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Aluminium Ion Battery Market Assessment, By Energy Density [Below 100 Wh/kg, 100 - 200 Wh/kg, 200 - 300 Wh/kg, Above 300 Wh/kg], By Application [Electric Vehicle, Portable Devices, Electrical Grids, Medical Equipment, Other], By Sales Channel [Direct, Channel], By Region, Opportunities and Forecast, 2023-2031F

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Abstracts

Aluminium ion battery market size was valued at USD 6.12 billion in 2023, which is expected to reach USD 10.61 billion in 2031, with a CAGR of 7.12% for the forecasted period between 2024 and 2031.

The aluminum-ion battery market is expected to grow significantly due to the increasing demand for EVs and renewable energy storage solutions. The market is driven by the easy availability of raw materials such as aluminum, the extended lifespan of aluminum-ion batteries, and their ability to store large amounts of energy. The market is being propelled by increased investment and research initiatives to enhance aluminum-ion batteries' cost-effectiveness and scalability.

Rise of research and development activities are propelling the growth of the aluminum-ion battery market significantly. Research institutions, startups, and established battery manufacturers are pouring resources into the development and commercialization of aluminum-ion battery technology. The influx of funding and research efforts is facilitating innovation and bringing aluminum-ion batteries closer to commercial viability.

For instance, in April 2022, Log9, a nanotech and battery specialist from Bengaluru, announced plans to construct a manufacturing plant that would produce aluminum-ion

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battery cells to power low-cost electric vehicles, such as two and three-wheelers. In September 2022, Log9 acquired a significant fund of USD 9.65 million from Amara Raja Batteries to invest in this technology.

Utilization of Aluminum-ion batteries in Electrical Grids

The usage of Ai-ion batteries in electrical grids is proliferating the market growth significantly. These electrical grids are crucial in the Ai-ion battery market as they offer a means of storing and transporting electric energy via aluminum metal from the place of production to the place of usage. Moreover, the aluminum-ion battery technology is considered worth investing in due to the higher safety range of aluminum-ion in all aspects.

For example, in February 2023, the United States Department of Energy stated that a new battery design could help ease integration of renewable energy into the nation's electrical grid at lower cost, using Earth-abundant metals. Scientists, led by the Department of Energy's (DOE) Pacific Northwest National Laboratory, demonstrated that the new design for a grid energy storage battery built with the low-cost metals sodium and aluminum provides a pathway towards a safer and more scalable stationary energy storage system.

Advent of Aluminium-ion Batteries with Improvised Storage

The utilization of aluminum-ion batteries with improvised storage capacity is significantly driving the growth of the market. Moreover, the demand for aluminum-ion batteries is rising abruptly due to their ability to store large amounts of energy as well as possessing an extended lifespan.

For instance, in June 2023, researchers at the University of Freiburg, Germany, developed a positive electrode material for aluminum-ion batteries using an organic redox polymer based on phenothiazine. This development has enabled aluminum-ion batteries to achieve a storage capacity of 167 milliampere hours/gram, surpassing the performance of batteries utilizing graphite as an electrode material. Aluminum-ion batteries are being recognized as a promising alternative to traditional batteries due to the abundance and recyclability of aluminum, as well as its comparative safety and cost-effectiveness over lithium.

Rise In Investments for Aluminum Ion Batteries to lead to Myriad Opportunities

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The rising investments in aluminum-ion batteries are driving significant opportunities in the market. Key factors contributing to this growth include the increasing demand for electric vehicles, the easy availability of raw materials such as aluminum, and the rapid charging capabilities of these batteries.

For example, in July 2022, Graphene Manufacturing Group (GMG) announced the completion of its pouch cell graphene aluminum-ion batteries. GMG was the first company to manufacture G+Al battery pouch cells. The lightweight & faster-charging aluminum-ion batteries developed by the business have the potential to totally transform the EV market. These batteries last long than lithium-ion batteries. In August, the business announced a Final Investment Decision (FID) of over USD 0.98 million to extend Phase 1 of their graphene production project. GMG begun raising USD 5 million through a 'purchased transaction' in the same month, spending an additional USD 393.6 k in the month of December to see improved output in 2023.

Asia-Pacific Leads the Aluminium Ion Battery Market

Asia-Pacific dominate the market in all aspects and is expected to continue its dominance over the forecasted period. This leadership is attributed to the rapid industrialization, rising demand for aluminum-ion batteries in the automotive sector, and the presence of key market players in the region. Additionally, the comparative low cost of aluminum and the growing extraction of aluminum in the region have further fueled the market's growth.

For example, in July 2023, scientists in Australia and China collaborated to develop the world's first safe and efficient non-toxic aqueous aluminum radical battery. The teams from Flinders University and Zhejiang Sci-Tech University jointly achieved the first stage of this innovation, creating a design that uses water-based electrolytes, making the batteries fire-retardant and air-stable. The batteries deliver a stable voltage output of 1.25 V and a capacity of 110 mAh g–1 over 800 cycles with 0.028% loss per cycle.

Government Initiatives to Augment the Market Growth

Government initiatives are crucial for the growth of the aluminum-ion battery market. Governments worldwide are implementing policies and regulations to promote the adoption of clean and renewable energy systems, creating a favorable environment for the growth of the market. Moreover, the aluminum-ion battery market faces intense competition from established players and new entrants competing for market share. However, the ongoing R&D efforts are focused on enhancing the performance and

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durability of aluminum-ion batteries, thereby propelling the market growth.

For example, in January 2023, IOC Phinergy Limited (IOP), a joint venture of IOCL, collaborated with Tata Motors and Mahindra & Mahindra in India, and a pilot project on the integration of Aluminum-Air batteries in electric cars is already on the process in Israel. In a continuous drive of the Al-Air integrated EVs in India, IOP achieved a range of over 500 kilometers. IOP has demonstrated the Al-Air technology effectively for the energy backup applications at the locations of a large telecom tower firm in India.

Impact of COVID-19

The COVID-19 pandemic had a significant impact on the market, in both pre-COVID and post-COVID (present) situations. Pre-COVID, the market was growing steadily, driven by increasing demand for efficient and sustainable energy storage solutions. However, the pandemic disrupted supply chains, which led to economic uncertainty, and caused mass layoffs, which in turn affected the demand for aluminum-ion batteries. In the post-COVID or present scenario, the market is expediting rapidly as the demand for efficient and sustainable energy storage solutions continue to increase. Moreover, these policies are expected to lead to substantial opportunities for growth in the future. Hence, it can be concluded that the pandemic had a noticeable impact on the aluminum-ion battery market, disrupting supply chains and affecting demand. However, as the world is recovering from the pandemic, the market is expected to prosper, driven by the need for more efficient and sustainable energy storage solutions.

Key Players Landscape and Outlook

Major companies are investing heavily in the technological advancements of Ai-ion batteries, propelling the overall industry growth. Moreover, the market is highly competitive, with several players vying for market share and investing in research and development activities, partnerships, and collaborations to enhance their product portfolios and gain a competitive edge. The outlook for the aluminum-ion battery market looks promising, with substantial growth expected in the coming years, driven by advancements in cathode materials, electrolytes, and manufacturing processes, as well as the increasing demand for energy storage solutions, electric vehicles, and renewable energy systems.

In September 2023, the Graphene Manufacturing Group (GMG) launched prototype graphene aluminum ion (G+AI) battery pouch cells with an overall storage capacity of more than 500 mAh & a nominal voltage of roughly 2 volts. GMG considers it a major

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advancement since, it highlights how the company has improved its battery electrochemistry and assembly procedures to build pouch cells with more than ten layers of graphene-coated cathode and aluminum foil anode.

In November 2022, Cellnex completed a pilot project to test and confirm the usage of aluminum-air batteries as a backup power at its facilities in conjunction with the Phinergy company. The project was carried out in Ossa de Montiel, in the province of Albacete (Spain), near the Lagunas de Ruidera Park, and consisted of replacing a diesel generator set with these revolutionary aluminum-air batteries.

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