FROST & SULLIVAN

Waygate Technologies
a Baker Hughes business

WAYGATE TECHNOLOGIES RECEIVES THE 2023 COMPANY OF THE YEAR AWARD

Identified as best in class in the global industrial CT systems enabling sustainability industry

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Waygate Technologies excels in many of the criteria in the global industrial CT systems enabling sustainability space.

Industry Challenges, Addressing Unmet Customer Needs, and Leadership Focus

Per the Paris Climate Agreement and Sustainable Development Goals (SDG) set by the United Nations (UN), organizations globally are stepping up their environmental, social & governance (ESG) efforts as sustainability is becoming more critical due to the adverse effects of emissions on the environment. Scientists recommend reducing emissions by 4% by 2030, compared to 2010, to contain the issue. Based on current activities, a 14% emission increase is projected by the end of this decade,[1] implying the need to accelerate the implementation of the strategies formulated in the agreement. One of the promising areas to reduce emissions is mobility through electrification.

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> ***- Prabhu Karunakaran, Industry Principal***

Electric vehicles (EVs) have gained significant attention in the last four years as emission norms become more stringent and as the technology moves from the lab to commercialization. EVs running on lithium-ion (Li-

[1] United Nations; "The Sustainable Development Goals Report 2022"

ion) batteries, therefore, have been witnessing rapid adoption in recent years.

According to the Frost & Sullivan report on Global Battery Testing and Inspection, EV sales and awareness are at an all-time high. Global EV sales, including plug-in hybrid EVs (PHEVs) and battery EVs (BEVs), surpassed 5.8 million units in 2021, exhibiting a 79.3% growth year-over-year. EV sales are forecast to increase at a compound annual growth rate (CAGR) of 28.5% over the next 5 years. The report further identifies that the Li-ion battery is the most critical component of an EV, constituting nearly 60% of the cost of an EV powertrain and about 35% of the overall vehicle cost. Driving down the cost of batteries in EVs, therefore, will be a critical industry challenge. The second key challenge is addressing the safety and reliability concerns associated with EV batteries, which are linked to internal defects of the components because based on the status quo in the mass manufacturing of Li-ion batteries, about 20 to 30% of the products are scrapped during quality control.

Industrial computed tomography (CT) systems play an important role in mitigating the issue because they can visualize and characterize the defects internal to the assembled batteries. While several market participants offer CT solutions for the battery inspection application, a solution that meets the requirements of a manufacturing plant, in terms of cost, return on investment (RoI), output, accuracy, automation, and Industry 4.0 compliance is not common.

Waygate Technologies, a Baker Hughes business, offers the broadest CT portfolio among its competitors, with more than 10 solutions combining hardware and software for battery inspection applications, thus catering to the specific needs of research and production, both in-line and at-line. Waygate Technologies' CT systems are powered by several exclusive technologies, including Scatter|correct, Scatter correct ASC| filter, Dynamic 41 digital detector, High-flux|target, Helix|CT, and Multi|bhc, all of which are developed in-house to provide best-in-class, high-resolution images with less noise, high accuracy, repeatability, and reproducibility while reducing the inspection time from hours to minutes.

The company's offerings meet the requirements during mass product inspection in the manufacturing line. Customers, therefore, find it lucrative to invest in CT systems from Waygate Technologies, to realize a higher RoI, improved output, and high accuracy in production lines. Waygate Technologies holds the leadership position by revenue in the global industrial CT systems market, reflecting its ability to identify defects reliably in the production environment.

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Visionary Scenarios through Mega Trends and Price/Performance Value

Beyond technological superiority that enables faster, clearer, and more highly accurate image reconstruction for inspection, compared to the competition, Waygate Technologies offers multiple features that enable automation and Industry 4.0 concepts with industrial CT systems, which are critical for optimizing production performance and accelerating RoI.

State-of-the-art battery manufacturing technology for EVs is witnessing higher defectivity rates, leading to higher concerns on cost, safety, and reliability. Dealing with higher defectivity requires a deeper understanding of the root causes and the ability to solve the production, technology, and human errors to improve cost and yield. In this aspect, automating the inspection process can lower the number of defects caused by human error in various aspects of the CT inspection process, in addition to improving production rates.

Waygate Technologies offers market-leading automation features in CT systems, such as Sample|changer and Filter|changer, that allow customers to run a large number of samples to facilitate overnight and 24/7 production operation, resulting in increased productivity. Filter|changer complements the former feature by enabling CT systems to scan samples of different sizes and materials, providing operational flexibility. Moreover, the company provides a Production|edition collaborative robot for its Phoenix V|tome|x systems further increasing the automation level and throughput. These automation offerings are extended to measurement functions as well, with the company's advanced technology True|position and the patented Ruby|plate offerings. These technologies achieve specified measurement accuracy in all directions, lengths, and locations, with three-times faster automated verification compared to manual verification, enabling higher throughput with precision, and thus creating exceptional end-to-end customer value from a price/performance standpoint.

Reducing the cost to produce batteries and increasing performance reliability can extend beyond defects identified from one tool. A holistic view of the defect pareto from different inspection tools/technologies during all stages of the process flow and value chain is critical.

Waygate Technologies introduced the InspectionWorks platform, a multi-faceted cloud-based solution that can support multi-modal inspections, such as X-ray, ultrasonic testing (UT), and visual inspection. The solution is designed to offer various capabilities, including data collection, data analysis, data management, and asset management, thus serving as a unique one-stop solution to identify and contain defects across the entire battery manufacturing process flow. InspectionWorks provides customers with the highest degree of flexibility and ease of use to achieve holistic defect inspection analysis. For instance, the solution has been designed in such a way to be compatible with process data from all types of vendors (i.e., not restricted to Waygate Technologies' equipment), end-user verticals, and all types of files, in addition to having the ability to process data across the battery production value chain, from raw materials to services.

InspectionWorks can be integrated with factory planning systems, providing design and engineering teams with real-time feedback to improve the design, optimize processes, and resolve in-line issues much faster than manual flow. This solution can be extremely powerful when combined with the CT system for battery inspection because during the final inspection of battery cells in the gigafactory, each scanned cell will generate a high-resolution 3D digital dataset that can fully describe the cell, along with unique and shared identifiers about the asset, production setting, and other information. The platform can carry out an automated data evaluation to provide insights into the characteristics of the cell, including dimensional measurements and all types of non-conformances. This data evaluation is turned into analytics that can highlight even subtle trend variations or drift that indicate deviations in the process, material quality or environmental conditions at an early stage, thus facilitating faster reactions to solving defects. The early

defect detection capability enables manufacturers to reduce the cost of poor quality while improving product reliability across the entire battery production flow, with a single holistic platform.

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Considering the challenges and market maturity stage, battery manufacturers need to deploy advanced inspection and comprehensive monitoring solutions to detect problems at an earlier stage, improve process control, and increase yield, to lower the cost of batteries and enhance reliability. Waygate Technologies has solved this challenge with its patented automation offerings and with its innovative InspectionWorks solution, which will help battery manufacturers overcome their operational challenges and accelerate innovation to zero.

In addition to EVs, Waygate Technologies supports the transportation sector to enable the use of hydrogen cars by using CT systems to inspect fuel cells for stack misalignments, parallelism, casting defects, and fitting tolerances. Through its pioneering presence in the green hydrogen space, Waygate Technologies is at the forefront of leading sustainability initiatives that go beyond EVs and batteries, with its CT and CT-enabling digital solutions.

Implementation of Best Practices and Customer Ownership Experience

When inspecting batteries on a mass-production scale, defects must be detected in an automated manner to ensure manufacturers meet cost and quality requirements. Waygate Technologies has been offering automated defect recognition (ADR) technology for commercial use for the last three decades. For the CT inspection of batteries, the company offers X|approver, an automated and interactive software tool that is provided on-premises with CT equipment. The software uses both physics-based and artificial intelligence (AI)-based algorithms to analyze images swiftly and detect several non-conformances in battery inspections, such as foreign particle inclusions, excessive electrode bend angles, spacing, midtab, overhanging, and cracks. The software can learn from inspection data and feedback over time, drastically improving the detection performance during quality control. Additionally, the company built the X|approver software on open algorithms that customers can access to annotate, train, and release ADR and review, retrain, and release ADR. This feature is unique because X|approver not only executes an algorithm model based on inference but allows customers to retrain the AI-network, which is usually time consuming and costly and needs supplier intervention to optimize the ADR. The capabilities of X|approver clearly demonstrate the competitively distinctive ownership experience that Waygate Technologies offers to customers, in terms of precisely determining the defects to changing products and quality requirements with minimal intervention.

Furthermore, Waygate Technologies continues to demonstrate its commitment to develop battery technology by collaborating with UK Battery Industrialization Centre (UKBIC). The company signed a memorandum of understanding (MoU) with UKBIC in July 2022 to provide a digital twin to gigafactories that produce batteries to optimize production and improve yield. In this MoU, Waygate Technologies will provide the technology and deep knowledge of industrial CT inspection solutions to deliver the digital

twin. The partnership emerged as the winner of the Faraday Battery Challenge funding competition, led by UK Research and Innovation. Moreover, the partnership demonstrates the feasibility in improving the yield and productivity of UK gigafactories with data based on an industrial CT system and the InspectionWorks solution. With the digital twin solution, Waygate Technologies aims to reduce the waste downstream of the cell assembly, which contributes to over 30% of the battery cost, by identifying defects earlier.

Digital twin is emerging as an important technology for growth in the industrial landscape, which Waygate Technologies is utilizing innovatively. The company's customers, therefore, can use the InspectionWorks solution to create a digital twin of fuel cells to determine leaks, thereby showcasing the scalability and broad applicability of the InspectionWorks solution to develop technologies that enable a greener future.

Conclusion

Reducing emissions is critical to have a sustainable and greener world by 2030, as laid out by the UN's SDG; therefore, advancing the commercial viability of battery technology to accelerate EV adoption is important.

Waygate Technologies, with its advanced industrial CT system for battery inspection, is well positioned to increase the safety and reliability of batteries, thus driving EV adoption. Additionally, with its patented automation offerings, AI-based ADR features, and innovative InspectionWorks platform, the company continues to demonstrate its ability to transform the future of battery manufacturing with a better yield and with reduced costs across the entire production flow.

With its strong overall performance, Waygate Technologies earns Frost & Sullivan's 2023 Global Company of the Year Award in the industrial CT systems enabling sustainability industry.

What You Need to Know about the Company of the Year Recognition

Frost & Sullivan's Company of the Year Award is its top honor and recognizes the market participant that exemplifies visionary innovation, market-leading performance, and unmatched customer care.

Best Practices Award Analysis

For the Company of the Year Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Visionary Innovation & Performance

Addressing Unmet Needs: Customers' unmet or under-served needs are unearthed and addressed by a robust solution development process

Visionary Scenarios Through Mega Trends: Long-range, macro-level scenarios are incorporated into the innovation strategy through the use of Mega Trends, thereby enabling first-to-market solutions and new growth opportunities

Leadership Focus: Company focuses on building a leadership position in core markets and on creating stiff barriers to entry for new competitors

Best Practices Implementation: Best-in-class implementation is characterized by processes, tools, or activities that generate a consistent and repeatable level of success

Financial Performance: Strong overall business performance is achieved in terms of revenue, revenue growth, operating margin, and other key financial metrics

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

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The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.
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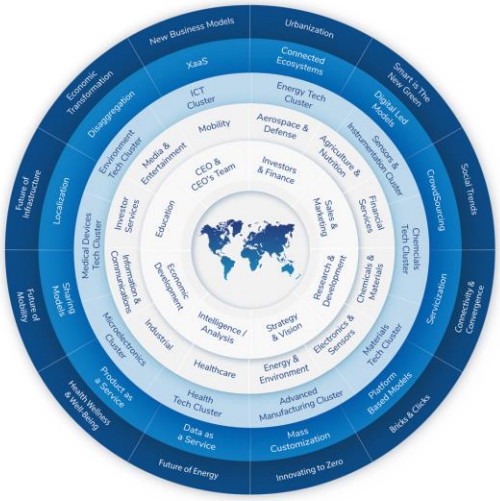
Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.



Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)