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Recent advances in lithium–ion battery utilization: A mini review

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ABSTRACT

Lithium-ion (Li-ion) batteries have become popular recently by performing better than conventional batteries. With the advancements in battery technologies, the amount of energy stored by li-ion batteries increases, and important developments occur in control systems. In this article, temperature approaches to the design of advanced electrolyte solutions for Li-ion batteries, electrochemical and electrode effects are examined.

Keywords: *Lithium-ion Battery; Temperature; Cathode; Anode and Separator*

INTRODUCTION

As it is obvious today energy and energy storage play more important role than any time in our history. Fig.2 shows the global market values of the lithium-ion battery annually with the statistics from 1992 to 2020. To achieve the support of expansion in energy and power density, it is indispensable to imagine our future challenges for energy furthermore; energy storage by the use of new materials of chemistry. The general scheme of the battery has shown in the fig.1. We should find paths for synthesizing new Nano-materials with up-to-date and latest properties, that can be used as electrodes or electrolytes in LIB's [1].

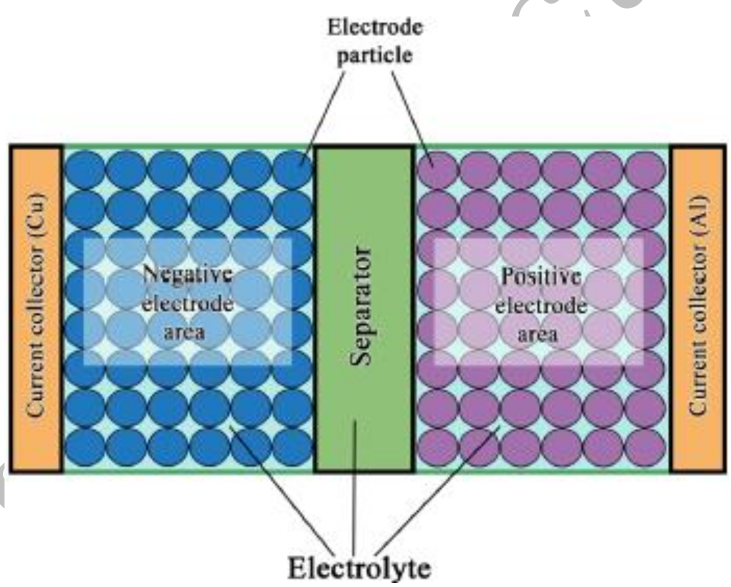

Fig.1. Illustrative sketch of LIB [2].

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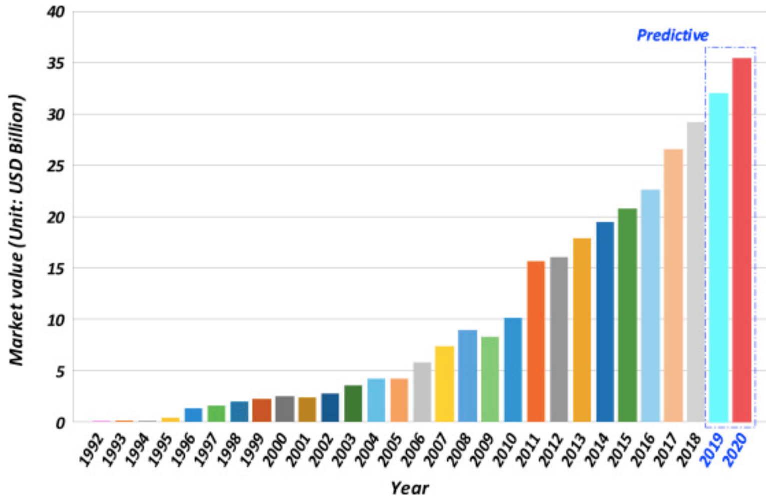

Fig.2. World market of LIB's from 1992 to 2020 [3–5].

With the advancement of technology, interest in lithium-ion batteries is increasing. As the various articles revealed, the total consumption amount of energy increased drastically in a couple of years[6]. Also, energy usage in the countries with higher GDP is more than in other countries [7]. Besides, results confirm the presence of a positive relationship between energy consumption and GDP per capita in both developed and underdeveloped countries [8]. The neutrality hypothesis reveals there is no causality between the consumption of energy and economic growth. The feedback hypothesis claims the presence of mutual interdependence of economic growth and energy consumption [9]. As word oil forecast from 2008 to 2030 demonstrates, fossil fuels production will be decrease promptly, which means countries will not have the chance to use that kind of fuel forever [10]. With regards to robust empirical findings, we can conclude that due to massive consumption of fossil fuels, the rapid degradation of the region's environment moreover, carbon emission has happened all around the world. Indeed, a majority of environmental challenges in so many regions are exacerbated by the consumption of fossil fuels. It means that burning fossil fuels and carbon emission has parallel and direct relation [11].To surpass and diminish all the problems of fossil fuels and environmental problems one approach can be utilizing the renewable sources and energies like solar power, biofuel, etc. But the main problem in all these types of sources is their non-uniform energy output [12]. The most emphasize point due to the mentioned problems is to make a balance between the energy output and energy storage. The spirit item in the modern chain of energy supply is energy storage as the main factor to boost the grid stability and grow the penetration of renewable energy resources, affect the energy productivity of the systems above all, deplete the environmental impact of energy generation [13]. Though, to balance among the energy output and also the energy storage by employing the battery to reservoir energy. The battery utilizes a chemical reaction to convert the stored chemical energy into electrical energy and produce a voltage between two terminals. Batteries are used frequently in so different and various industrial and domestic fields. There are several types of batteries also Lithium batteries with diverse battery technologies are used in off-grid, on-grid, hybrid and energy storages of the vehicles fields [14]. Lithium batteries component is lithium metal as an anode. The privilege of these batteries such as, safety, abundance and low cost of cathode material make them favorable for the future too. Lithium oxides and salts can be recycled which is the promising point of these batteries [15]. Li-ion batteries can be designed for different ranges of power and energy due to cell sizes, thicknesses of the electrode, also relative quantities of material can be used [16]. Lithium battery manufacturers can produce small portable also large industrial batteries as power sources by addressing a very large market from portable phones to EVs [17]. Lithium batteries has so many advantages despite that, factors such as safety concerns, thermal runaway, short-circuiting, toxic gas emissions, overcharging, high cost reflect pettifogging and performance issues in those batteries [18]. One of the most important factors in LIB's is safety. However, if they operated improperly, the chemical energy can be briskly rescued in the form of fire or explosions [19,20]. The other main concerns are the generated heat within the cell, which may be due the onset of thermal runaway [21–23]. Methods to ensure battery safety involve external or internal protection mechanisms External protection depends on external electronic devices like temperature sensors and pressure valves that increase the dead weight/volume of the battery. Internal protection relies on to focusing the inherent materials as battery elements and is considered being the summit solution for battery safety [24]. In recent times, the aging and deterioration of LIB cells and their reaction due to thermal effects and analyzing the effect of temperature has been studied and investigated in so many researches [25–35]. As the life cycle of LIB, thermal management is one of the key factors. Besides optimum operating temperature of Lithium-ion battery pack is about 25–40 °C [36]. Reports illustrate that Li-ion cell performance, due to capacity fade, is sensitive to the operating temperature [30,37]. Likewise, cell action is commonly defined with a technique as Electrochemical Impedance Spectroscopy (EIS) [34,38]. As mentioned above temperature plays a vital role in LIB's, also the increased temperature around LIB's has resulted from the heat generation phenomena of Lithium-ion cells that happened while charging and discharge cycles [39]. However, this study differs from existing papers in that it comprehensively analyzes the effects on the efficiency of LIBs and their use in various fields.

2. Effect of temperature

As Fig.3 reveals Lithium-ion batteries do not the look like the other type of batteries. In the other kinds, the temperature is so effective factor in their efficiency, e.g. the efficiency of the batteries has fluctuated due to the weather temperature. Although in LIB's the efficiency does not change and rises up and down regards the outside factors.

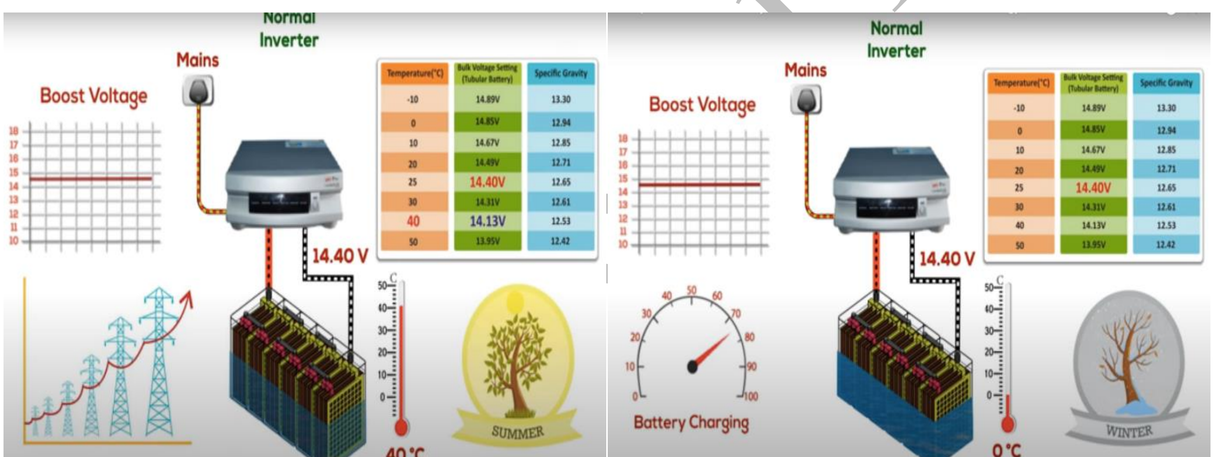

Fig.3. As the figure shows, LIB's efficiency remains constant as a result of seasonal changes [40].

Researches demonstrate that power and capacity can diminish significantly while cells operated or are stored at temperatures above 50 °C and high States Of Charge (SOCs) [30]. One of the studies reports that high temperatures hasten capacity decay, although temperatures, especially during charging, are also destructive, as they conduct the lithium plating and dendrite growth [25].

Fig. 4. Shows various Cobalt oxides composites and inorganic materials are concerned on assorted industries. The major raw material as an anode for preparation of LIBs is Co_3O_4. Due to the researches which, illustrates Co_3O_4 with obverse spinal constructions supposed to be used widely in new types of LIBs why has a great performance of high redox capacitance, physical effects and giant chemical freshness [41].

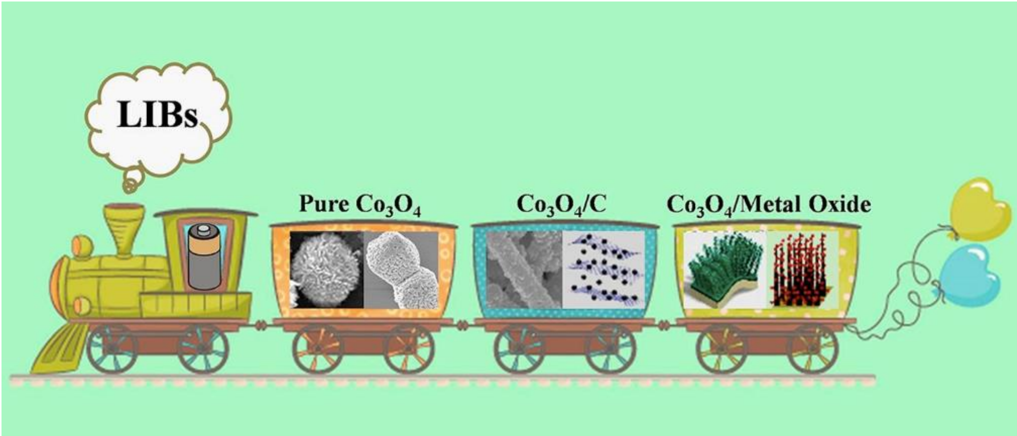

Fig.4. Lithium ion batteries anode materials [41].

Fig. 5, all the reversible and irreversible due to heat generation processes have been illustrated. Due to the figure, reversible process and entropy change on the electrochemical reactions. Moreover, it shows the irreversible process and active polarization process on charge transfer resistance, ohmic heating process on transport resistance in phases, heating due to mixing on inhomogeneous ion distribution, and finally enthalpy change on the diffusion of Lithium ions has been shown [42].

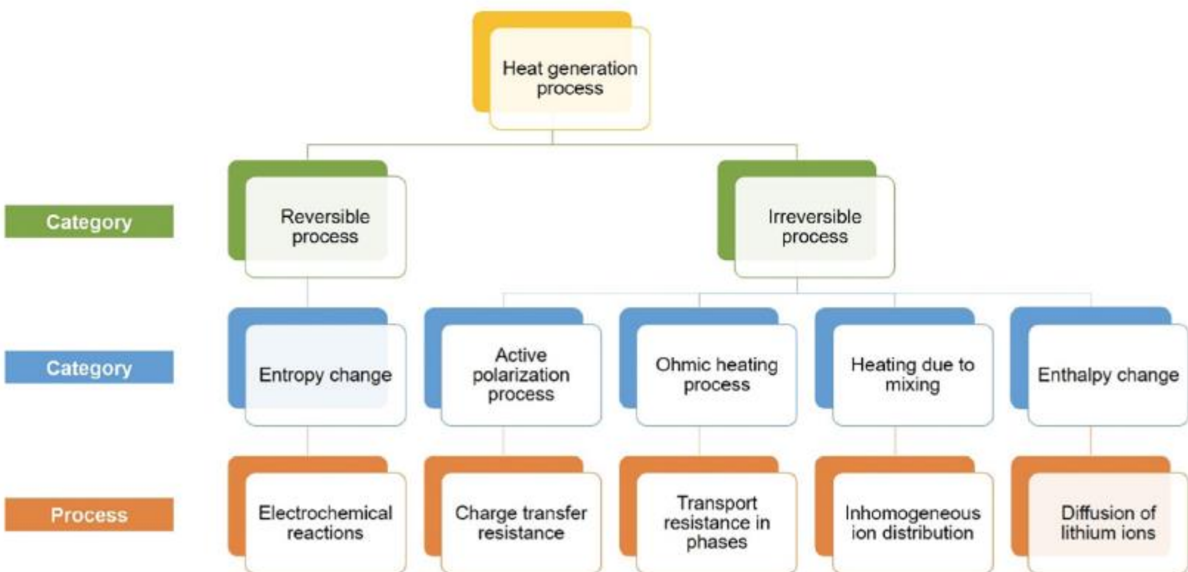

Fig.5. Heat generation reversible and irreversible processes in LIBs [42].

Fig.6 shows the different looming monitoring the internal temperature of LIBs regards the sealed nature reactions during operation. The approaches are classified in two brackets that include contact measurement and contactless measurement [42].

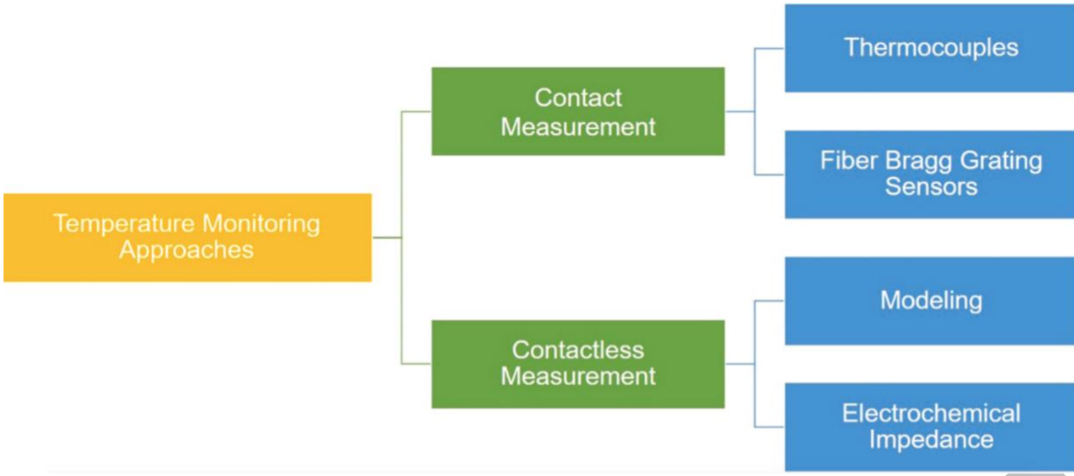

Fig.6. Systematization of temperature monitoring approaches [42].

2.1. Effect of temperature on Lithium ion batteries

Fig.7 illustrates the effects of various temperature range and their effects on the negative electrode. Besides the effect of electrolyte decomposition has been depicted by details in the mentioned figure [43].

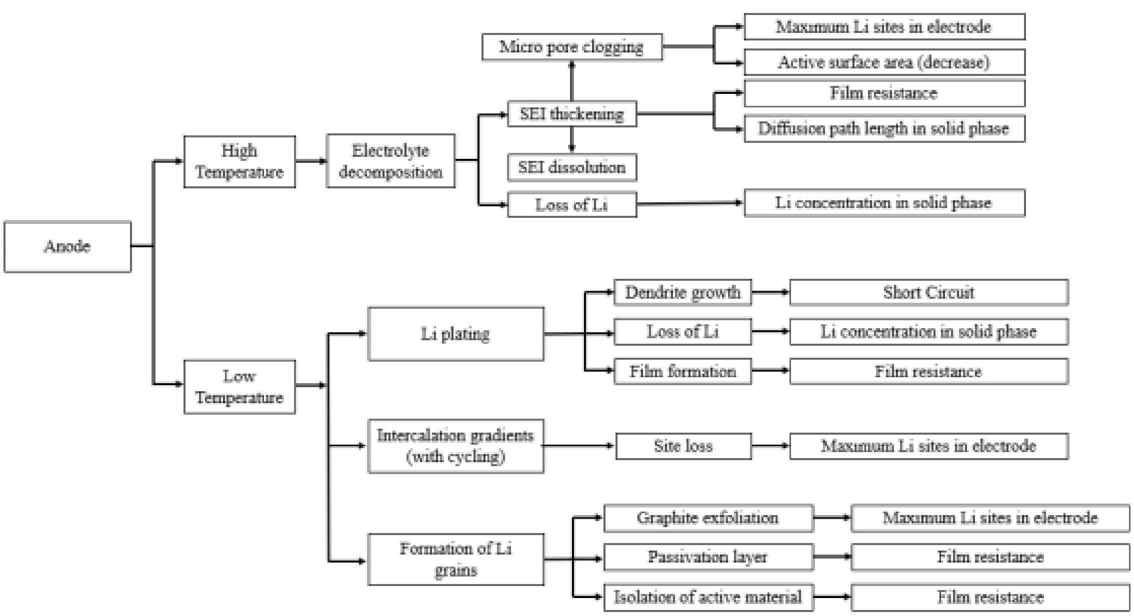

Fig.7. Negative electrode and temperature effect [43].

Fig.8 shows the results and consequences of high temperature on the cathode. Also, the depletion of viscosity by boosting the coating temperature enhances the productivity of the cathode [44].

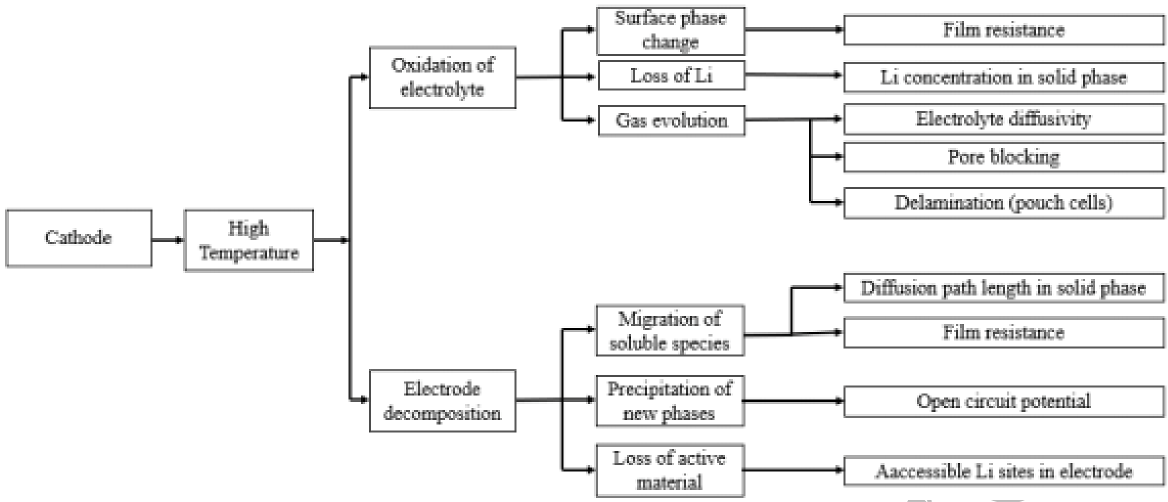

Fig.8. Positive electrode and temperature effect [43].

Simply can be easily understood that thermal effect on Lithium ion batteries plays a vital role in the battery performance besides the battery safety. Though; to clarify the temperature effect on the batteries, one can note the thermal effects, which leads to the chemical reactions that happened in the batteries. Due to the chemical reactions, the connection among the changing rate of them and response of temperature that obey the Arrhenius equation [45]. In table 1 the thermal effects on the lithium ion batteries have been listed and depicted.

Table 1. The most effective factors as thermal effects on the LIB's.

Electrolyte decomposition [46].
Short circuit [46].
Electrolyte burning [46].
Separator melting [46].

2.1.1 Effect on electrolyte

The electrolyte as part of polymer science is an interdisciplinary field that encircles the polymer and chemistry as electrochemistry, organic chemistry, inorganic chemistry [47]. Also, the science of polymer electrolytes was emerged [48]. The lithium-ion batteries that recruit a solid-state electrolyte, due to the amount of flammability factor commonly are safer than the other types of electrolytes that utilize the liquid organic electrolytes. To improve the quality of all-solid-state lithium-ion batteries should have the qualifications such as giant conductivity of lithium ion batteries, good level of stability towards the chemical reaction with lithium in the anode part finally the good electrochemical capacity to use the high- voltage cathode materials [49]. As a general, there is the belief that states solid oxides electrolytes have more advantages regards to their chemical stability and handling in comparison with the inorganic materials. Otherwise, the lithium-ion conductivity of the solid oxide electrolytes is less than the liquid organic electrolytes and solid sulfide electrolytes [50–53].

2.1.2 Thermal runaway

Nowadays by the rapid growth of population and as a sequence, huge needs for electric gadgets and equipment lithium-ion batteries and their role in the technology has been emphasized [19,54,55]. Nevertheless, safety in batteries still is the chief problem and concern for scientists. The major calamitous failure of the LIB's is their thermal runaway or simply TR, which should be avoided to be happened. Thermal runaway could happen as a result of overcharging, short circuits of the interior cell, or in some cases the collision of the gadget. Moreover, during the thermal runaway chain reactions of sourcing the heat generation might be occurred [56–58]. Besides the exact source of the happening the thermal runaway mechanism of lithium-ion batteries need more comprehensive researches and investigations [59] as in some cases there is clear field failures thermal runaway also in others there are not clear causes [60].

2.2. Cathode, anode and separator

As it is clear all kind of batteries involve the cathode, anode and electrolyte. The cathode is generally an oxide that embedded Lithium with very little chemical potential confirms a large open-cell voltage for the battery. Also Lithium intercalation causes remarkable electron move to the Oxygen ions in the structure [61]. Most research for cathode materials has concentrated on transition-metal oxides; the reason of this tendency is transition-metal oxide delivers a better cell voltage than most sulfides [61]. While the battery, which includes the Lithium-ion, has been charged Li^+ ions are removed from the frame and moved through the electrolyte to the anode. Transfer electrons of the Li ions tends to de-stabilize the shape with regards to the increasing repulsion between the bare oxygen layers that face each other [61].

There are various effective items for designing and settling the materials and development. The most functional factors could be arranged by different scaling. The first one is energy density and it is the amount of energy that can be stored or kept in a special mass of a substance or system [62]. Also Density here determines the energy density with the articles reversible capacity or their operating voltage. In the second and third factors, electronic and ionic movability are the key factor [63]. The second factor is rate capability that relies on the fraction of maximum to minimum charge or discharge rate of a battery [64]. The third element is cycling life performance. It is the round of the full recharges numbers depending on time and charge or discharge cycles. Now day's batteries after reaching the maximum life cycle start to deteriorate faster and also their capacity to be recharged fully decreases [65]. The last two features are safety and cost. As it is clear the mentioned items should be assumed in the maximum level to reach the superior design [63].

2.2.1. Cathode

The three key components in batteries are cathode, anode and electrolyte. In today's trading LIB's, both anode and cathode materials are embedded materials. As we know from basic chemistry rules, the metal oxides in cathodes include of fixed host with specific sites for Lithium ions. Electrons tend to move from cathode to anode by the external current collectors, which are named as electric circuit. In Lithium-ion batteries the chemical potential of Lithium is higher in the anode due to the cathode, though electric energy is stored in the form of (electro) chemical energy [63]. The separators must separate the cathode and anode areas. The separator is a micro-porous membrane, which lets the electrolyte enter or prevent the shorting circuit of electrodes [63]. The cathode material is usually the most expensive one with highest weight in the battery, which justifies the intense research focus on this electrode. Even in figure 9, the battery market share of lithium-ion batteries shows the percentage of each cathode, anode, separator and electrolyte quantity from 2018 to 2024 years.

Lithium-ion Battery Market by Material has been divided into below groups [66]:

- LCO (Lithium Cobalt Oxide)
- NMC (Lithium Nickel Manganese Cobalt Oxide)
- NCA (Lithium Nickel Cobalt Aluminum Oxide)
- LMO (Lithium Manganese Oxide)
- LPF (Lithium Iron Phosphate)

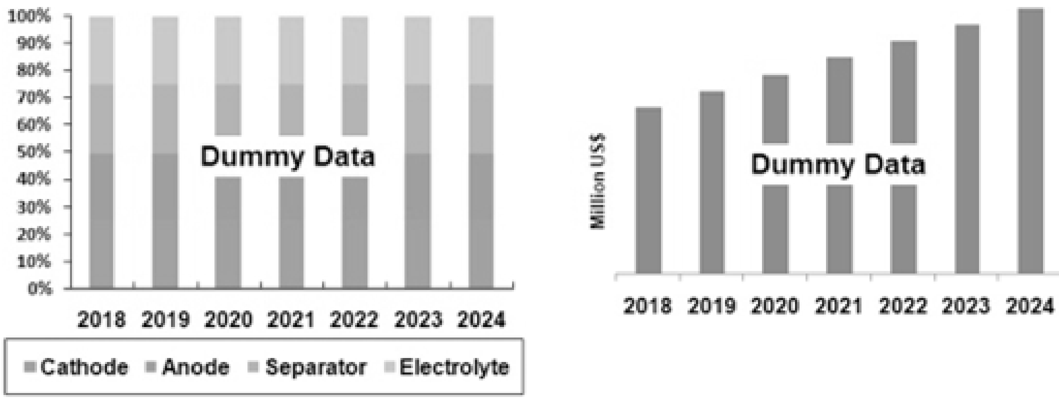

Fig.9. Global forecast for Lithium-ion battery market 2018-2024, Left graph shows the market share (percent) by materials, the right one reveals the market share by electrolyte [66].

2.2.2. Anode

According to statistics for more than three decades Lithium batteries are used as energy storage technology also major power source in electronic appliance especially in different portable electronic devices [67,68]. The technology of the batteries is growing to be significant to the demands of large-scale devices that utilize the batteries. Though most important factors to meet their requirements like energy density and power performance are the research topics of the researchers. The market LIB's due to their energy amount and power density, as anode type arranged to graphite type and remain batteries, according to cathode type can be ordered in lithium-phosphate- based and lithium-metal-oxide type [69]. In Fig.10, potential alternative elements with reliable safety and steadiness cycling to traditional carbon-based anodes with tiny structure change have been revealed [70–72]. The development of high-capacity materials for LIB's principally for cathode and anode materials provide a great moment for the execution of modern and newest batteries [73]. In general for anode materials, three types of reaction mechanisms outlined [74]. A graphitic carbon is the mainstay as successful intercalation-type material for the anode in today's lithium-ion technology has commercialized [67,68]. Although the weaknesses of the graphite materials is their poor electrical conductivity of them even though their large irreversible capacity [75]. Over and above to classify the anode materials based on the intercalation reaction mechanism Ti-based oxides such TiO_2 and $Li_4Ti_5O_{12}$ [76–78]. Moreover, in the figure 10, the phase diagram of Titanium base batteries has been drawn.

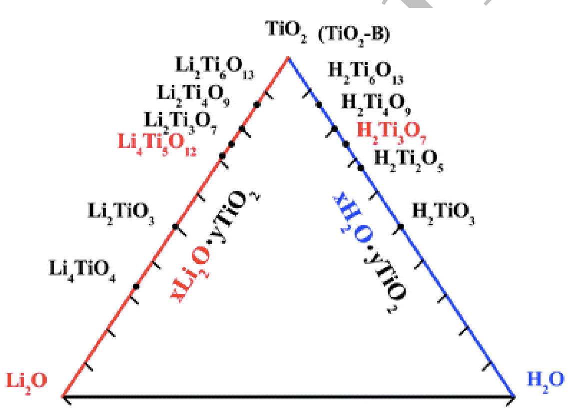

Fig.10. The phase diagram of Ti-based [78].

2.2.3. Solid-Electrolyte Interphase (SEI)

Broadly the solid-electrolyte interphase or simply SEI is substantially for the existent operation of Lithium ion batteries, as principle and minor power sources [79]. Also, Peled in 1979 confirmed that the SEI model was reasonable for all alkali metals and; alkaline piles of earth in non-aqueous-battery systems [79]. Then the layer that formed directly, alongside contact of the metal with the solution, contains unsolvable and partly solvable cutting products of electrolyte components. The depth and diameter of the newly shaped layer are regulated and controlled by the electron-tunneling span. The layer functions as the interphase among the solution and the metal additionally, the layer has the possessions of a solid electrolyte with high electronic resistance [79]. Even the solid-electrolyte interphase is the key element that dictates the morphology, power capability and the most emphasized the safety of the lithium deposits and the cycle life of the batteries[80,81]. The SEI should be flexible and mechanically stable. Therefore, the cation transportation number must be close to unity. For this reason, the concentration polarization should be eliminated and the metallic anode dissolution/deposition process operated easily. Besides, to generate a protective SEI on the alkali-metal anodes, the vital point is the volume of the SEI materials should be larger than the amount of the anode, otherwise the SEI will not cover the surface and layer of the anode completely, and results he corrosion on top of the anode [82]. The most emphasized factors for the SEI are such as: high electrical resistance of solid-electrolyte interphase or simply RSEI, the thickness close to a few nanometers, selectivity and permeability, giant amount of strength, toleration to the enlargement and growth of contraction stresses, amount of unsolvable character in the electrolyte, further the stability over a wide range of functioning temperatures and potentials [83].

3. Methods of managing the thermal's system

Lithium-ion batteries or simply LIB are used increasingly as the principle of the electronic devices especially in vehicle markets and electronic vehicles (EV). Moreover, the performance of the mentioned batteries directly depends on the operating temperature and working voltage as shown in Fig.11 [84].

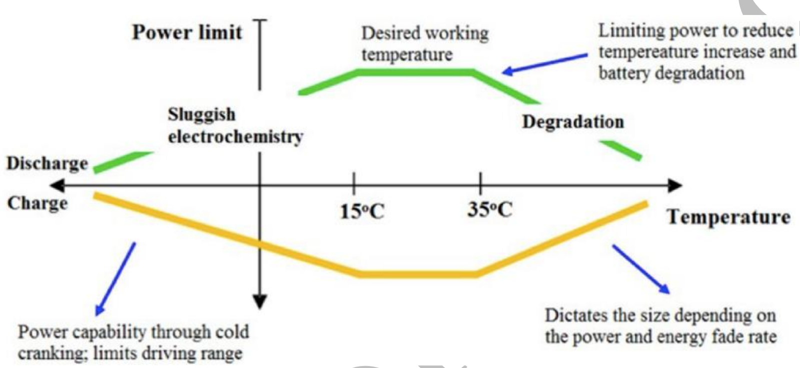

Fig. 11. Working temperature interval of batteries [85].

Bulk size of batteries in electronic vehicles face hard and harsh circumstances such as thermal, electrical and uncomplimentary loading that cause the short circuit and parallels deteriorated performance and explosion [30,86–99]. Reaction rates escalate while the temperature increases and leading the heat decadences and eliciting greater temperatures [100]. In this stage, if the produced heat will not evacuated drive the thermal runaway [101]. As consequences of the detritions in batteries thermal runaway (TR) could lead the deathly occasions. In reality, in modern battery, electrified vehicles, the most concern with vital priority is the safety of the system [102]. Though for battery safety it should be kept in a controllable environment where the temperature and heat gradient could be scanned and detected to prevented happening the thermal runaway and assure the safety [84]. As a result, there are various methods to cool down or prevent the causing the thermal runaway and manage the heat of battery Lithium-ion batteries (Table.2).

Table.2. Categorization of the thermal management system of batteries[102–108].

Battery cooling system	Power consumption	Passive cooling	
		Active cooling	
	Heat transfer medium	Air cooling	Natural
			Forced
		Liquid cooling	Liquid jacket cooling
			Cold plate cooling
			Mini/Micro channel cooling
			Serpentine channel cooling plates
			Submerged battery packs in coolant
		Phase change material (PCM) cooling	Liquid-Vapor phase change/ refrigerant cooling
			Solid-Liquid phase change
			Composite PCM
	Contact between the coolant & battery surface	Direct contact	
		Indirect contact	
	Based on cell configuration	Series	
		Parallel	
		Series+parallel	
		Cross flow	
		Staggered	
	Other techniques	Thermoelectric cooling	
		Heat pipe cooling	Ultra thin heat pipe
			Flat heat pipe
			Oscillating heat pipe
			Use water bath& water
			Micro heat pipe array
		Use of hydrogels	
		Vortex generator	
		Mist cooling	
	Hybrid battery cooling systems		

3.1. Air-cooling

One of the natural methods for cooling down the batteries is air-cooling system. The mentioned structure had specific advantages such as low cost, negligible weight, easy maintenance and most important is their simplicity [102,109]. As the natural air-cooling had some disadvantages and drawbacks such as the high temperature working circumstances, the technology of the forced-air with different additions and extra items had structured [110–121].

3.2. Liquid and refrigerant cooling

The liquid and refrigerant cooling in a comparison with the air-cooling system has the better thermal performance. Then nowadays it has been using widely as the common technique in various batteries [122]. There are diverse fluids that using for heat transfer directly or indirectly to cool the liquid-based battery systems such as liquid metal, water, de-ionized water, blend of water and Ethylene glycol, and other divergent fluids [90,123–130].

3.3. PCM cooling

As phase change materials can absorb the huge quantity of heat, which has generated by Lithium-Ion Batteries has a great capacity to utilize as a cooling technique in battery systems [131]. The introductory of utilizing the PCM's for commercial use had started from the automotive implementation industry [108]. A phase change material is a kind of components that can store the heat and also expel it from the system and is categorized as cost effective and cheap moreover non-corrosive materials [132–135]. In different surveys, researchers demonstrated that cooling with PCM has disadvantages of lower thermal conductivity [136]. There are diverse ways to improve the drawbacks of PCM in cooling such as adding graphite, metal foams, and moreover adding the paraffin to improve the thermal conductivity of PCM [137–139].

3.4. Heat pipe

Heat pipes are applications, which transfer the heat and are filled with a fluid that evaporates to produce heat [140]. Nowadays heat pipes are widely commercialized in battery packs [122]. The list of merits and benefits of the HP's are so much which some of the emphasized items are great high thermal conductivity, lightweight, reliability, flexibility, low conductivity, volume expansion[141–145]. Table 3 demonstrates the most relevant classification of the heat pipes which has been evaluated and arranged by many scientists [122].

Table. 3.Categorization of the heat pipe [146–150].

Heat pipe based BTMS	
Flat heat pipe	
Flat plate loop heat pipe (FPLHP)	
Ultra thin heat pipe	Ultra thin flat heat pipe
	Ultra thin loop heat pipe(ULHP)
	Ultra thin micro heat pipe (UMHP)
Pulsating heat pipe	
Tube heat pipe	Tube heat pipe with flat evaporator section
	L-shape tube heat pipe with flat evaporator section
	Blended tube heat pipe
Oscillating heat pipe (OHP)	Flexible oscillating heat pipe
Loop heat pipe	
Open-loop flat plate heat pipe	

4. Battery technology and application areas

Electrification is proceeding notably with the common transportation category like any kind of commercial vehicles, buses, cars, railways, aviation, marine and road mobility, moreover; working on the emergency power backup, solar power storage, alarm systems in isolated places and finally portable power packs which empowered and expanded as giant factory -scale production of Lithium-Ion battery automation [151]. Some of the most important factors which affects the commercial vehicle's storage energy are the weight of the battery system and battery management system or basically BMS, battery system performance, cost of the battery, life cycle of the battery, being environment friendly, the power and the energy of the battery, even the most notable is the battery safety. Due to so many researches, LIB's allows the maximum level of energy density [152]. Lithium-ion batteries have various merits such as long life and low self-discharge, furthermore, these batteries have great cycling performances [153]. In the below table, as in table 4 the general application area of the LIB's has been demonstrated.

Table. 4. Classification of the LIB's utilization [143–145].

The implementation fields of LIB's	Commercial vehicles and road mobility
	Aviation
	Marine
	Emergency power backup
	Solar energy storage
	Alarm systems in isolated places
	Portable power packs

5. Conclusion

As a result of the research on Li-ion batteries, the following results were obtained. As the advances in battery technologies, the amount of energy stored by Li-ion batteries increases and important developments occur in control systems. Even more, with the decrease in Li-ion battery prices, it is observed that the usage rate has increased in many areas. It has been observed that the voltage, current, and temperature of the cells commonly affect these batteries. According to the statistics, it has been observed that there is a significant annual increase in the global market values of the Lithium-ion battery from 1992 to 2021.

Subscripts

GDP Gross Domestic Product
EV Electric Vehicle
LIB Lithium Ion Batteries
TR Thermal Runaway
PCM Phase Change Materials
HP Heat Pipe

References

[1] Bruce, P. G., Scrosati, B., ve Tarascon, J., "Nanomaterials for rechargeable lithium batteries", Angewandte Chemie International Edition, 47 (16): 2930–2946 (2008).
[2] Esmaeili, J. ve Jannesari, H., "Developing heat source term including heat generation at rest condition for Lithium-ion battery pack by up scaling information from cell scale", Energy Conversion And Management, 139: 194–205 (2017).
[3] Yoshino, A., "Development of the lithium-ion battery and recent technological trends", Lithium-ion batteries, Elsevier, 1–20 (2014).
[4] Lyu, D., Ren, B., ve Li, S., "Failure modes and mechanisms for rechargeable Lithium-based batteries: a state-of-the-art review", Acta Mechanica, 230 (3): 701–727 (2019).
[5] Liao, Z., Zhang, S., Li, K., Zhang, G., ve Habetler, T. G., "A survey of methods for monitoring and detecting thermal runaway of lithium-ion batteries", Journal Of Power Sources, 436: 226879 (2019).
[6] Bilgen, S., "Structure and environmental impact of global energy consumption", Renewable And Sustainable Energy Reviews, 38: 890–902 (2014).
[7] Ozturk, I., Aslan, A., ve Kalyoncu, H., "Energy consumption and economic growth relationship: Evidence from panel data for low and middle income countries", Energy Policy, 38 (8): 4422–4428 (2010).
[8] Abbas, Z., "Re-assessing the Contribution of Energy Consumption to GDP Per-Capita: Evidence from Developed and Developing Countries", International Journal Of Energy Economics And Policy, 10 (6): 404 (2020).
[9] Aslan, A., "Energy consumption and GDP: The strong relationship in OECD countries", Energy Sources, Part B: Economics, Planning, And Policy, 8 (4): 339–345 (2013).
[10] Aleklett, K., Höök, M., Jakobsson, K., Lardelli, M., Snowden, S., ve Söderbergh, B., "The peak of the oil age–analyzing the world oil production reference scenario in world energy outlook 2008", Energy Policy, 38

(3): 1398–1414 (2010).
[11] Chang, C.-L. ve McAleer, M., "The fiction of full BEKK: Pricing fossil fuels and carbon emissions", Finance Research Letters, 28: 11–19 (2019).
[12] Ellabban, O., Abu-Rub, H., ve Blaabjerg, F., "Renewable energy resources: Current status, future prospects and their enabling technology", Renewable And Sustainable Energy Reviews, 39: 748–764 (2014).
[13] Aneke, M. ve Wang, M., "Energy storage technologies and real life applications–A state of the art review", Applied Energy, 179: 350–377 (2016).
[14] Mahlia, T. M. I., Saktisahdan, T. J., Jannifar, A., Hasan, M. H., ve Matseelar, H. S. C., "A review of available methods and development on energy storage; technology update", Renewable And Sustainable Energy Reviews, 33: 532–545 (2014).
[15] Naish, C., McCubbin, I., Edberg, O., ve Harfoot, M., "Outlook of energy storage technologies", European Parliament, Policy Department, Economic And Scientific Policy, (2008).
[16] Gaines, L. ve Cuenca, R., "Costs of lithium-ion batteries for vehicles", Argonne National Lab., IL (US), (2000).
[17] Broussely, M., "Recent developments on lithium ion batteries at SAFT", Journal Of Power Sources, 81: 140–143 (1999).
[18] Ramadass, P., Fang, W., ve Zhang, Z. J., "Study of internal short in a Li-ion cell I. Test method development using infra-red imaging technique", Journal Of Power Sources, 248: 769–776 (2014).
[19] Lu, L., Han, X., Li, J., Hua, J., ve Ouyang, M., "A review on the key issues for lithium-ion battery management in electric vehicles", Journal Of Power Sources, 226: 272–288 (2013).
[20] Doughty, D. ve Roth, E. P., "A general discussion of Li Ion battery safety", Electrochemical Society Interface, 21 (2): 37–44 (2012).
[21] Ploehn, H. J., Ramadass, P., ve White, R. E., "Solvent diffusion model for aging of lithium-ion battery cells", Journal Of The Electrochemical Society, 151 (3): A456 (2004).
[22] Hong, J., Maleki, H., Al Hallaj, S., Redey, L., ve Selman, J. R., "Electrochemical-calorimetric studies of lithium-ion cells", Journal Of The Electrochemical Society, 145 (5): 1489 (1998).
[23] Spotnitz, R. M., Weaver, J., Yeduvaka, G., Doughty, D. H., ve Roth, E. P., "Simulation of abuse tolerance of lithium-ion battery packs", Journal Of Power Sources, 163 (2): 1080–1086 (2007).
[24] Liu, K., Liu, Y., Lin, D., Pei, A., ve Cui, Y., "Materials for lithium-ion battery safety", Science Advances, 4 (6): eaas9820 (2018).
[25] Vetter, J., Novák, P., Wagner, M. R., Veit, C., Möller, K.-C., Besenhard, J. O., Winter, M., Wohlfahrt-Mehrens, M., Vogler, C., ve Hammouche, A., "Ageing mechanisms in lithium-ion batteries", Journal Of Power Sources, 147 (1–2): 269–281 (2005).
[26] Spotnitz, R. ve Franklin, J., "Abuse behavior of high-power, lithium-ion cells", Journal Of Power Sources, 113 (1): 81–100 (2003).
[27] Gerver, R. E. ve Meyers, J. P., "Three-dimensional modeling of electrochemical performance and heat generation of lithium-ion batteries in tabbed planar configurations", Journal Of The Electrochemical Society, 158 (7): A835 (2011).
[28] Abraham, D. P., Liu, J., Chen, C. H., Hyung, Y. E., Stoll, M., Elsen, N., MacLaren, S., Twesten, R., Haasch, R., ve Sammann, E., "Diagnosis of power fade mechanisms in high-power lithium-ion cells", Journal Of Power Sources, 119: 511–516 (2003).
[29] Abraham, D. P., Reynolds, E. M., Schultz, P. L., Jansen, A. N., ve Dees, D. W., "Temperature dependence of capacity and impedance data from fresh and aged high-power lithium-ion cells", Journal Of The Electrochemical Society, 153 (8): A1610 (2006).
[30] Bandhauer, T. M., Garimella, S., ve Fuller, T. F., "A critical review of thermal issues in lithium-ion batteries", Journal Of The Electrochemical Society, 158 (3): R1 (2011).
[31] Guo, G., Long, B., Cheng, B., Zhou, S., Xu, P., ve Cao, B., "Three-dimensional thermal finite element modeling of lithium-ion battery in thermal abuse application", Journal Of Power Sources, 195 (8): 2393–2398 (2010).
[32] Ramasamy, R. P., White, R. E., ve Popov, B. N., "Calendar life performance of pouch lithium-ion cells", Journal Of Power Sources, 141 (2): 298–306 (2005).
[33] Smith, A. J., Dahn, H. M., Burns, J. C., ve Dahn, J. R., "Long-term low-rate cycling of LiCoO2/graphite Li-ion cells at 55 C", Journal Of The Electrochemical Society, 159 (6): A705 (2012).
[34] Jossen, A., "Fundamentals of battery dynamics", Journal Of Power Sources, 154 (2): 530–538 (2006).
[35] Fleckenstein, M., Bohlen, O., Roscher, M. A., ve Bäker, B., "Current density and state of charge inhomogeneities in Li-ion battery cells with LiFePO4 as cathode material due to temperature gradients",

Journal Of Power Sources, 196 (10): 4769–4778 (2011).
[36] Saw, L. H., Poon, H. M., San Thiam, H., Cai, Z., Chong, W. T., Pambudi, N. A., ve King, Y. J., "Novel thermal management system using mist cooling for lithium-ion battery packs", Applied Energy, 223: 146–158 (2018).
[37] Spotnitz, R., "Simulation of capacity fade in lithium-ion batteries", Journal Of Power Sources, 113 (1): 72–80 (2003).
[38] Forgez, C., Do, D. V., Friedrich, G., Morcrette, M., ve Delacourt, C., "Thermal modeling of a cylindrical LiFePO4/graphite lithium-ion battery", Journal Of Power Sources, 195 (9): 2961–2968 (2010).
[39] Akinlabi, A. A. H. ve Solyali, D., "Configuration, design, and optimization of air-cooled battery thermal management system for electric vehicles: A review", Renewable And Sustainable Energy Reviews, 125: 109815 (2020).
[40] Farias-Rocha, A. P., Hassan, K. M. K., Malimata, J. R. R., Sánchez-Cubedo, G. A., ve Rojas-Solórzano, L. R., "Solar photovoltaic policy review and economic analysis for on-grid residential installations in the Philippines", Journal Of Cleaner Production, 223: 45–56 (2019).
[41] Shi, Y., Pan, X., Li, B., Zhao, M., ve Pang, H., "Co3O4 and its composites for high-performance Li-ion batteries", Chemical Engineering Journal, 343: 427–446 (2018).
[42] Ma, S., Jiang, M., Tao, P., Song, C., Wu, J., Wang, J., Deng, T., ve Shang, W., "Temperature effect and thermal impact in lithium-ion batteries: A review", Progress In Natural Science: Materials International, 28 (6): 653–666 (2018).
[43] Alipour, M., Ziebert, C., Conte, F. V., ve Kizilel, R., "A review on temperature-dependent electrochemical properties, aging, and performance of lithium-ion cells", Batteries, 6 (3): 35 (2020).
[44] Hawley, W. B. ve Li, J., "Electrode manufacturing for lithium-ion batteries—Analysis of current and next generation processing", Journal Of Energy Storage, 25: 100862 (2019).
[45] Laidler, K. J., "The development of the Arrhenius equation", Journal Of Chemical Education, 61 (6): 494 (1984).
[46] Jiang, X., Chen, Y., Meng, X., Cao, W., Liu, C., Huang, Q., Naik, N., Murugadoss, V., Huang, M., ve Guo, Z., "The impact of electrode with carbon materials on safety performance of lithium-ion batteries: A review", Carbon, (2022).
[47] Song, J. Y., Wang, Y. Y., ve Wan, C. C., "Review of gel-type polymer electrolytes for lithium-ion batteries", Journal Of Power Sources, 77 (2): 183–197 (1999).
[48] Fenton, D.E.a, Parker, J.M.b, Wright, P. V. ., "Complexes of alkali metal ions with poly (ethylene oxide)", Polymer, 14 (00323861): 589 (1973).
[49] Ohta, S., Kobayashi, T., Seki, J., ve Asaoka, T., "Electrochemical performance of an all-solid-state lithium ion battery with garnet-type oxide electrolyte", Journal Of Power Sources, 202: 332–335 (2012).
[50] Takada, K., Inada, T., Kajiyama, A., Sasaki, H., Kondo, S., Watanabe, M., Murayama, M., ve Kanno, R., "Solid-state lithium battery with graphite anode", Solid State Ionics, 158 (3–4): 269–274 (2003).
[51] Ohta, N., Takada, K., Zhang, L., Ma, R., Osada, M., ve Sasaki, T., "Enhancement of the high-rate capability of solid-state lithium batteries by nanoscale interfacial modification", Advanced Materials, 18 (17): 2226–2229 (2006).
[52] Ohta, N., Takada, K., Sakaguchi, I., Zhang, L., Ma, R., Fukuda, K., Osada, M., ve Sasaki, T., "LiNbO3-coated LiCoO2 as cathode material for all solid-state lithium secondary batteries", Electrochemistry Communications, 9 (7): 1486–1490 (2007).
[53] Sakuda, A., Kitaura, H., Hayashi, A., Tadanaga, K., ve Tatsumisago, M., "Improvement of high-rate performance of all-solid-state lithium secondary batteries using LiCoO2 coated with Li2O–SiO2 glasses", Electrochemical And Solid State Letters, 11 (1): A1 (2007).
[54] Sun, Y., Liu, N., ve Cui, Y., "Promises and challenges of nanomaterials for lithium-based rechargeable batteries", Nature Energy, 1 (7): 1–12 (2016).
[55] Chen, Z., Qin, Y., Ren, Y., Lu, W., Orendorff, C., Roth, E. P., ve Amine, K., "Multi-scale study of thermal stability of lithiated graphite", Energy & Environmental Science, 4 (10): 4023–4030 (2011).
[56] Feng, X., He, X., Ouyang, M., Lu, L., Wu, P., Kulp, C., ve Prasser, S., "Thermal runaway propagation model for designing a safer battery pack with 25 Ah LiNixCoyMnzO2 large format lithium ion battery", Applied Energy, 154: 74–91 (2015).
[57] Guo, R., Lu, L., Ouyang, M., ve Feng, X., "Mechanism of the entire overdischarge process and overdischarge-induced internal short circuit in lithium-ion batteries", Scientific Reports, 6 (1): 1–9 (2016).
[58] Feng, X., Fang, M., He, X., Ouyang, M., Lu, L., Wang, H., ve Zhang, M., "Thermal runaway features of large format prismatic lithium ion battery using extended volume accelerating rate calorimetry", Journal Of

Power Sources, 255: 294–301 (2014).
[59] Feng, X., He, X., Ouyang, M., Wang, L., Lu, L., Ren, D., ve Santhanagopalan, S., "A coupled electrochemical-thermal failure model for predicting the thermal runaway behavior of lithium-ion batteries", Journal Of The Electrochemical Society, 165 (16): A3748 (2018).
[60] Doughty, D. H., "Vehicle battery safety roadmap guidance", National Renewable Energy Lab.(NREL), Golden, CO (United States), (2012).
[61] Ceder, G., Aydinol, M. K., ve Kohan, A. F., "Application of first-principles calculations to the design of rechargeable Li-batteries", Computational Materials Science, 8 (1–2): 161–169 (1997).
[62] El-Sebaii, A. A. ve Shalaby, S. M., .
[63] Xu, B., Qian, D., Wang, Z., ve Meng, Y. S., "Recent progress in cathode materials research for advanced lithium ion batteries", Materials Science And Engineering: R: Reports, 73 (5–6): 51–65 (2012).
[64] Kalantarian, M. M., Asgari, S., ve Mustarelli, P., "A theoretical approach to evaluate the rate capability of Li-ion battery cathode materials", Journal Of Materials Chemistry A, 2 (1): 107–115 (2014).
[65] Bocca, A., Sassone, A., Shin, D., Macii, A., Macii, E., ve Poncino, M., "An equation-based battery cycle life model for various battery chemistries", (2015).
[66] Ramírez, F. J., Honrubia-Escribano, A., Gómez-Lázaro, E., ve Pham, D. T., "Combining feed-in tariffs and net-metering schemes to balance development in adoption of photovoltaic energy: Comparative economic assessment and policy implications for European countries", Energy Policy, 102 (September 2016): 440–452 (2017).
[67] Lu, Y., Yu, L., ve Lou, X. W. D., "Nanostructured conversion-type anode materials for advanced lithium-ion batteries", Chem, 4 (5): 972–996 (2018).
[68] Stephan, A. M., Kumar, T. P., Ramesh, R., Thomas, S., Jeong, S. K., ve Nahm, K. S., "Pyrolitic carbon from biomass precursors as anode materials for lithium batteries", Materials Science And Engineering: A, 430 (1–2): 132–137 (2006).
[69] Nitta, N., Wu, F., Lee, J. T., ve Yushin, G., "Li-ion battery materials: present and future", Materials Today, 18 (5): 252–264 (2015).
[70] Ferg, E., Gummow, R. J. d, De Kock, A., ve Thackeray, M. M., "Spinel anodes for lithium-ion batteries", Journal Of The Electrochemical Society, 141 (11): L147 (1994).
[71] Johnston, D. C., "Superconducting and normal state properties of Li 1+ x Ti 2− x O 4 spinel compounds. I. Preparation, crystallography, superconducting properties, electrical resistivity, dielectric behavior, and magnetic susceptibility", Journal Of Low Temperature Physics, 25 (1): 145–175 (1976).
[72] Rossi Albertini, V., Perfetti, P., Ronci, F., ve Scrosati, B., "Structural changes of electrodic materials in electrochemical cells observed by in situ energy dispersive X-ray diffraction (EDXD)", Chemistry Of Materials, 13 (2): 450–455 (2001).
[73] Mahmood, N., Tang, T., ve Hou, Y., "Nanostructured anode materials for lithium ion batteries: progress, challenge and perspective", Advanced Energy Materials, 6 (17): 1600374 (2016).
[74] Reddy, M. V, Subba Rao, G. V, ve Chowdari, B. V. R., "Metal oxides and oxysalts as anode materials for Li ion batteries", Chemical Reviews, 113 (7): 5364–5457 (2013).
[75] Roy, P. ve Srivastava, S. K., "Nanostructured anode materials for lithium ion batteries", Journal Of Materials Chemistry A, 3 (6): 2454–2484 (2015).
[76] Guan, B. Y., Yu, L., Li, J., ve Lou, X. W. D., "A universal cooperative assembly-directed method for coating of mesoporous TiO2 nanoshells with enhanced lithium storage properties", Science Advances, 2 (3): e1501554 (2016).
[77] Yu, L., Wu, H. Bin, ve Lou, X. W., "Mesoporous Li4Ti5O12 hollow spheres with enhanced lithium storage capability", Advanced Materials, 25 (16): 2296–2300 (2013).
[78] Zhu, G.-N., Wang, Y.-G., ve Xia, Y.-Y., "Ti-based compounds as anode materials for Li-ion batteries", Energy & Environmental Science, 5 (5): 6652–6667 (2012).
[79] Peled, E., "The electrochemical behavior of alkali and alkaline earth metals in nonaqueous battery systems—the solid electrolyte interphase model", Journal Of The Electrochemical Society, 126 (12): 2047 (1979).
[80] Funabiki, A., Inaba, M., Abe, T., ve Ogumi, Z., "Stage transformation of lithium-graphite intercalation compounds caused by electrochemical lithium intercalation", Journal Of The Electrochemical Society, 146 (7): 2443 (1999).
[81] Peled, E., Golodnitsky, D., ve Ardel, G., "Advanced model for solid electrolyte interphase electrodes in liquid and polymer electrolytes", Journal Of The Electrochemical Society, 144 (8): L208 (1997).
[82] Peled, E., Golodnitsky, D., Mazor, H., Goor, M., ve Avshalomov, S., "Parameter analysis of a practical lithium-and sodium-air electric vehicle battery", Journal Of Power Sources, 196 (16): 6835–6840 (2011).

[83] Peled, E. ve Menkin, S., "Review—SEI: Past, Present and Future", Journal Of The Electrochemical Society, 164 (7): A1703–A1719 (2017).
[84] Jaguemont, J. ve Van Mierlo, J., "A comprehensive review of future thermal management systems for battery-electrified vehicles", Journal Of Energy Storage, 31: 101551 (2020).
[85] Wang, Q., Jiang, B., Li, B., ve Yan, Y., "A critical review of thermal management models and solutions of lithium-ion batteries for the development of pure electric vehicles", Renewable And Sustainable Energy Reviews, 64: 106–128 (2016).
[86] Liu, B., Jia, Y., Li, J., Yin, S., Yuan, C., Hu, Z., Wang, L., Li, Y., ve Xu, J., "Safety issues caused by internal short circuits in lithium-ion batteries", Journal Of Materials Chemistry A, 6 (43): 21475–21484 (2018).
[87] Bai, P., Li, J., Brushett, F. R., ve Bazant, M. Z., "Transition of lithium growth mechanisms in liquid electrolytes", Energy & Environmental Science, 9 (10): 3221–3229 (2016).
[88] Wang, Q., Ping, P., Zhao, X., Chu, G., Sun, J., ve Chen, C., "Thermal runaway caused fire and explosion of lithium ion battery", Journal Of Power Sources, 208: 210–224 (2012).
[89] Liu, B., Zhang, J., Zhang, C., ve Xu, J., "Mechanical integrity of 18650 lithium-ion battery module: packing density and packing mode", Engineering Failure Analysis, 91: 315–326 (2018).
[90] Liu, B., Zhao, H., Yu, H., Li, J., ve Xu, J., "Multiphysics computational framework for cylindrical lithium-ion batteries under mechanical abusive loading", Electrochimica Acta, 256: 172–184 (2017).
[91] Yuan, C., Wang, L., Yin, S., ve Xu, J., "Generalized separator failure criteria for internal short circuit of lithium-ion battery", Journal Of Power Sources, 467: 228360 (2020).
[92] Zhu, J., Wierzbicki, T., ve Li, W., "A review of safety-focused mechanical modeling of commercial lithium-ion batteries", Journal Of Power Sources, 378: 153–168 (2018).
[93] Liu, B., Jia, Y., Yuan, C., Wang, L., Gao, X., Yin, S., ve Xu, J., "Safety issues and mechanisms of lithium-ion battery cell upon mechanical abusive loading: A review", Energy Storage Materials, 24: 85–112 (2020).
[94] Jia, Y., Yin, S., Liu, B., Zhao, H., Yu, H., Li, J., ve Xu, J., "Unlocking the coupling mechanical-electrochemical behavior of lithium-ion battery upon dynamic mechanical loading", Energy, 166: 951–960 (2019).
[95] Xu, J., Jia, Y., Liu, B., Zhao, H., Yu, H., Li, J., ve Yin, S., "Coupling effect of state-of-health and state-of-charge on the mechanical integrity of lithium-ion batteries", Experimental Mechanics, 58 (4): 633–643 (2018).
[96] Wang, L., Yin, S., ve Xu, J., "A detailed computational model for cylindrical lithium-ion batteries under mechanical loading: from cell deformation to short-circuit onset", Journal Of Power Sources, 413: 284–292 (2019).
[97] Jia, Y., Uddin, M., Li, Y., ve Xu, J., "Thermal runaway propagation behavior within 18,650 lithium-ion battery packs: A modeling study", Journal Of Energy Storage, 31: 101668 (2020).
[98] Huang, P., Ping, P., Li, K., Chen, H., Wang, Q., Wen, J., ve Sun, J., "Experimental and modeling analysis of thermal runaway propagation over the large format energy storage battery module with $Li_4Ti_5O_{12}$ anode", Applied Energy, 183: 659–673 (2016).
[99] Wu, H., Zhuo, D., Kong, D., ve Cui, Y., "Improving battery safety by early detection of internal shorting with a bifunctional separator", Nature Communications, 5 (1): 1–6 (2014).
[100] Jaguemont, J., Omar, N., Abdel-Monem, M., Van den Bossche, P., ve Van Mierlo, J., "Fast-charging investigation on high-power and high-energy density pouch cells with 3D-thermal model development", Applied Thermal Engineering, 128: 1282–1296 (2018).
[101] De Hoog, J., Jaguemont, J., Abdel-Monem, M., Van Den Bossche, P., Van Mierlo, J., ve Omar, N., "Combining an electrothermal and impedance aging model to investigate thermal degradation caused by fast charging", Energies, 11 (4): 804 (2018).
[102] Wu, W., Wang, S., Wu, W., Chen, K., Hong, S., ve Lai, Y., "A critical review of battery thermal performance and liquid based battery thermal management", Energy Conversion And Management, 182: 262–281 (2019).
[103] Kim, J., Oh, J., ve Lee, H., "Review on battery thermal management system for electric vehicles", Applied Thermal Engineering, 149: 192–212 (2019).
[104] Deng, T., Zhang, G., Ran, Y., ve Liu, P., "Thermal performance of lithium ion battery pack by using cold plate", Applied Thermal Engineering, 160: 114088 (2019).
[105] Jaguemont, J., Boulon, L., ve Dubé, Y., "A comprehensive review of lithium-ion batteries used in hybrid and electric vehicles at cold temperatures", Applied Energy, 164: 99–114 (2016).
[106] Xia, G., Cao, L., ve Bi, G., "A review on battery thermal management in electric vehicle application", Journal Of Power Sources, 367: 90–105 (2017).
[107] Liu, H., Wei, Z., He, W., ve Zhao, J., "Thermal issues about Li-ion batteries and recent progress in battery

thermal management systems: A review", Energy Conversion And Management, 150: 304–330 (2017).
[108] Jaguemont, J., Omar, N., Van den Bossche, P., ve Mierlo, J., "Phase-change materials (PCM) for automotive applications: A review", Applied Thermal Engineering, 132: 308–320 (2018).
[109] Deng, Y., Feng, C., Jiaqiang, E., Zhu, H., Chen, J., Wen, M., ve Yin, H., "Effects of different coolants and cooling strategies on the cooling performance of the power lithium ion battery system: A review", Applied Thermal Engineering, 142: 10–29 (2018).
[110] Fan, Y., Bao, Y., Ling, C., Chu, Y., Tan, X., ve Yang, S., "Experimental study on the thermal management performance of air cooling for high energy density cylindrical lithium-ion batteries", Applied Thermal Engineering, 155: 96–109 (2019).
[111] Yang, N., Zhang, X., Li, G., ve Hua, D., "Assessment of the forced air-cooling performance for cylindrical lithium-ion battery packs: A comparative analysis between aligned and staggered cell arrangements", Applied Thermal Engineering, 80: 55–65 (2015).
[112] Mohammadian, S. K. ve Zhang, Y., "Thermal management optimization of an air-cooled Li-ion battery module using pin-fin heat sinks for hybrid electric vehicles", Journal Of Power Sources, 273: 431–439 (2015).
[113] Mohammadian, S. K. ve Zhang, Y., "Cumulative effects of using pin fin heat sink and porous metal foam on thermal management of lithium-ion batteries", Applied Thermal Engineering, 118: 375–384 (2017).
[114] Liu, Y. ve Zhang, J., "Design a J-type air-based battery thermal management system through surrogate-based optimization", Applied Energy, 252: 113426 (2019).
[115] Chen, K., Wu, W., Yuan, F., Chen, L., ve Wang, S., "Cooling efficiency improvement of air-cooled battery thermal management system through designing the flow pattern", Energy, 167: 781–790 (2019).
[116] Fan, L., Khodadadi, J. M., ve Pesaran, A. A., "A parametric study on thermal management of an air-cooled lithium-ion battery module for plug-in hybrid electric vehicles", Journal Of Power Sources, 238: 301–312 (2013).
[117] Park, H., "A design of air flow configuration for cooling lithium ion battery in hybrid electric vehicles", Journal Of Power Sources, 239: 30–36 (2013).
[118] Cho, G. Y., Choi, J. W., Park, J. H., ve Cha, S. W., "Transient modeling and validation of lithium ion battery pack with air cooled thermal management system for electric vehicles", International Journal Of Automotive Technology, 15 (5): 795–803 (2014).
[119] Wang, S., Li, K., Tian, Y., Wang, J., Wu, Y., ve Ji, S., "Improved thermal performance of a large laminated lithium-ion power battery by reciprocating air flow", Applied Thermal Engineering, 152: 445–454 (2019).
[120] Na, X., Kang, H., Wang, T., ve Wang, Y., "Reverse layered air flow for Li-ion battery thermal management", Applied Thermal Engineering, 143: 257–262 (2018).
[121] Mahamud, R. ve Park, C., "Reciprocating air flow for Li-ion battery thermal management to improve temperature uniformity", Journal Of Power Sources, 196 (13): 5685–5696 (2011).
[122] Tete, P. R., Gupta, M. M., ve Joshi, S. S., "Developments in battery thermal management systems for electric vehicles: A technical review", Journal Of Energy Storage, 35: 102255 (2021).
[123] Huo, Y. ve Rao, Z., "The numerical investigation of nanofluid based cylinder battery thermal management using lattice Boltzmann method", International Journal Of Heat And Mass Transfer, 91: 374–384 (2015).
[124] Yang, X.-H., Tan, S.-C., ve Liu, J., "Thermal management of Li-ion battery with liquid metal", Energy Conversion And Management, 117: 577–585 (2016).
[125] Hosseinzadeh, E., Barai, A., Marco, J., ve Jennings, P., "A comparative study on different cooling strategies for lithium-ion battery cells", (2017).
[126] Jarrett, A. ve Kim, I. Y., "Influence of operating conditions on the optimum design of electric vehicle battery cooling plates", Journal Of Power Sources, 245: 644–655 (2014).
[127] Jarrett, A. ve Kim, I. Y., "Design optimization of electric vehicle battery cooling plates for thermal performance", Journal Of Power Sources, 196 (23): 10359–10368 (2011).
[128] Gou, J. ve Liu, W., "Feasibility study on a novel 3D vapor chamber used for Li-ion battery thermal management system of electric vehicle", Applied Thermal Engineering, 152: 362–369 (2019).
[129] Panchal, S., Dincer, I., Agelin-Chaab, M., Fraser, R., ve Fowler, M., "Experimental and theoretical investigations of heat generation rates for a water cooled LiFePO4 battery", International Journal Of Heat And Mass Transfer, 101: 1093–1102 (2016).
[130] Panchal, S., Dincer, I., Agelin-Chaab, M., Fraser, R., ve Fowler, M., "Thermal modeling and validation of temperature distributions in a prismatic lithium-ion battery at different discharge rates and varying boundary conditions", Applied Thermal Engineering, 96: 190–199 (2016).
[131] Al Hallaj, S. ve Selman, J. R., "A novel thermal management system for electric vehicle batteries using

phase-change material", Journal Of The Electrochemical Society, 147 (9): 3231 (2000).
[132] Siddique, A. R. M., Mahmud, S., ve Van Heyst, B., "A comprehensive review on a passive (phase change materials) and an active (thermoelectric cooler) battery thermal management system and their limitations", Journal Of Power Sources, 401: 224–237 (2018).
[133] Ianniciello, L., Biwolé, P. H., ve Achard, P., "Electric vehicles batteries thermal management systems employing phase change materials", Journal Of Power Sources, 378: 383–403 (2018).
[134] Souayfane, F., Fardoun, F., ve Biwole, P.-H., "Phase change materials (PCM) for cooling applications in buildings: A review", Energy And Buildings, 129: 396–431 (2016).
[135]
[136] Farid, M. M., Khudhair, A. M., Razack, S. A. K., ve Al-Hallaj, S., "A review on phase change energy storage: materials and applications", Energy Conversion And Management, 45 (9–10): 1597–1615 (2004).
[137] Khateeb, S. A., Amiruddin, S., Farid, M., Selman, J. R., ve Al-Hallaj, S., "Thermal management of Li-ion battery with phase change material for electric scooters: experimental validation", Journal Of Power Sources, 142 (1–2): 345–353 (2005).
[138] Khateeb, S. A., Farid, M. M., Selman, J. R., ve Al-Hallaj, S., "Design and simulation of a lithium-ion battery with a phase change material thermal management system for an electric scooter", Journal Of Power Sources, 128 (2): 292–307 (2004).
[139] Ling, Z., Chen, J., Fang, X., Zhang, Z., Xu, T., Gao, X., ve Wang, S., "Experimental and numerical investigation of the application of phase change materials in a simulative power batteries thermal management system", Applied Energy, 121: 104–113 (2014).
[140] Huang, Q., Li, X., Zhang, G., Zhang, J., He, F., ve Li, Y., "Experimental investigation of the thermal performance of heat pipe assisted phase change material for battery thermal management system", Applied Thermal Engineering, 141: 1092–1100 (2018).
[141] Wang, J., Gan, Y., Liang, J., Tan, M., ve Li, Y., "Sensitivity analysis of factors influencing a heat pipe-based thermal management system for a battery module with cylindrical cells", Applied Thermal Engineering, 151: 475–485 (2019).
[142] Jiang, Z. Y. ve Qu, Z. G., "Lithium–ion battery thermal management using heat pipe and phase change material during discharge–charge cycle: A comprehensive numerical study", Applied Energy, 242: 378–392 (2019).
[143] Yang, X., Yan, Y. Y., ve Mullen, D., "Recent developments of lightweight, high performance heat pipes", Applied Thermal Engineering, 33: 1–14 (2012).
[144] Zou, H., Wang, W., Zhang, G., Qin, F., Tian, C., ve Yan, Y., "Experimental investigation on an integrated thermal management system with heat pipe heat exchanger for electric vehicle", Energy Conversion And Management, 118: 88–95 (2016).
[145] Wang, Q., Jiang, B., Xue, Q. F., Sun, H. L., Li, B., Zou, H. M., ve Yan, Y. Y., "Experimental investigation on EV battery cooling and heating by heat pipes", Applied Thermal Engineering, 88: 54–60 (2015).
[146] Tran, T.-H., Harmand, S., Desmet, B., ve Filangi, S., "Experimental investigation on the feasibility of heat pipe cooling for HEV/EV lithium-ion battery", Applied Thermal Engineering, 63 (2): 551–558 (2014).
[147] Hong, S., Zhang, X., Wang, S., ve Zhang, Z., "Experiment study on heat transfer capability of an innovative gravity assisted ultra-thin looped heat pipe", International Journal Of Thermal Sciences, 95: 106–114 (2015).
[148] Tran, T.-H., Harmand, S., ve Sahut, B., "Experimental investigation on heat pipe cooling for hybrid electric vehicle and electric vehicle lithium-ion battery", Journal Of Power Sources, 265: 262–272 (2014).
[149] Park, Y., Jun, S., Kim, S., ve Lee, D.-H., "Design optimization of a loop heat pipe to cool a lithium ion battery onboard a military aircraft", Journal Of Mechanical Science And Technology, 24 (2): 609–618 (2010).
[150] Manno, V., Filippeschi, S., Mameli, M., Romestant, C., Ayel, V., ve Bertin, Y., "Thermal-hydraulic characterization of a flat plate pulsating heat pipe for automotive applications", Interfacial Phenomena And Heat Transfer, 3 (4): (2015).
[151] Dörfler, S., Walus, S., Locke, J., Fotouhi, A., Auger, D. J., Shateri, N., Abendroth, T., Härtel, P., Althues, H., ve Kaskel, S., "Recent Progress and Emerging Application Areas for Lithium–Sulfur Battery Technology", Energy Technology, 9 (1): 2000694 (2021).
[152] Lee, J., Tai Kim, S., Cao, R., Choi, N., Liu, M., Lee, K. T., ve Cho, J., "Metal–air batteries with high energy density: Li–air versus Zn–air", Advanced Energy Materials, 1 (1): 34–50 (2011).
[153] Nayak, P. K., Yang, L., Brehm, W., ve Adelhelm, P., "From lithium-ion to sodium-ion batteries: advantages, challenges, and surprises", Angewandte Chemie International Edition, 57 (1): 102–120 (2018).