative oxidation of dissolved sulfur dioxide with packed –bed anodes. Environmental Science Technology 1998; 22(12):1499-1505.
61. Hayduk W, Asatani H, Lu B.C.Y. Solubility of Sulfur dioxide in Aqueous Sulfuric acid solutions. Journal of Chem. Eng. Data 1988; 33: 506-509.
62. Un U.T, Koparal A.S, O gutveren U.B. Electrochemical desulphurization of water gases in a batch reactor. J. Environmental engineering 2007; 133:1.
63. Py X, Roizard C, Midoux N. Kinetics of sulfur dioxide oxidation in slurries of activated carbon and concentrated sulfuric acid. Chemical Engineering Science 1995; 50(13):2069-2079.
64. CDIAC, Oak Ridge National Laboratory. Fossil-Fuel CO<sub>2</sub> Emissions from South Africa. Printed on the 2010-07-13.
65. Greyvenstein R, Correia M, Kriel W. South Africa's opportunity to maximize the role of nuclear power in a global hydrogen economy. Nuclear Engineering and Design 2008; 238:3031-3040.
66. Schultz K.R, Herring J.S, Lewis M.A. The hydrogen energy. Nuclear Engineering International 2005 july 28.
67. Enviroadmin, Environment South Africa, South Africa's energy crisis. Posted on 2006-09-04.
68. Department of Minerals and Energy, Energy efficiency strategy of Republic of South Africa. March 2005.
69. Borgard J.M, Le Duigou A, Lovera P, Carles P, Moutiers G. A comparative study of Iodine-sulfur and hybrid sulfur cycle. Nuclear Energy Division, Department of physical chemistry, CEA Saclay, 91191 Gif sur Yvette Cedex. France.
70. Balat M, Possible methods for hydrogen production. Energy sources Part A 2009; 31:39-50.
71. Zhong H, Zhang H, Liang Y, Zhang J, Wang M, Wang X. A novel non-noble electrocatalyst for oxygen reduction in proton exchange membrane fuel cells. J. of Power Sources 2007; 164:572-577.
72. Winter C-J, Hydrogen energy- Abundant, efficient, clean: A debate over the energy-system of change. Int. J of Hydrogen energy 2009; 34: S1-S52.
73. Wang H. Hydrogen production from a chemical cycle of H<sub>2</sub>S splitting. Int. J Hydrogen energy 2007; 32:3907-3914.
74. Van Vuuren D. The hydrogen economy: a debate on the merits. SAIChE Seminar. CSIR; 2007 January 25.

75. Schultz K.R, Herring J.S, Lewis M.A. The hydrogen energy. Nuclear Engineering International 2005; July 28.
76. Qing-yu L, Ji-hong D, Zheng-ping X. Preparation of zirconium by electro-oxidization in molten salt. Trans. Nonferrous Metal Soc. China 2007; 17: s560-s564 Northwest Institute for Nonferrous Metal Research, Xi'an 710016, China. 2007 September 10.
77. Prieskorn J.N, Chen H, Chen W, Tornquist W.J. Electrochemical and infrared spectroscopic comparison of Pt, ZrPt<sub>3</sub> and HfPt<sub>3</sub> Catalytic properties: Hydrogen evolution and CO adsorption. J. Phys. Chem. 1992; 96:810-816.
78. Park K, Sung Y. Pt nanostructured electrode encapsulated by a tantalum oxide for thin-film fuel cell. J. Vac. Sci. Technol. B 22(6): Nov 2004. School of Chemical Engineering& Research Center for Energy Conversion and Storage. Seoul National University, Seoul 151-744, South Africa.
79. Nguyen D.T. Corrosion resistance and behavior of construction materials exposed to dilute sulfuric acid at elevated temperatures under static conditions. Tennessee Valley Authority. P.O Box 1010; Muscle Shoals, AL 35660-1010.
80. Janardhanan V.M, Deutschmann O, Reimert R. A detailed approach to model transport, heterogenous chemistry and electrochemistry in solid-oxide fuel cells; University of Karlsruhe(TH) 27 June 2007.
81. McIntyre D.R, Vossen A, Wilde J.R, Burstein G.T, Electrocatalytic properties of a nickel-tantalum-carbon alloy in an acidic electrolyte. Journal of Power of Sources 2002; 108: 1-7.
82. Kodera F, Kuwahara Y, Nakazawa A, Umeda M. Electrochemical corrosion of platinum electrode in concentrated sulfuric acid. Journal of Power Sources 2007; 172:698-703.
83. Kostin V.I, Fasteev N, Bokach D.A, Korobstev S.V, Kozolii A.V, Sal'nikov S.E. Hydrogen and sulfuric acid production by electrolysis with anodic depolarization by sulfurous anhydride. Chemical and Petroleum Engineering 2008; 44:3-4.
84. Guerrero S, Miller J.T, Kropf J, Wolf E.E, Preferential oxidation of CO on Pt – Nb<sub>2</sub>O<sub>5</sub>/Al<sub>2</sub>O<sub>3</sub> catalysts. Study of the Nb promotion effect and kinetics analysis. University of Notre Dame; Chemical Engineering: 2007-11-07
85. De Strycker J, Westbroek P, Temmerman E.T. Development of a platinum rotating disc electrode for dynamic electrochemical measurements in glass melts. J. of Non-Crystalline solids 2001; 289:106-112.

86. Caillard A, Coutanceau C, Brault P, Mathias J, Léger J.M. Structure of Pt/C and PtRu/C catalytic layers prepared by plasma sputtering and electric performance in direct methanol fuel cells (DMFC). *J of Power Sources* 2006; 162: 66-73.
87. Bai Y, Wu J, Xi J, Wang J, Zhu W, Chen L, Qiu X. Electrochemical oxidation of ethanol on Pt-ZrO<sub>2</sub>/C catalyst. *Electrochemistry Communications* 2007; 7: 1087-1090.
88. Auer E, Freund A, Pietsch, T. Tacke. Carbons as supports for industrial precious metal catalysts *Applied Catalysis A: General* 173; 1998: 259-271.
89. Zhang Q, Zhang D, Jia S, Shong W. Microstructure and properties of some dispersion strengthened platinum alloys the influence of Yttrium and Zirconium additions. *Platinum Metal Review* 1995; 39(4): 167-171
90. Ueda A, Yamada Y, Ioroi T, Fujiwara N, Yasuda K, Miyazaki Y, Kobayashi T. Electrochemical oxidation of CO in sulfuric acid solution over Pt and PtRu catalysts modified with TaOx and NbOx, *Catalysis Today* 2003; 84:223-229.
91. Taylor D.F. Acid corrosion resistance of tantalum, columbium, zirconium and titanium. *Industrial and engineering chemistry*. <http://pubs.acs.org>; 1950 May: published 2002 May 1.
92. Szymanski R, Charcosset H. Platinum-Zirconium alloy catalysts supported on carbon or zirconia. *Platinum Metals* 1986; 30(1): 23-27.
93. Srinivas S.T, Rao K.R. Synthesis, characterization and activity studies of carbon supported platinum alloy catalysts. *J. of Catalysis* 1998; 179: 1-17.
94. De-los-Santos Alvarez N, Alden L.R, Rus E, Wang H, DiSalvo F.J, Abruna H.D. CO tolerance of ordered intermetallic phases. *J. of Electrochimica Acta* 2009; 626: 14-22.
95. Acres G.J.K, Bird A.J, Jenkins J.W, King F. The design and preparation of supported catalysts
96. Gasteiger H.A, Markovic N.M, Ross P.N, H<sub>2</sub> and CO electroxidation on well-characterized Pt, Ru and Pt-Ru.1. Rotating Disk electrode studies of the pure gases including temperatures effects. *J. Phys. Chem.* 1995; 99:8290-8301.
97. Guerrero-Perez M.O, Lewandowska A.E, Banares M.A, Niobium as a catalytic promoting agent. *Recent patents on chemical engineering* 2008; 1:201-208.
98. Thamahane T.C, Development of anodic catalyst. Chemistry department; University of western cape, South Africa; SABI 6680:2005.
99. Rodriguez N.M, Chamber A, Baker R.T, Catalytic engineering of carbon nanostructures. *Langmuir* 1995;11:3862

100. Bonakdarpour A, Lobel R, Sheng S, Monchesky T.L, Dahn J.R, Acid stability and oxygen reduction activity of magnetron-sputtered  $\text{Pt}_{1-x}\text{Ta}_x$  ( $0 \leq x \leq 1$ ) films. *J. Electrochem Soc* 2006;153:A2304-13
101. Dicks A.L The role of carbon in fuel cells. *J. Power sources* 2007;156:128-41
102. Morbidelli M, Gavrilidis A, Varma A. Catalyst design: optimal distribution of catalyst in pellets, reactors and membranes. Cambridge series in chemical engineering, Cambridge University press. ISBN 139780521660594:2005.
103. Pletcher D, Industrial electrochemistry. Department of chemistry. University of Southampton, UK, Chapman and Hall Publishing 1982
104. Pletcher D, A first course in electrode processes 2<sup>nd</sup> Edn. Department of chemistry. University of Southampton, UK, RSC publishing 2009.
105. Skoog D.A, Holler F.J, Nieman T.A, Principles of instrumental analysis 5<sup>th</sup> Edn. Brooks/Cole Thomson learning 1997.
106. Scholes R.J, van der Merwe M.R, Greeenhouse gas emissions from South Africa. *South African Journal of Science*; May 1996: Vol 92.
107. Department of Science and technology, National Hydrogen and Fuel cell technologies research development and innovation strategy, 95306,:p5; April 2007.
108. Steimke J.L, Design performance objectives of the single cell test system for  $\text{SO}_2$  depolarised electrolyser development, Report WSRC-STI-2007-00002. Savannah River National Laboratory, Aiken, SC29808, 2007
109. Lu P.W.T, Technological aspects of sulphur dioxide depolarized electrolysis for hydrogen production, *Int J Hydrogen Energy* 8(1983), p773-781.
110. Lu P.W.T and Ammon R.L, *Int. J. Hydrogen energy* 7(7) (1982), p563-575.
111. Appleby A.J and Pichon B, The mechanisms of electrochemical oxidation of sulphur dioxide in sulphuric acid solutions. *J Electroanal Chem* . 95(1979)59-71.
112. Lu P.W.T and Ammon R.L, *J Electrochem Soc* 127(1980), p2610.
113. Vernikovskaya N.V, Zagoruiko A.N, Noskov A.S.  $\text{SO}_2$  oxidation method. Mathematical modeling taking into account dynamic properties of the catalyst. *Chemical engineering science* 1999; 54:4475-4482.
114. Quemere E, Zirconium dioxide gas desulphurisation catalyst, United States Patent 5010052, 23 April 1991, Cormeilles/Paris, France.
115. Thomas D, Colle S, Vanderschuren J, Kinetics of  $\text{SO}_2$  absorption into fairly concentrated sulphuric acid solutions cointaining hydrogen peroxide. *Chemical Engineering and processing* 42(2003) 487-494.

116. Schutten R, Behr F. Process for the preparation of sulphuric acid from sulphur dioxide. United State Patent 4059496, 22 November 1977, Germany,.
117. Wang H, Carter E.A, Metal-Metal bonding in Engel-Brewer Intermetallics. Anomalous charge transfer in ZrPt<sub>3</sub>. *J Am. Chem. Soc* 115(1993); 2357-2365.
118. Zhang J, PEM Fuel-cell electrocatalysts and catalyst, Springer Publishing; May 2008.
119. Blumenthal W.B. The chemical behaviour of zirconium, Van Nostrand Company inc, Princeton, New Jersey, 1958, p13-17.
120. Struck B.D, Junginger R, Neumeister H, Dujka B.A. Three compartment electrolytic cell for anodic oxidation of sulphur dioxide and cathodic production of hydrogen. *Int J Hydrogen Energy* 7(1) (1982):42-9.
121. Liu G, Zhang H, Zhong H, Hu J, Xu D, Shao Z, Novel sintering resistant and corrosion resistant Pt<sub>4</sub>ZrO<sub>2</sub>/C catalyst for high temperature PEMFCs *Electrochimica Acta* 51(2006) 5710-5714.
122. Justin P, Charan P.H.K, Rao G.R. High Performance Pt-Nb<sub>2</sub>O<sub>5</sub>/C electrocatalysts for methanol electrooxidation in acidic media *Applied catalysis B: Environmental* 100(2010)510-515.
123. He Q, Mukerje S, Zeis R, Parres-Escalapez S, Illan-Gomez M.J. Bueno-Lopez A. *Applied Catalysis A: General* (2010) 1-12.
124. Garsany Y, Baturina O.A, Swider-Lyons KE, Impact of sulphur dioxide on the oxygen reduction reaction at Pt/Vulcan carbon electrocatalysts. *J Electrochemical Soc.* 154(7) (2007) B 670-B675.
125. Prabhuram J, Zhao T.S, Wong C.W, Guo J.W, Synthesis and physical electrochemical characterisation of Pt/C nanocatalysts of Polymer electrolyte fuel cells. *J of Power Sources* 134(2004)1-6.
126. Li X, Hsing I. The effect of the deposition method and the support on Pt dispersion on carbon nanotubes. *Electrochimica Acta* 51(2006)5250-5258.
127. Baturina O.A, Garsany Y, Zega T.J, Stroud R.M Oxygen Reduction reaction of Platinum/Tantalum oxide electrocatalysts for PEM Fuel cell electrocatalysts for PEM FUEL cells. Naval Research Laboratory, Swider-Lyons: Washington DC.
128. Sasaki K, Adzic R.R, Development of platinum on niobium oxide nanoparticle electrocatalysts for oxygen reduction. Department of chemistry. Brookhaven. National laboratory, Upton NY 11973.
129. Chen Y, Tang Y, Liu C, Xing W, Lu T. Room temperature preparation of carbon supported Pt-Ru catalysts. *J of Power Sources* 161(2006)470-473.

130. Punyawudho K, SO<sub>2</sub> adsorption on carbon supported Pt electrocatalyst. University of South Carolina. [Konlayuc@hotmail.com](mailto:Konlayuc@hotmail.com)
131. Lee J, Langer S.H, Electrochemical sulphur dioxide oxidation with Platinum-aluminium electrocatalysts. J of Applied electrochemistry 25(1995)353-357.
132. Carmo M, dos Santos A.R, Poco J.G.R, Linardi M. Physical and electrochemical evaluation of carbon black as electrocatalysts support for DMFC applications. J of Power sources 173(2007)860-866.
133. Aranda D.A.G, de Souza M.V.M, Rodrigues A.C.C, Siquerra P.M, Lopes I.S, Passos F.B, Selective CO oxidation on Pt/Nb<sub>2</sub>O<sub>5</sub> catalysts for fuel cell applications.
134. Crabtree S, Ellis P, Catalyst preparation of the 21<sup>st</sup> century –controlled catalysts synthesis to match form to function. Platinum Metal Review 54(3), 2010, 162-165.
135. Govindarao V.M.H, Gopalakrishna K.V. Solubility of Sulfur dioxide at lower partial pressures in dilute sulphuric acid solutions. Ind. Eng. Chem. 32(1993)2111-2117.
136. Gupta R.B Hydrogen fuel: Production, Transport and Storage, ISBN 978142004575, CRC Press Taylor and Francis group.
137. Copper K.R, In situ PEMFC electrochemical surface area and catalyst utilization measurement, Electrochemistry and fuel cell knowledgebase: Advanced products for electrochemical research, printed on 2010-12-02.
138. Wang J, Yin G, Shao Y, Zhang S, Wang Z, Gao, Effect of carbon black support corrosion on the durability of Pt/C catalyst. J. Power sources 171;2007:331-339
139. Zholanov S.I, (edited by A.J Bard and M Dekker) IV Sulfur in encyclopaedia of the electrochemistry of elements volume 9:1975; New York.
140. Thermochemical cycle- Wikipedia, the free encyclopedia;2011/02/07: [http://en.wikipedia.org/wiki/Thermochemical\\_cycle](http://en.wikipedia.org/wiki/Thermochemical_cycle)
141. The transmission electron microscope Nobelprize.org. The official website of the Nobel prize.org/educational/physics/microscopes/tem/index.html 2011/02/07
142. Electrocatalyst-Wikipedia, the free encyclopedia;2011/02/07: <http://en.wikipedia.org/wiki/electrocatalyst>
143. Bezerra C.W.B, Zhang L, Liu H, Lee K, Marques A.L.B, Marques E.P, Wang H, Zhang J, A review of heat-treatment effects on activity and stability of PEM fuel cell catalysts for oxygen reduction reaction. J. Of Power Sources 173(2007)891-908.
144. Antolini E, Salgado J.R.C , da Silva R.M, Gonzalez E.R. Preparation of carbon supported binary Pt-M alloy catalysts (M= first row transition metals) by low/medium temperature methods. Materials Chemistry and Physics 101(2007)395-403

145. Huang H-C, Hsieh T-S, Preparation and characterisation of tantalum pentoxide ( $Ta_2O_5$ ) Nanoparticles and UV-curable  $Ta_2O_5$ -acrylic nanocomposites. *J. Applied polymer science* 117(2010)1252-1259
146. Pozio A, De Francesco M, Cemmi A, Cardellini F, Giorgi. Comparison of high surface Pt/C catalysts by cyclic voltammetry. *J. Power sources* 105(2002)13-19
147. Dercz G, Prusik K, Pajak L. X-ray and SEM studies on zirconia powders. *J Achievements in material and manufacturing engineering* 31(2):(2008)408-414
148. Weast R.C, Astle M.J, *Handbook of chemistry and physics* 62<sup>nd</sup> edition, 1981-1982, CRC press.
149. Jung Y.H, Jeong Y.H. Development of the once-through hybrid sulphur process for nuclear hydrogen production. *Int J. Hydrogen energy* 35(2010) p12255-12267.
150. Kriek R.J, HyS Hydrogen production process development special studies, Section 3: Electrolyser study. TCWS002-0016. 16 January 2010.
151. Lu P.W.T, Garcia E.R and Ammon R.L. Recent developments in the technology of sulphur dioxide depolarised electrolysis; *J. Appl Electrochem*, 11, 347-355, 1981.
152. O'Brien J.A, Donne S.W and Hinkley J.T, Anodic catalyst development for the hybrid sulphur; Abstract #2073, 218<sup>th</sup> ECS Meeting, 2010 The Electrochemical Society.
153. Energy and energy supply, E Volume 6: The World Book Encyclopedia; World Book International 1992, ISBN 0716666952.
154. Ryan Richards surface and nanomolecular catalysis, Taylor & Francis Group (CRC press) 2006; ISBN 157444481(US-HC) or 3131409211 (GTV)