FROST & SULLIVAN

AWARD RECIPIENT

2009 North American Product Innovation Award

QuantumSphere, Inc.

The 2009 Frost & Sullivan North American Product Innovation Award, in the field of advanced catalysts for portable power applications, goes to QuantumSphere, Inc. for its QSI-Nano® manganese, a key catalyst used in electrodes for metal-air batteries. Notably, QSI's electrode design incorporating nano manganese has demonstrated an increase in zinc-air battery cathode power up to 320% that could facilitate new power applications. In addition to this solution, the firm is also developing nanocatalysts to reduce the cost of direct methanol fuel cells and address some of the unmet needs in the portable power sector. The company's nanoscale catalysts are manufactured using its patented QSI-Nano® Gas Phase Condensation (GPC) process, a fully automated and scalable manufacturing process that enables production of superior quality nanocatalysts in commercial volumes.

Company Background

QuantumSphere, Inc. (QSI) was founded in 2002 and is headquartered in Santa Ana, California. The company focuses on developing revolutionary portable power and clean technology products leveraging its proprietary catalyst materials technology, high-performance electrode systems, and other advanced technology platforms. The company's technologies are focused on providing lower costs and breakthrough performance in markets such as batteries, fuel cells, hydrogen generation, emissions reduction, and conductive inks. QSI supplies high-quality nanometals and catalysts - and nano-integrated components - for electrochemical and thermochemical applications and licenses its intellectual property in end-use applications.

Relevance in the Market

Today's handheld devices provide users with a number of robust multimedia applications including phone service, internet access, music, cameras, and video, to name a few. Though handy, these functions are placing tremendous strain on portable device batteries, which are not keeping up with the increasing power demands. Hence, there is a critical demand for both disposable as well as rechargeable batteries that can provide the required energy density and power density for the newest portable devices. In addition to power demands, device companies are demanding instant rechargeability and prolonged life without cost penalties. Increased capacity in portable devices also translates into enabling batteries that can meet the cost and performance needs of clean transportation markets.

Technology Overview and Competitive Benefits

QSI has addressed these industry needs by developing high-performance electrodes for primary batteries, rechargeable batteries, and fuel cells. These electrodes include new designs and process formulations that incorporate high surface area nanometal catalysts. One such development is the anode structure for rechargeable nickel metal hydride batteries that leverage the firm's GPC manufacturing process. This development could reduce battery size, which will enable electronics and automotive battery manufacturers to offer their customers improved functionality.

QSI has developed a successful strategy to increase the power density of batteries by pairing new process chemistries with its proprietary nanomaterials. This pairing has achieved a 320% increase in power density in QSI's high-rate cathode electrode for disposable metal air batteries. Vis-à-vis currently used metal particles that are used as catalysts, nanomaterials can have 2,000% greater surface area with just 10% loading in the battery solution. The increased surface area offered by nanocatalysts is largely responsible for the higher reactivity, catalysis, energy density, and power density. QSI is currently working with a global battery manufacturer to provide this increased power in a battery for military and portable power applications.

QSI has also developed a nanocatalyst which reduces the cost of direct methanol fuel cells by reducing platinum usage by 30 to 50%. Additionally, the firm's nanometal catalysts, when used in direct methanol fuel cell electrodes, significantly increase the catalytic surface area resulting in enhanced durability, extended life cycles, and a reduction in device size. This development is expected to accelerate the commercialization of this emerging technology. Recently, QSI received a U.S. Army grant to develop a unitized reformed hydrocarbon fuel cell that can operate at 300 degrees centigrade by leveraging its proprietary membranes and bi-functional anodes.

Best Practices

QSI's patented production process enables high purity, narrow size distribution, and specially engineered oxide coatings for its nanomaterials that are vastly superior to other producers of nanometals. However, the production of nanomaterials is only one step in commercializing next generation performance in portable power. Proper integration of these materials into systems and processes through the use of new chemistries and material sciences holds the key to the success of these nanocatalysts in portable electronic devices. In order to ensure seamless integration with the end-user application, QSI has adopted a hands-on approach with its customers as its core value proposition.

With its disciplined approach to marketing, QSI engages only in specific high-value sectors and only when securing access to industry application experts and compelled lead customers. This focus has resulted in multiple validated products either launched or in process - each with a lead customer to provide initial revenue.

QSI is also known for its frequent collaborations with academic, governmental, and global industrial partners to explore the potential applications of its nanomaterials. The firm announces requests for proposals from universities and colleges in the United States on a yearly basis that are focused on the integration of QSI nanomaterials in devices. Some successful projects include magnetic sensors, antimicrobial coatings and membranes, hydrogen storage, and CIGS thin film solar cells. Additionally, QSI collaborates with universities as subcontractors under various Federal grants that have been awarded to the company in the hydrogen generation, fuel cell, and algae-to-bio fuel domains.

QSI has been granted one patent relating to the manufacture of its nanomaterials, and has 32 other patent applications pending relating to materials and several end-use applications including components for batteries, unitized reformed methanol fuel cells, fuel reforming to hydrogen, emissions catalysts, hydrogen production by electrolysis, bio fuels, ammonia synthesis catalysts, CIGS thin film solar cells, and industrials inks and pastes. Through the licensing of the foregoing intellectual property and know-how, QSI provides competitive advantages to its customers. For its noteworthy achievements in the field of nanoscience, the firm has previously won two key awards: the 2005 Frost & Sullivan Technology Innovation of the Year Award for its Gas Phase Condensation (GPC) process, and the 2007 Small Times Product of the Year Award for its QSI-Nano® manganese product.

Conclusion

Frost & Sullivan is pleased to recognize the significant contributions of QuantumSphere, Inc. to the development of nanometal catalyst products that facilitate the development of next-generation energy storage devices for portable electronic and automotive applications by presenting the company with the 2009 Frost & Sullivan North American Award for Product Innovation. Notably, the company's novel QSI-Nano® manganese is recognized for providing more energy and power density in metal air batteries when used as catalysts. This nanocatalyst, when used in the company's new cathode design for zinc-air batteries, increases their longevity and power output more than 320%, thus enabling new power applications. The company's website is www.qsinano.com.

Award Description

The Frost & Sullivan Award for Product Innovation is presented each year to the company that has demonstrated excellence in new products and technologies within its industry. The recipient company has shown innovation by launching a broad line of emerging products and technologies.

Research Methodology

To choose a recipient of this Award, the analyst team tracks all new product launches, research and development (R&D) spending, products in development, and new product

features and modifications. This is accomplished through interviews with the market participants and extensive secondary and technology research. All new product launches and new products in development in each company are compared and evaluated based on degree of innovation and customer satisfaction. Companies are then ranked by number of new product launches and new products in development.

Measurement Criteria

In addition to the methodology described above, there are specific criteria used to determine final competitor rankings in this industry. The recipient of this Award has excelled based on one or more of the following criteria:

- Significance of new product(s) in its industry
- Competitive advantage of new product(s) in its industry
- Product innovation in terms of unique or revolutionary technology
- Product acceptance in the marketplace
- New product value-added services provided to customers
- Number of competitors with similar product(s)

About Best Practices

Frost & Sullivan Best Practices Awards recognize companies in a variety of regional and global markets for demonstrating outstanding achievement and superior performance in areas such as leadership, technological innovation, customer service, and strategic product development. Industry analysts compare market participants and measure performance through in-depth interviews, analysis, and extensive secondary research in order to identify best practices in the industry.

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