Fuel Cell Automobile Performance Analysis and Power Distribution

E-mail: 9419568@ mail.dyu.edu.tw

ABSTRACT

There are two most important factors that effect the automobile industry hugely: the increase of the price of the gasoline and people 's realization of the environmental protection. Therefore, the development of the fuel cell cars will help to solve the problems of lacking gasoline and serious environmental pollution in the future. Fuel cell is different from traditional engine. It does not need to combustion to release power. It releases power by electrolytic reverse reaction of water. After the reaction, it only produces water, which will not pollute the environment. Furthermore, we can use water to refine hydrogen and oxygen. It is easy to obtain fuel, so the development of the fuel cell cars is crucial for people to live more comfortable in the near future. In this paper, we will briefly introduce each unit of the fuel cell cars and its various controlling systems. Use advance vehicle simulator , input necessary variables are: car model, motor type, battery model, exhausting system, transmission system, car tire, loading capacity, and control function of transmission system into program. It goes through computer calculation to quickly get necessary simulation result. This makes fuel cell designers easier to choose the best test model in the future. It also will shorten the design time. According to a research, it is better for fuel cell cars to have Lithium-Ion Battery than any other battery. When the hybrid ratio increases, the fuel cell cars are more efficient; the cost will increase a well. According to the above mentioned facts, when the price of the battery is lower than 25US$/kW, the hybrid ratio is higher, and the fuel cell cars are more efficient, which means lower cost for building fuel cell cars.

Keywords : fuel cell car, efficiency, cost, simulation calculation

Table of Contents

REFERENCES

[1] J.Larminie and A.Dicks," Fuel Cell System Explained" , J.Wiley ,chapter 1-7, pp. 1-226, 2003.

[2] "   "

[3] Fuel Cell Test and Evaluation Center, http://www.fctec.com/fctec_types_pem.asp, 2003.

[4] http://www.automobilemag.com/auto_shows/naias_2005/0501gmr_sequel/ [5]
http://www.germancarfans.com/news.cfm/newsid/2050304.005/pageview/photo/photo/1/page/1/lang/eng/mercedes/1.html [6]
http://hk.geocities.com/chem4cell/first.htm [7]   "   " pp. 34~60

[8]   "   "

[9] "   "

[10] "   "

[11] D.Z. Megede, " Fuel processors for fuel cell vehicles" , Journal of Power Sources, Vol. 106, pp. 35~41, 2002.

[12] K. Kordesh, V. Hacker, J. Gsellmann, M. Cifrain, G. Faleschini, Alkaline fuel cells applications" , Journal of Power Sources, Vol.86, pp. 162~165, 2000.

[13] M.D. Francesco, E. Arato, " Start-up analysis for automotive PEM fuel cell systems" , Journal of Power Sources, Vol. 108, pp.41~52, 2002.

[14] J.V. Mierlo, P.V. Bossche, G. Maggetto, " Models of energy sources for EV and HEV: fuel cells, batteries, ultracapacitors,flywheels and engine-generators" , Journal of Power Sources, Vol.128, pp. 76~89, 2004. 15] G. Pede, A. lacobazzi, S. Passerini, A. Bobbio, G. Botto, " FC vehicle hybridisation: an affordable solution for anenergy-efficient FC powered drive train" , Journal of Power Sources, Vol. 125, pp. 280~291, 2004.

[16] Y. Gao, M. Ehsani, " Systematic design of fuel cell powered hybrid vehicle drive train" , Society of Automotive Engineers, pp. 1~10, 2001-01-2532.

[17] A.K. Shukla , A.S. Arico, V. Antonucci, " An appraisal of electric automobile power sources" , Renewable and Sustainable Energy Reviews, Vol. 5, pp. 137~155, 2001.

[18] T. Markel, M. Zolot, K.B. Wipke, " Energy Storage System Requirements for Hybrid Fuel Cell Vehicles" , National Renewable Energy Laboratory, June 10-13, 2003.

[19] O. Bitsche, G. Gutmann, " Systems for hybrid cars" , Journal of Power Sources, Vol. 117, pp. 8~15, 2004.

[20] K.S. Jeong, B.S. Oh, " Fuel economy and life-cycle cost analysis of a fuel cell hybrid vehicle" , Journal of Power Sources, Vol.105,pp. 58~65, 2002.

[21]   "   "

[22]   "   "

[23]   "   "

[24]   "   "

[25]   "   "

[26] S. Jeme., D. Hissel, M.C. Pera, J.M. Kauffmann., " On-board fuel cell power supply modeling on the basis of neural network methodology" , Journal of Power Sources, Vol. 124, pp. 479~486, 2003.

[27] S. Yerramalla, A. Davari, A. Feliachi, T. Biswas, " Modeling and simulation of the dynamic behavior of a polymer electrolytr membrane fuel cell" , Journal of Power Sources, Vol. 124, pp. 104~113, 2003.

[28] A. Rowe, X. Li, " Mathematical modeling of proton exchange membrane fuel cells" , Journal of Power Sources, Vol. 102, pp. 82~96, 2001.

[29] K. Haraldsson, K. Wipke, " Evaluating PEM fuel cell system models" , Journal of Power Sources, Vol. 126, pp. 88~97, 2004.

[30] Z. Jiang, L. Gao, M.J. Blackwelder, R.A. Dougal, " Design and experimental tests of control strategies for active hybrid fuel cell/battery power sources" , Journal of Power Sources, Vol. 130, pp. 163~171, 2004.

[31] C.N. Maxoulis, D.N. Tsinoglou, G.C. Koltsakis , " Modeling of automotive fuel cell operation in driving cycles" , Energy Conversion and Management, Vol.45, pp. 559~573, 2004.

[32]   "   "

[33] T. Markel, A. Brooker, T. Hendricks, V. Johnson, K. Kelly,B. Kramer, M.O. Keefe, S. Sprik, K. Wipke, " ADVISOR: a systems analysis tool for advanced vehicle modeling" , Journal of Power Sources, Vol. 110, pp. 255~266, 2002.

[34] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, " ADVISOR Simulation Tool for Vehicle Evaluation and Testing" , pp. 1~2, January 2004.

[35] M. Ogburn, A. Boligitz, W. Luttrell, B. King, S. Postle, R. Fahrenkrog and D.J. Nelson, " Integration of Fuel Cell Technology into a Hybrid Electric Vehicle" , Society of Automotive Engineers, pp. 1~17, 2000-01-0592.

[36] A. Brooker, K. Haraldsson, T. Hendricks, V. Johnson, K. Kelly, B. Kramer, T. Markel, S. Sprik, K. Wipke, " ADVISOR Documentation" , National Renewable Energy Laboratory, April 30, 2002.

[37] T.E. Lipman, J.L. Edwards, D.M Kammen, " Fuel cell system economics: Comparing the costs of generating power with stationary and motor vehicle PEM fuel cell systems" , Energy Policy 32, pp. 101~125, 2004.

[38] R.A. Sutula, " Highlights Report for the Vehicle High-Power Energy Storage Program" , U. S. Department of Energy Office Advanced

Automotive Technologies, DC 20585-0121, pp. 1~8, 2000.

[39] Fuel Cell Report to Congress(ESECS EE-1973), U. S. Department of Energy, pp. 13~14, 2003.

[40] E.J. Carlson, " Cost Analyses of Fuel Cell Stacks/Systems", Argonne National Laboratory, DE-FC02-99EE50587, pp. 1~22, 2003.