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Technology and Costs

TECH 2021S8: Advanced Carbon Applications in Lithium-ion Batteries

Advanced Carbon Applications in Lithium-ion Batteries is one in a series of reports published as part of NexantECA's 2021Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The advanced carbon materials sector plays a large role in lithium-ion batteries as the provider of materials for anodes, conductive additives, and other important applications. These applications are experiencing unprecedented growth with the expansion in the importance of lithium-ion batteries and an expected wave of battery-electric vehicle demand in the medium term.

This report is a comprehensive review of advanced carbon materials, their value chains, and their applications in the lithium-ion battery industry. It engages with the complex interaction of advanced carbon manufacturing with today's (and tomorrow's) lithium-ion battery material needs.

The advanced carbon industry is rapidly changing along with its growth in the battery sector:

- The technology and innovation in the sector have adapted to both new demand and to renewed commitments to environmental protection from governments, consumers, and corporations
- Players within the formerly largely siloed synthetic and natural flake graphite value chains have begun to horizontally and vertically integrate to address
- New battery electrode chemistries and additive offerings are both threats and opportunities for continued use of carbon materials
- Players outside of China are looking to expand into spherical graphite manufacturing using environmentally friendly technologies not previously used in the heretofore China-centric industry

Commercial Technologies

Most technologies for the manufacturing of carbon materials are not widely differentiated, and intellectual property is freely available. NexantECA covers in this report the commoditized parts of the the manufacturing of spherical graphite and conductive carbon black, prior to the compounding and finishing steps performed by formulators and anode material manufacturers.

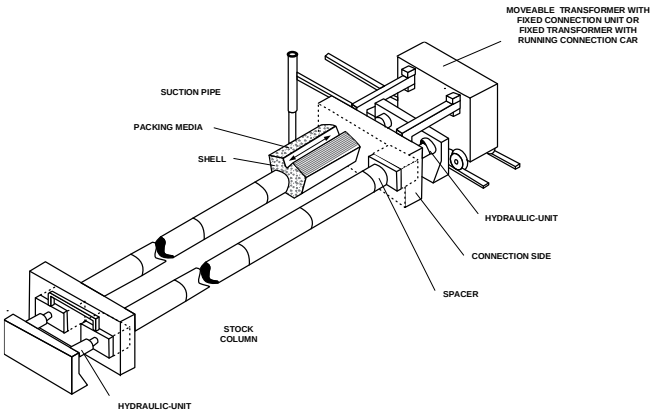
Natural graphite is covered from mined flake graphite mining and beneficiation, micronization, rounding, and purification. Purification methods covered include the major hydrofluoric-sulfuric acid leaches as well as new and innovative fining approaches such as carbochlorination, basic roasting, and high-temperature calcination.

Synthetic graphite is covered from the feedstock level, starting from the coking of soft carbon feedstock and continuing to molding, carbonization, graphitization, micronization, and rounding. Coverage emphasizes innovative techniques for graphitization beyond Acheson furnace processes.

Process Economics

This report covers production scenarios for spherical graphite in coastal China with an emphasis on new cost regimes imposed by Chinese authorities' renewed focus on environmental compliance. Indicative economics are provided for spherical graphite from natural flake graphite and synthetic graphite.

Figure: Castner-Type Graphitization Furnace



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Technology@NexantECA.com or www.NexantECA.com

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

NexantECA serves its clients from over 10 offices located throughout the Americas, Europe, the Middle East, Africa, and Asia.

Americas
Tel: +1 914 609 0300
44 S Broadway,
5th Floor White Plains
NY 10601-4425
USA

Europe, Middle East & Africa
Tel: +44 20 7950 1600
110 Cannon Street
London EC4N 6EU
United Kingdom

Asia Pacific
Tel: +662 793 4600
22nd Floor, Rasa Tower I
555 Phahonyothin Road
Kwaeng Chatuchak
Khet Chatuchak
Bangkok 10900
Thailand

For more information. please contact
Technology@NexantECA.com or www.NexantECA.com