IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 1, June 2023

Electric and Hybrid Vehicle Battery Technologies: Advancements and Challenges

Jerry A. Madrid

Faculty, College of Technology,

Surigao del Norte State University, Surigao City, Philippines

Abstract: *This study investigates the ever-evolving realm of electric and hybrid vehicle battery technologies, encompassing their advancements, challenges, and profound implications. Lithium-ion batteries, renowned for their heightened energy density and extended life cycles, serve as the cornerstone of electric and hybrid vehicles. Ongoing research endeavors drive innovations such as silicon anodes and solid-state electrolytes, offering the promise of improved efficiency and performance. Nonetheless, substantial hurdles emerge, including the scarcity and price volatility of critical materials like cobalt and nickel, which have the potential to obstruct the scalability of electric vehicles. Environmental concerns associated with battery production and disposal necessitate sustainable solutions, while energy density limitations persist, impacting driving range and charging times and urging the pursuit of breakthroughs. These technologies are reshaping the automotive sector, driven by global emissions regulations and incentives that accelerate the transition toward cleaner transportation. Electric and hybrid vehicles hold the potential to significantly curtail greenhouse gas emissions and combat air pollution, aligning seamlessly with worldwide sustainability objectives. Addressing these challenges is pivotal to fully realizing the potential of electric and hybrid vehicle battery technologies, paving the way for a cleaner and more ecologically mindful era of transportation.*

Keywords: electric vehicles, hybrid vehicles, battery technologies, lithium-ion batteries

REFERENCES

[1]. Sperling, D. (2018). Electric vehicles: Approaching the tipping point. *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*, 21-54.

[2]. Paba, S. (2022). The Chinese automotive industry at a turning point. An Overview. *DEMB WORKING PAPER SERIES*.

[3]. Dijk, M., Orsato, R. J., & Kemp, R. (2013). The emergence of an electric mobility trajectory. *Energy policy*, *52*, 135-145.

[4]. Schürmann, J. (1996). *Pattern classification: a unified view of statistical and neural approaches* (Vol. 199, No. 6). New York: Wiley.

[5]. Koubaa, A. (2023). GPT-4 vs. GPT-3.5: A concise showdown.

[6]. Cohen, A. J., Mori-Sánchez, P., & Yang, W. (2008). Insights into current limitations of density functional theory. *Science*, *321*(5890), 792-794.

[7]. Deng, D. (2015). Li-ion batteries: basics, progress, and challenges. *Energy Science & Engineering*, *3*(5), 385-418.

[8]. Sayed, E., Yang, Y., Bilgin, B., Bakr, M. H., & Emadi, A. (2019). A comprehensive review of flux barriers in interior permanent magnet synchronous machines. *IEEE Access*, *7*, 149168-149181.

[9]. Zapata, C., & Nieuwenhuis, P. (2010). Exploring innovation in the automotive industry: new technologies for cleaner cars. *Journal of cleaner production*, *18*(1), 14-20.

[10]. Brown, S., Pyke, D., & Steenhof, P. (2010). Electric vehicles: The role and importance of standards in an emerging market. *Energy Policy*, *38*(7), 3797-3806.

[11]. Koohi-Fayegh, S., & Rosen, M. A. (2020). A review of energy storage types, applications and recent developments. *Journal of Energy Storage*, *27*, 101047.

[12]. Zhou, Q., Ma, J., Dong, S., Li, X., & Cui, G. (2019). Intermolecular chemistry in solid polymer electrolytes for high-energy-density lithium batteries. *Advanced Materials*, *31*(50), 1902029.

[13]. Liu, Z., Quek, A., Hoekman, S. K., & Balasubramanian, R. (2013). Production of solid biochar fuel from waste biomass by hydrothermal carbonization. *Fuel*, *103*, 943-949.

[14]. Yang, X., Adair, K. R., Gao, X., & Sun, X. (2021). Recent advances and perspectives on thin electrolytes for high-energy-density solid-state lithium batteries. *Energy & environmental science*, *14*(2), 643-671.

[15]. Fernández, R. A., & Pérez-Dávila, O. (2022). Fuel cell hybrid vehicles and their role in the decarbonisation of road transport. *Journal of Cleaner Production*, *342*, 130902.

[16]. Wajima, T., Matsumoto, M., & Sekino, S. (2017). Latest system technologies for railway electric cars. *Hitachi Review*, *54*, 161.

[17]. Lin, Z. (2014). Optimizing and diversifying electric vehicle driving range for US drivers. *Transportation Science*, *48*(4), 635-650.

[18]. Wager, G., Whale, J., & Braunl, T. (2016). Driving electric vehicles at highway speeds: The effect of higher driving speeds on energy consumption and driving range for electric vehicles in Australia. *Renewable and sustainable energy reviews*, *63*, 158-165.

[19]. Neubauer, J., & Wood, E. (2014). The impact of range anxiety and home, workplace, and public charging infrastructure on simulated battery electric vehicle lifetime utility. *Journal of power sources*, *257*, 12-20.