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Global Li-ion Battery Recycling Market: Analysis By Battery Chemistry (Lithium-Manganese Oxide, Lithium-Nickel-Cobalt-Aluminum Oxide, Lithium-Iron Phosphate, Lithium-Nickel-Manganese-Cobalt and Lithium-Titanate Oxide), By Recycling Process (Hydrometallurgical Process, Pyrometallurgy Process and Physical/Mechanical Process), By End User (Non Automotive and Automotive), By Region, Size and Trends with Impact of COVID-19 and Forecast up to 2029

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Abstracts

The soaring demand for lithium-ion batteries across industries highlights the pressing need for effective battery disposal and recycling. Since 2010, the lithium-ion battery market has boomed, fueled by electric vehicles (EVs) and renewable energy storage. Sustainable management of these batteries is paramount due to their valuable components like lithium, cobalt, nickel, and graphite. Recycling these batteries not only reduces environmental impact but also conserves resources and decreases dependence on new materials. This process salvages critical materials, fostering a greener battery supply chain and mitigating manufacturing and disposal footprints. The global li-ion battery recycling market was valued at US$4.97 billion in 2023, and is expected to be worth US$17.67 billion in 2029.

In the rapidly evolving landscape of battery recycling, several trends are poised to shape the market. Additionally, technological advancements in recycling processes, such as advanced sorting techniques and innovative metallurgical methods, are

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improving the efficiency and viability of battery recycling. Furthermore, the emergence of new business models, such as battery leasing and remanufacturing, presents opportunities for further integration of recycling practices into the battery value chain. With set targets to reduce the carbon footprint and greenhouse gas emissions, governments are continuously making efforts to combat extreme climatic conditions. The global li-ion battery recycling market is expected to grow at a CAGR of 23.54% over the years 2024-2029.

Market Segmentation Analysis:

By Battery Chemistry: The report identifies five segments on the basis of battery chemistry: Lithium-Manganese Oxide, Lithium-Nickel-Cobalt-Aluminum Oxide, Lithium-Iron Phosphate, Lithium-Nickel-Manganese-Cobalt and Lithium-Titanate Oxide. Lithium-Manganese Oxide (LMO) batteries dominated the market in 2023. LMO batteris are known for their high discharge rates, making them ideal for applications requiring quick bursts of power, such as power tools, medical devices, and drones. The growing demand for high-powered cordless tools and the potential for second-life applications in stationary energy storage systems are expected to drive the future growth of LMO battery recycling. Lithium-iron phosphate battery recycling segment is anticipated to grow at the fatstest CAGR during the forecasted period.

By Recycling Process: The global li-ion battery recycling market by recycling process can broadly be divided into three segments namely, Hydrometallurgical Process, Pyrometallurgy Process and Physical/Mechanical Process. Hydrometallurgical process accounted for the highest share in the li-ion battery recycling market. This recycling method involves the use of aqueous solutions to extract valuable metals from lithium-ion batteries. The process typically includes leaching, solvent extraction, precipitation, and purification steps to separate and recover metals such as lithium, cobalt, nickel, and copper. The hydrometallurgical process is known for its high metal recovery rates and ability to produce high-purity materials suitable for reuse in battery manufacturing. Simultaneously, physical/mechanical process segment is anticipated to exhibit the fastest CAGR during the forecasted period.

By End User: The global li-ion battery recycling market by end user can broadly be divided into two segments namely, Non Automotive and Automotive. The non-automotive sector encompasses diverse fields like consumer electronics, energy storage, and industrial tools. Lithium-ion batteries power various devices, and their demand rises with global electronic consumption and renewable energy initiatives, fueling recycling needs and sustainability efforts. Simultaneously, automotive segment

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is anticipated to exhibit the fastest CAGR during the forecasted period.

By Region: In the report, the global li-ion battery recycling market is divided into five regions: North America, Europe, Asia Pacific, Latin America and Middle East & Africa. In 2023, the Asia Pacific region led the li-ion battery recycling market, spurred by factors like consumer preference for NEV makers amid high gasoline prices, increasing launches of lower-priced plug-in hybrid electric vehicles, and intense competition. Governments in the region have implemented favorable policies for electric vehicles, enhancing demand. Rising consumer awareness of electric vehicle benefits also fuels market growth. With China, Japan, and India adopting more electric vehicles, and urbanization driving demand, lithium-ion battery use is projected to surge, propelling li-ion battery recycling demand. Favorable policies and technological advancements, especially in China and India, are bolstering the commercial and industrial sector, further driving demand for lithium-ion-based energy storage systems.

China dominates the electric vehicle market with 40% global sales, driven by efforts to combat air pollution. This surge fuels demand for lithium-ion batteries (LIB). China leads LIB production, with lithium output rising from 6,800 to 8,000 metric tons in 2018. Government policies promote recycling, fostering growth in the LIB recycling market amid rising demand.

Market Dynamics:

Growth Drivers: The market has been growing over the past few years, due to factors such as growing li-ion battery demand, increasing demand for electric vehicles, growing demand for energy storage, increasing environmental awareness, favorable government policies and incentives and favorable government policies and incentives. The surge in demand for lithium-ion batteries propels the Li-ion battery recycling market. These batteries are vital for energy storage in diverse fields, including renewables, grid storage, and aerospace. With the escalating use of solar and wind power, the necessity for reliable energy storage grows, driving lithium-ion battery demand. Recycling addresses resource scarcity concerns, recovering valuable materials and minimizing environmental impact to sustain battery supply chains amid rising demand.

Challenges: However, some challenges are also impeding the growth of the market such as high cost of recycling and dearth of technologies and safety issues related to the storage and transportation of spent batteries. The high cost of recycling and the dearth of advanced technologies pose significant challenges to the Li-ion battery recycling market. Recycling lithium-ion batteries involves complex processes such as

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dismantling, sorting, shredding, and chemical treatment to recover valuable materials like lithium, cobalt, and nickel. These processes require substantial investment in equipment, infrastructure, and skilled labor, contributing to the high cost of recycling. Additionally, the limited availability of cost-effective and efficient recycling technologies further exacerbates this challenge.

Trends: The market is projected to grow at a fast pace during the forecast period, due to various latest trends such as growing demand for clean energy, technological advancements and higher energy efficiency requirements in technologically updated consumer gadgets. The surging demand for clean energy is reshaping the Li-ion battery recycling market. With the global shift towards a low-carbon economy, emphasis on renewable sources like solar and wind power grows. Li-ion batteries are pivotal in enabling widespread adoption of clean energy tech, storing energy from intermittent sources and providing reliable power. As clean energy demand rises, so does the need for large-scale energy storage, with Li-ion batteries favored for their efficiency and density. Recycling becomes crucial to sustainably manage materials and support the circular economy, reducing environmental impact and promoting clean energy growth.

Impact Analysis of COVID-19 and Way Forward:

In 2020, the global Li-ion battery recycling market plummeted due to COVID-19. Pandemic-induced delays and disruptions triggered a sharp decline in market value. National lockdowns and distancing measures worsened the situation, hampering industrial operations and reducing battery demand. The global supply chain suffered, with insufficient recycling infrastructure hindering battery processing. Cross-border trade faced limitations as governments aimed to contain the virus. The World Trade Organization anticipated a substantial decline in 2020 global trade due to pandemic uncertainties. These factors collectively led to a significant downturn in the Li-ion battery recycling, underscoring COVID-19's adverse impact on the industry.

In the post COVID-19 scenario, the global Li-ion battery recycling market sees promising growth. As economies rebound, there's a renewed emphasis on sustainability, boosting demand for recycling solutions. Governments are poised to enact stricter regulations, incentivizing recycling companies and setting recycling targets. COVID-19 has underscored the importance of sustainability, prompting increased adoption of recycling practices. Advancements in recycling tech, like hydrometallurgical and pyrometallurgical methods, promise more efficient recovery of valuable materials from batteries, shaping a greener post-COVID future.

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Competitive Landscape:

The competitive landscape of the Li-ion battery recycling market is characterized by the presence of several key players operating across different regions globally. These players are engaged in various strategic initiatives such as partnerships, collaborations, acquisitions, and investments to strengthen their market position and expand their recycling capabilities. Furthermore, competition in the Li-ion battery recycling market is intensified by the increasing focus on technological innovation and process optimization to improve the efficiency and sustainability of recycling operations. Companies are investing in research and development to develop advanced recycling technologies, including hydrometallurgical and pyrometallurgical processes, as well as exploring novel approaches such as direct battery-to-battery recycling.

The key players of the global li-ion battery recycling market are:

Umicore SA
Fortum Oyj
Li-Cycle Holdings Corp.
Ganfeng Lithium Group Co., Ltd.
American Battery Technology Company
Redwood Materials
RecycLiCo Battery Materials Inc.
Batrec Industrie AG
Accurec Recycling GmbH
Neometals Ltd.
Lithion Technologies
Duesenfeld GmbH
Akkuser OY

The regulatory developments and environmental policies play a significant role in shaping the competitive landscape of the Li-ion battery recycling market. Compliance with stringent regulations related to electronic waste management and resource conservation is crucial for market players to maintain their operations and meet customer expectations. In April 2023, Glencore, FCC ?mbito, and Iberdrola unveiled a collaborative effort to introduce widespread lithium-ion battery recycling solutions in Spain and Portugal. This initiative targets a significant challenge in the sector by establishing a dedicated facility.

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