

Li-Ion
Electric Vehicle **Battery**



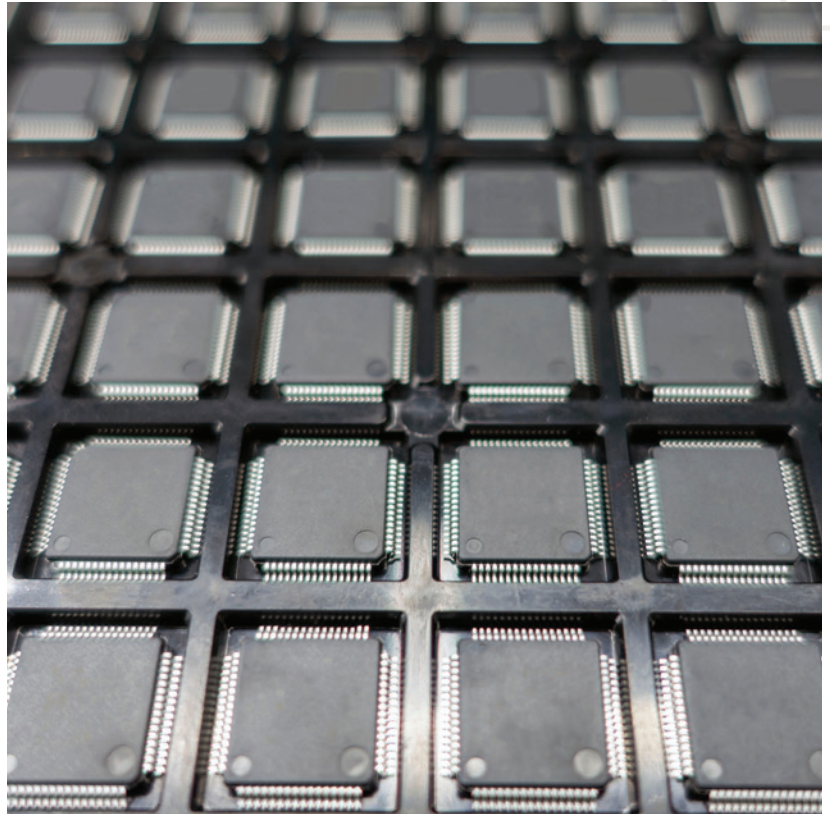
BIRLA CARBON
Materials Innovation

BIRLA CARBON MATERIALS INNOVATION GROUP

As carbon applications become increasingly diverse, Birla Carbon has recognized the need for increasingly flexible alternatives to our core product offering. Our Materials Innovation Group is tasked with exploring the practical edges of what carbon can offer our customers, expanding our mission to be the world's leading carbon company.

Our teams of highly qualified scientists and engineers are researching carbon nanotubes, graphene, natural graphite, and synthetic graphite, to name a few. These innovations will offer our customers solutions for challenges that are only now emerging and will advantageously position them as we all move forward towards unexpected opportunities.

With two substantial research facilities, Birla Carbon has been able to serve the world as a collaborative partner, helping to advance the use of carbon blacks in making products stronger, lighter and longer lasting. Our Materials Innovation Group is taking this mission further by exploring carbon in applications unimagined to previous generations. Paired with our drive towards circularity, our Materials Innovation Group is helping deliver a new generation of carbon solutions, which allow us to expand on our fundamental product purpose.



LEADING ADVANCEMENTS IN CARBON

Our synthesis and characterization capabilities have grown by leaps and bounds. The industry is well aware of our expertise in electron microscopy, which has been honed since the installation of our first electron microscope more than 80 years ago. We have continued to expand our laboratories to ensure that we have all the tools necessary to innovate.

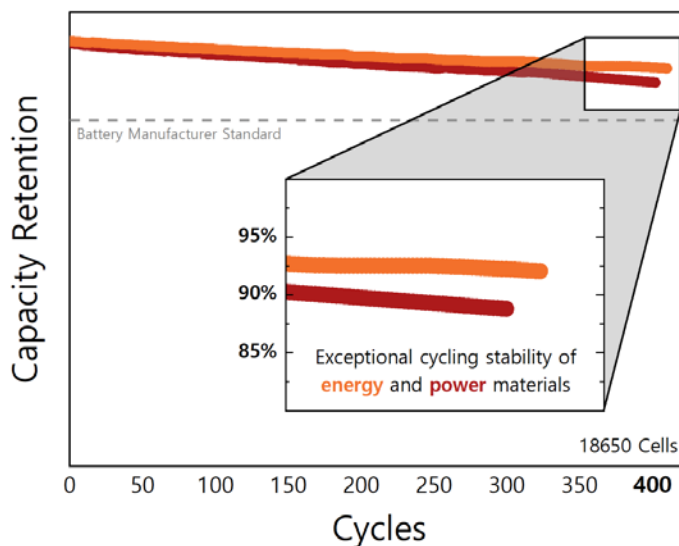
- High-temperature processing
- Chemical vapor deposition
- Advanced microscopy
- Chemical analysis
- Compositional analysis and material identification
- 3D modeling

Our Materials Innovation Group is tasked with searching for new solutions within our existing markets as we identify emerging market needs so that we can build a sustainable future through innovative products and processes. Providing innovative carbon solutions to our existing customers remains our priority. We are dedicated to expanding research and development in novel areas that will redefine what can be achieved with carbon.

BREAKTHROUGHS IN ENERGY APPLICATIONS

The lithium-ion battery market is undergoing rapid growth, and the demand for this type of energy storage will likely outpace raw material supply by 2026. This provides an opportunity for Birla Carbon to participate in this market space by leveraging its carbon raw material manufacturing expertise, culture of innovation, and global footprint. We are combining years of experience across several industries to create high throughput, high-efficiency processes for all types of carbons, including advanced conductive additives as well as anode active materials to be used by energy solutions manufacturers.

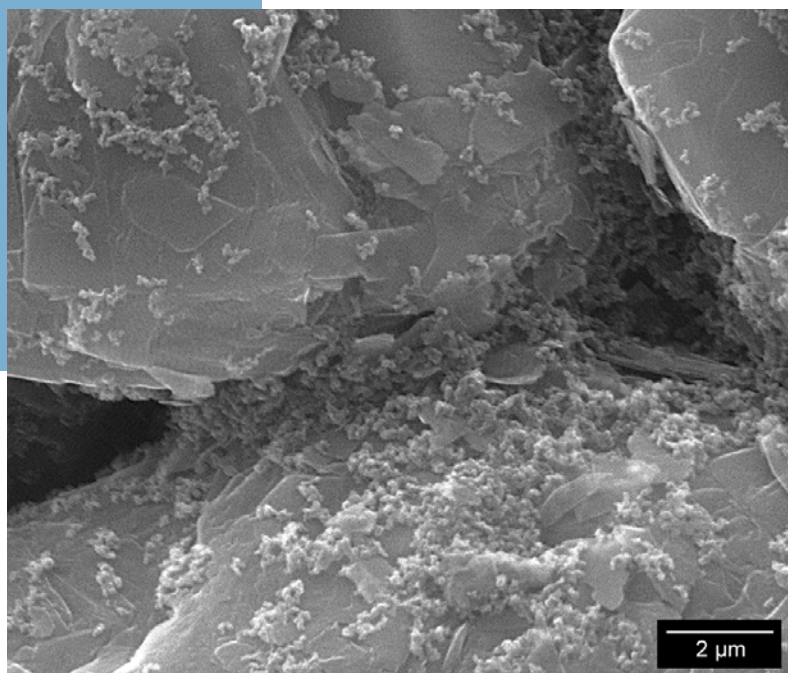
One group in Materials Innovation, Energy Systems, continuously works to develop a wide portfolio of conductive carbons that are designed to dramatically improve the energy efficiency, power density, and charging speed of lithium and lead-acid batteries. We also work closely with our process innovation team to produce graphites for anode active materials with controlled morphological characteristics and advanced coatings. This work will offer our global partners more and better alternatives than currently exist, enhancing the value of products that incorporate our carbon products. The group is also collaborating with national labs and industry partners to develop next generation product offerings for conductive additives, active materials, and synergistic material combinations.



Our state-of-the-art battery assembly and characterization laboratory allows us to quickly screen promising materials for this rapidly growing market. With these capabilities, we have identified materials and formulations that increase battery manufacturer throughput.

- Slurry, electrode, and coin cell production
- Advanced dispersion capabilities
- Long-term cycle life testing
- Fast charge cycling
- Cell resistivity
- Cyclic voltammetry

The Energy Systems team is made up of scientists and engineers with extensive expertise in materials science and chemical engineering. This expertise not only gives the group an advantage to meet the challenges associated with today's state-of-the-art battery technologies, but also accelerates the development of materials and processes that could transform the energy industry.



LEADING THE INDUSTRY IN TRANSFORMATIVE SOLUTIONS

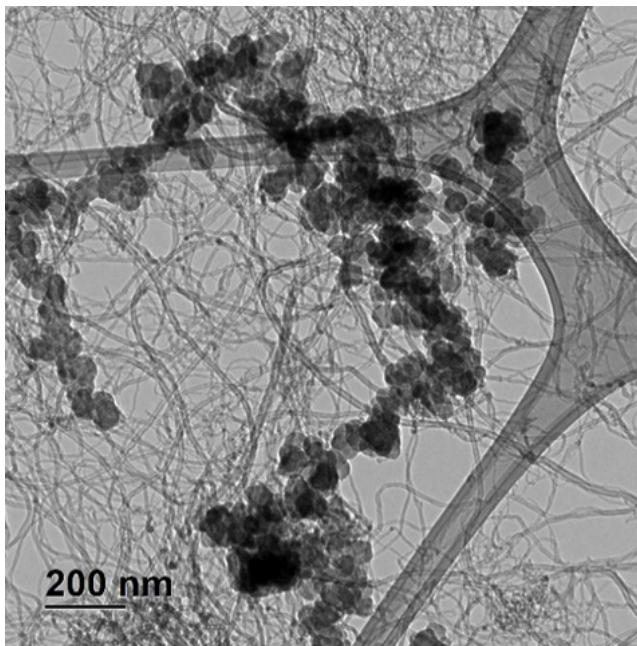
Birla Carbon has an extensive history of producing exceptional products for tires, plastics, coatings, and mechanical rubber goods. We efficiently and sustainably produce carbon materials that can meet internationally recognized ASTM specifications and can meet specific market requirements across industries that depend upon precise carbon formulations. To continue to be the leader in all these economic sectors, we are innovating new carbon materials that will result in transformational change across many different industries.

As a team within Materials Innovation, the New Domains group collaborates with academic, industrial, and research institutes to develop the most promising materials to achieve transformational change in the performance of plastics, coating, tire, MRG, and electronics products.

To push the boundaries, Birla Carbon is developing, identifying, and evaluating new nanomaterials, including carbon nanotubes, graphene, fullerene, carbon nanozoos, and carbon nanofibers. By leveraging the extraordinary properties of new materials, we have developed products that can provide a superior cost/performance ratio better than any other material available in the market for coatings and plastics applications.

Our advanced nanomaterial laboratory allows us to evaluate different materials in customer specific formulations for many different applications. We are then able to characterize these materials and formulations to deliver intelligent insights to our customers and collaborators. These capabilities have allowed us to develop carbons that achieve unseen superior performance and improved formulation costs.

The New Domains group consists of experts from nanotechnology, chemistry, polymer, and materials science backgrounds who challenge the status quo and find the new opportunities to eventually grow and shine both individually and as a member of Birla Carbon extended family. We welcome new opportunities for collaborations with external partners around the globe.





“

If the twentieth century was dominated by iron and steel, the twenty-first century will be dominated by carbon. This versatile element has a near-infinite number of uses and, if we can efficiently recycle carbon, it forms the core of a perfectly circular economy. With the innovations underway in Birla Carbon today, we are perfectly positioned for this future.

”

DOUG BARR

Director of Materials Innovation



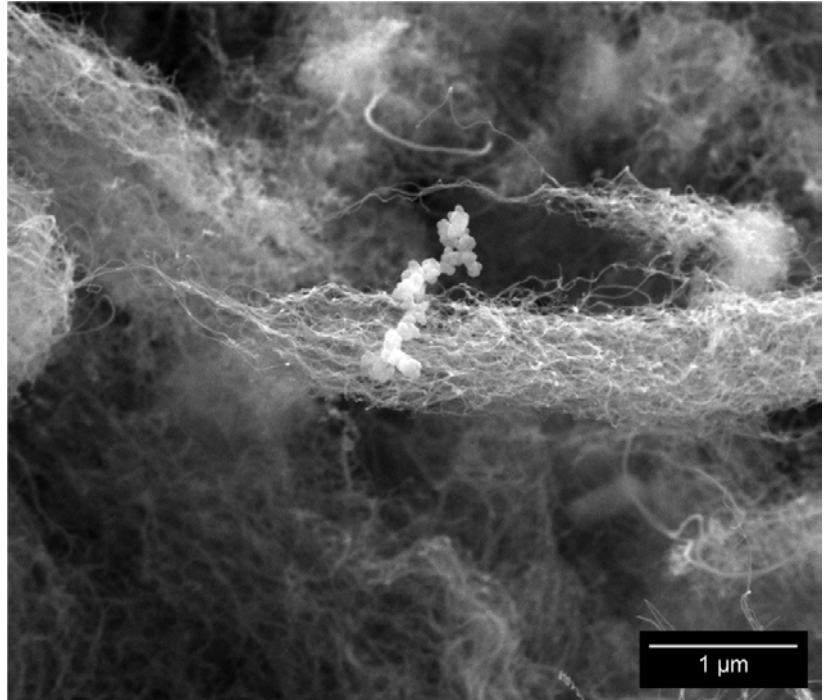
MAKING PRODUCTS STRONGER, LIGHTER AND LONGER-LASTING

Birla Carbon is one of the largest manufacturers and suppliers of high-quality carbon black additives globally, and a flagship business of the Aditya Birla Group.

With a history of innovation, Birla Carbon leads the industry in research and development to develop and accommodate custom solutions that meet or precede shifting industry demands, in collaboration with our customers.

We provide a complete portfolio of products across ASTM grades, non-ASTM grades and specialty blacks. Our global manufacturing presence ensures regular and uninterrupted availability of consistent high-quality products for our customers. Our research into carbon black and how to improve and adapt it for our existing customers remains our priority.

Our growing body of research and development is helping our Materials Innovation group bring new carbon solutions to market, solidifying Birla Carbon's position as a global leader.



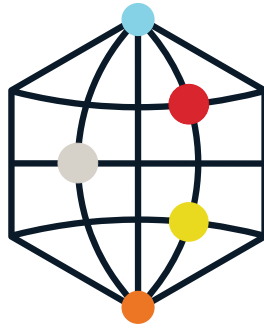
BENDING TOWARDS CIRCULARITY

Circular thinking is as important to us as our customers. Although a completely closed loop may not yet be possible for carbon black, there are areas where we are moving in the direction of circularity. We are an environmentally conscious supplier with concentrated efforts on sustaining and improving the environment through optimization of resources and reduction of emissions.

All of our locations comply with or go beyond all local, governmental and environmental regulations. And in 2020, we received our first ever score and feedback from the Circulytics Method to measure our circularity against their three guiding principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems





SHARE THE STRENGTH

When we form the bonds that make people, customers, and communities more resilient, we **SHARE THE STRENGTH** that matters.



FAMILIAR BONDS

Birla Carbon's value is enhanced through the bonds we form with each other.



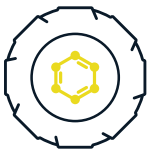
COMPOUND KNOWLEDGE

Birla Carbon is constantly searching for a deeper understanding of our products and their applications.



MICRO MATTERS

Birla Carbon pushes the industry beyond its limits to deliver limitless value.



BEYOND DURABLE

Birla Carbon makes every decision through a lens that anticipates future needs.



CHALLENGE TESTED

Birla Carbon's strength, like the sun, is an energy you can rely on to rise again and again. And that strength shines brightest when we are tested.

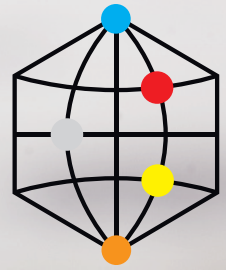
ABOUT BIRLA CARBON

At Birla Carbon, we've been sharing our knowledge for over a century, forging new pathways and finding new solutions. From learning the true structure of carbon black through the lens of an electron microscope, to sharing best practices around the globe, we push beyond the known to create new techniques and applications. We work with each other, for each other, creating value for our customers by being a partner of value. As a family, we take a generational view, making decisions for the long-term, our gaze just past the horizon.

As an ardent practitioner of sustainable development, Birla Carbon's Sustainable Operational Excellence (SOE) strategy

focuses on employee safety, environmental stewardship, efficient use of carbon sources and a key focus on conducting operations in a socially and ethically responsible manner. In 2020, Birla Carbon was awarded a Gold level rating for sustainable practices for the fourth consecutive year by Ecovadis.

Birla Carbon's Purpose, Share the Strength, is about balanced and shared leadership, working at the product level to innovate cutting edge solutions, through collaboration with its people, customers and communities and backed by knowledge built over a century.



SHARE THE STRENGTH

NORTH AMERICA

Birla Carbon U.S.A., Inc.
1800 West Oak Commons Court
Marietta, Georgia 30062-2253
USA
Phone: +1 770 792 9400

SOUTH AMERICA

Birla Carbon Brazil Ltda.
Rua Guaiaá, 66 —
Salas 1012 a 1016 —
Bairro Aparecida
Santos, Brazil 11035-260
Phone: +55 13 3279 1300

EUROPE, MIDDLE EAST, AFRICA

Birla Carbon Europe GmbH
Podbielskistrasse 160 D-30177
Hannover
Germany
Phone: +49 511 630 890

ASIA/INDIA

Birla Carbon India Private Limited
910/911, Kailash Building
Kasturba Gandhi Marg
New Delhi – 110 001
India
Phone: +91 11 2335 1069 / 2335 1070

ASIA/THAILAND

Birla Carbon (Thailand) Public
Co. Ltd.
888/122, 888/128, Mahatun Plaza,
12th Floor, Ploenchit Road,
Lumpini
Pratumwan, Bangkok 10330
Thailand
Phone: +66 2253 6745

ASIA/CHINA

Birla Carbon China (Jining) Co. Ltd.
6th, Chenguang Road,
Jibei High Tech Development Zone
Jining City, Shandong Province
China 272000
Phone: +86 177 5371 2538

ASIA/SOUTH KOREA

Birla Carbon Korea Co., Ltd.
7th Floor Taewoo Building
285 Gangnamdae-ro Seocho-gu
Seoul 137 070

ADITYA BIRLA



BIRLA CARBON

BIRLACARBON.COM

The information presented within this publication is based on Birla Carbon's research and the research of others, but neither its accuracy nor completeness is guaranteed. BIRLA CARBON MAKES NO, AND DISCLAIMS ALL, REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED, REGARDING ACCURACY, PERFORMANCE, STABILITY, RELIABILITY, OR USE, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND OR FITNESS FOR A PARTICULAR PURPOSE. The user is solely responsible for determining the suitability of any product for a specific purpose. No suggestion for use is intended as or should be construed as a recommendation to infringe upon any patent or to violate any law or regulation. Before handling, using, or processing any material, always read its Material Safety Data Sheet.