IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

Experimental Analysis and Simulation of Hybrid Electric Vehicle Using Lithium-ion Battery and Supercapacitors

Prof. Ravikant K. Nanwatkar[1], Mr. Pratik S. Bansode[2], Mr. Prajval R. Bhadakwad[2], Mr. Shubham S. Pingale[4], Mr. Varun V. Ovhal[5]
Assistant Professor, Mechanical Engineering, NBNSSOE, Pune, India[1]
UG Student, Mechanical Engineering, NBNSSOE, Pune, India[2,3,4,5]

Abstract: *Due to increasing environmental concerns, Hybrid vehicles are getting attention all over the globe. As our dependency on fossil fuels kept on increasing the supply of fuels keeps depleting and prices keep increasing. The need for alternative fuels is evident now more than ever. Nearly 25% to 30% of total greenhouse gases emitted are due to transportation industry. Harmful gases like CO2, NO2, NO and CO cause environmental damage and adverse effects on human health. To minimize these emissions hybrid vehicles were introduced. Hybrid vehicles can be powered by multiple setups like ICE and Battery combination, CNG and Battery combination etc. One such combination which could potentially be a game changer in this industry is combination of Lithium-ion Battery and Supercapacitor. The Main concern with electric vehicle in its limited range. This can be potentially solved by the use of supercapacitor. The function of supercapacitor in this setup will be to provide the motor of the vehicle with the required power where the battery fails to provide adequate power. The different types of batteries which can be used in this setup are Lead acid battery, Nickel bromide And Lithium-ion. From these Lithium-ion battery are used because of their higher density rechargeable properties and higher efficiency. Lithium-ion battery use inter calculated lithium compound as the material at positive electrode and graphite at negative electrode. The present work is focused on the analysis of Lithium-ion battery and Supercapacitor used in hybrid combination with DC motor in hybrid electric vehicle using simulation and scale model to compare and check different parameters like state of charge of battery, current, voltage, average speed of voltage etc.*

Keywords: Hybrid vehicle, Types of Batteries, Supercapacitor, Lithium-ion Battery, Average speed, State of charge, Simulation, etc.

REFERENCES

[1] Ravikant K. Nanwatkar, Dr. Deepak S. Watvisave, “Analysis and Simulation of Hybrid Energy Storage System for Electric Vehicle” in July 2021| IJIRT | Volume 8 Issue 2 | ISSN: 2349-6002.
[2] R. J. Huang et al., "High secondary aerosol contribution to particulate pollution during haze events in China," Nature, vol. 514, no. 7521, p. 218, 2014.
[3] F. W. Geels, "Disruption and low-carbon system transformation: Progress and new challenges in Socio-technical transitions research and the Multi-Level Perspective," Energy Research & Social Science,vol 34, pp. 224-231, 2017.
[4] C. Capasso and O. Veneri, "Experimental analysis on the performance of lithium-based batteries for road full electric and hybrid vehicles," Applied Energy, vol. 136, pp. 921-930, 2014.
[5] B. Dunn and J. M. Tarascon, "Electrical energy storage for the grid: a battery of choices," Science, vol. 334, no. 6058, pp. 928-35, 2011.
[6] L. Ahmadi, S. B. Young, M. Fowler, R. A. Fraser, and M. A. Achachlouei, "A cascaded life cycle: reuse of electric vehicle lithium-ion battery packs in energy storage systems," International Journal of Life Cycle Assessment, vol. 22, no. 1, pp. 1-14, 2015.
[7] K. Richa, C. W. Babbitt, and G. Gaustad, "Eco-Efficiency Analysis of a Lithium-Ion Battery Waste Hierarchy Inspired by Circular Economy," Journal of Industrial Ecology, no. 3, pp 715-730, 2017.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

[8] R. Gogoana, M. B. Pinson, M. Z. Bazant, and S. E. Sarma, "Internal resistance matching for parallel-connected lithium-ion cells and impacts on battery pack cycle life," Journal of Power Sources, vol. 252, pp. 8-13, 2014.
[9] J. Liu, G. Li, and H. K. Fathy, "A Computationally Efficient Approach for Optimizing Lithium-Ion Battery Charging," Journal of Dynamic Systems Measurement & Control, vol. 138, no. 2, 2015.
[10] N. Liu et al., "A pomegranate-inspired nanoscale design for large-volume-change lithium battery anodes," Nature Nanotechnology, vol. 9, no. 3, p. 187, 2014.
[11] Y. Zheng et al., "Cell state-of-charge inconsistency estimation for LiFePO4 battery pack in hybrid EVs using mean- difference model," Applied Energy, vol. 111, no. 11, pp. 571-580, 2013.
[12] F. Sun and R. Xiong, "A novel dual-scale cell state-of-charge estimation approach for series-connected battery pack used in EVs," Journal of Power Sources, vol. 274, pp. 582-594, 2015.
[13] L. C. Casals, B. A. García, F. Aguesse, and A. Iturrondobeitia, "Second life of electric vehicle batteries: relation between materials degradation and environmental impact," International Journal of Life Cycle Assessment, vol. 12, no. 4, pp. 1-12, 2015.
[14] H. Ambrose, D. Gershenson, A. Gershenson, and D. Kammen, "Driving rural energy access: a second-life application for electric-vehicle batteries," Environmental Research Letters, vol. 9, no. 9, p. 094004, 2014.
[15] C. Koch-Ciobotaru, A. Saez-De-Ibarra, E. Martinez-Laserna, D. I. Stroe, M. Swierczynski, and P. Rodriguez, "Second life battery energy storage system for enhancing renewable energy grid integration," in Energy Conversion Congress and xposition, 2015, pp. 78-84.
[16] E. Martinez-Laserna et al., "Evaluation of lithium-ion battery second life performance and degradation," in Energy Conversion Congress and Exposition, 2017.
[17] L. C. Casals, B. A. García, F. Aguesse, and A. Iturrondobeitia, "Second life of electric vehicle batteries: relation between materials degradation and environmental impact," International Journal of Life Cycle Assessment, vol. 12, no. 4, pp. 1-12, 2015.