Redefining limits for 125 years:

The history of GrafTech International, 1886 - 2011

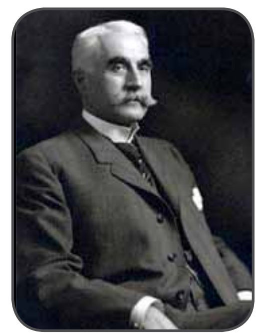
GrafTech International
125
Celebrating 125 Years

GrafTech International | Redefining limits

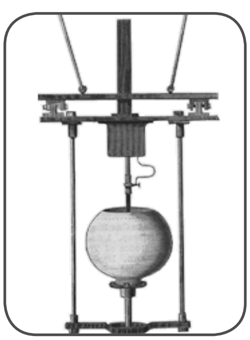
1886-1900:

National Carbon Company and the Beginning of the Carbon and Graphite Industry

The story of GrafTech International can be traced back to around 1872 when George B. Hicks formed the Cleveland Telegraph Supply and Manufacturing Company to manufacture and market his new device, the "Hicks Repeater" which revolutionized the transmission of telegraph machines. After a few years, the company was manufacturing a wide assortment of electrical products. After Hicks died in 1873, George Stockly (pictured at left) took charge of the company. In 1876, Stockly hired his childhood friend, Charles F. Brush. Brush soon perfected an electric dynamo. By 1877, Brush and the Telegraph Supply Company had entered a contract by which the company obtained the sole and exclusive rights to manufacture and sell all of Brush's patented products and in exchange Brush would get a royalty on every sale.



Brush was a prolific inventor. He soon turned his attention to electric arc lights. The use of carbon electrode arc lights had first been demonstrated by Sir Humphrey Davy in 1808. By the late 1870s, the primary arc light in use was the Yablochkov candle. The major weaknesses with the candle were that the carbons needed to be replaced after burning a few short hours and every time it was switched off. To overcome these issues, Brush invented a new type of simple, reliable, self-regulating arc lamp (pictured at right). Earlier attempts at self regulation of arc lamp carbons had often depended on complex clockwork mechanisms that, among other things, could not automatically re-strike an arc if there was an interruption in power. The simpler Brush design used a solenoid combined with a clutch mechanism to adjust the carbons over their entire length. With improvements like an automatic shunt coil to remove a failed lamp from the main circuit, this new lamp/dynamo system made large scale central-station lighting a practical possibility. Brush installed his first commercial arc lamp on the balcony of a doctor's residence in Cincinnati in 1878. By early 1879, small Brush arc lamp installations were being purchased by wealthy individuals, department stores, theaters and factories.



Arc lights needed carbon electrodes (about the size of a long pencil) to work. These were consumed as part of the lighting process and needed to be replaced daily. Brush developed a new carbon material from coke, a by-product of petroleum refining that was readily available from the Standard Oil Company in Cleveland. Brush then made several improvements to the existing carbon electrode technology. These included using a new process of making the electrodes from petroleum coke (first raw, later calcined) and a coal tar binder, then molding (or extruding) the electrodes, and then baking at moderate (non-graphitizing) temperatures. He also introduced the method of coating the rods in a copper jacket to prevent hot spots and increase the working life of the rods.

Brush gave a large scale demonstration in Cleveland's Public Square of the first practical public electric street lamp on April 29, 1879. The event had been advertised for weeks and thousands of people showed up. Many of the spectators, forewarned by the newspapers that the "blinding glare" might be expected "to rival the sun," carried smoked glass to protect their eyes. Just after sundown the dozen arc lights were lit, casting an "an eerie purple glow" over the spectators. Within six months, the Cleveland City Council contracted for "Brush lights," as they soon became known, to be installed, not only in Public Square, but all major adjacent streets as well.

In 1880, following the success of the public lighting demonstration, the name of the company was changed from the Telegraph Supply Company to the Brush Electric Company, both to better reflect the business in which it was engaged and to capitalize on the Brush name recognition. For his achievements, in 1913, Charles Brush was awarded the American Institute of Electrical Engineering's Edison Medal "for meritorious achievements in invention and development of the series arc lighting system."

In 1881, W. H. Boulton, the foreman of Brush Electric Company's carbon department, left Brush Electric, taking in his head all of the methods and Brush trade secrets used to make the world's most advanced arc light carbons. He formed the Boulton Carbon Company to produce identical carbons.

Our history of university-industry collaborations started in this era. Case professor Albert Michelson, who later received the Nobel Prize for his work in physics disproving the ether hypothesis, visited the Boulton factory twice in 1885 in conjunction with student research.

On June 14, 1886, Washington H. Lawrence, who was one of the original partners in the Telegraph Supply Company and co-inventor with Charles Brush on some carbon arc technology and the former Superintendent of the Brush Electric Company, in association with future Ohio Governor Myron T. Herrick; James Parmelee; and Webb Hayes, son of United States President Rutherford B. Hayes, bought a controlling interest in the Boulton Carbon Company. Lawrence then reorganized it as the National Carbon Company, serving as its president until his death in 1900. Under his leadership, National Carbon went from a successful local carbon company to the dominant carbon company in the country.

Also in 1886, another important event happened that would impact the future of the fledgling National Carbon Company. Simultaneously on two different continents, Charles Hall of Oberlin College in Oberlin, Ohio, and Paul Heroult in France used arc carbons in the development of the aluminum reduction process, which lowered the cost of aluminum and enabled the commercial use of the metal.

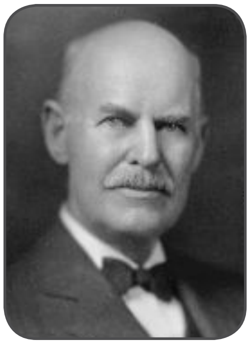
Arc carbons were the company's first line of business, but the company quickly diversified. In 1888, Charles Van Depoele of the Thompson-Houston Electric Company demonstrated the first carbon brushes in the motors of street cars. The next year, the National Carbon Company bought the carbon business from Thompson-Houston and began manufacturing carbon brushes.

Under the leadership of Washington H. Lawrence and his successors, National Carbon developed a strategy of growth based both on the development of new products and by strategic acquisitions. By 1906, National Carbon had acquired over 20 other battery and carbon companies. Among the companies they acquired were the Brush Electric Carbon Company; the Thompson-Huston Carbon Company of Fremont, Ohio; the Crouse-Tremaine Carbon Company of Fostoria, Ohio; the Faraday Carbon Company of Jeanette, Pennsylvania; the American Carbon Company of Noblesville, Indiana; the Phoenix Carbon Manufacturing Company of St. Louis, Missouri; and the Standard Carbon Company of Cleveland.

Along with the purchase of competitive carbon companies, National Carbon began to expand its own production. Started in 1892, a new National Carbon factory was built in Lakewood, a suburb of Cleveland. The plant, later known as “Factory A” was quickly put to use in early 1894, because on December 17, 1893, a fire partially destroyed the Boulton Carbon factory on Willson Avenue (now East 55th Street) in Cleveland. The useable salvaged equipment, along with some of the equipment from the old Brush Carbon plant, was quickly relocated and production restarted in the still unfinished Lakewood facility. Its first products included arc carbons for street lamps and porous plates for wet batteries. Factory A produced arc carbons until 1928, when the production was transferred to Fostoria. In over 120 years of production, Factory A has manufactured products ranging from radios to shower curtains. Today, it is GrafTech’s oldest plant, manufacturing some of our newest, highest technology electronic thermal management materials.

Boulton apparently had not improved the arc-carbon product, but under the leadership of Lawrence, research and development became a key strategy. As a testament to the importance of new product development, a laboratory was part of the original design of Factory A, establishing one of the country’s earliest industrial research laboratories and attracting some of the best scientific talent of the time. The lab specialized in arc carbon, carbon brush and battery applications and became a model for future corporate research centers. By 1910, there were 91 researchers working there.

One of the first successes in this emphasis on new product development occurred in 1896. National Carbon offered the first mass-produced commercial batteries for sale. The Columbia Dry Cell was six inches tall and was used to power home telephones. The batteries were of “dry” carbon-zinc construction. Up to this point, most batteries were “wet” – open glass beakers filled with various acids and strips of metals. National Carbon improved Gassner’s dry design by replacing the plaster of Paris with coiled cardboard, an innovation that left more space for the cathode and made the battery easier to assemble. It was the first “convenient battery for the masses” and made portable electrical devices practical. This technology was the basis for all dry cells for the next sixty years. This innovation was followed in 1898 with the introduction of the first D cell battery, which became the standard size for the newest electrical device, the flashlight. Dry cells were produced at Factory A until 1920. In 2005, the development of the Columbia Dry Cell battery was designated an American Chemical Society National Historical Chemical Landmark.



The artificial graphite industry began in the late 1890s. Dr. Edward G. Acheson was employed as first assistant engineer in Edison's Menlo Park, New Jersey, facility before he struck out on his own. In 1896, he accidentally made synthetic graphite while performing arc furnace experiments on carborundum (silicon carbide) and received a US patent for producing graphite from amorphous carbon in an electric furnace. In 1897, he produced the first commercial graphite rods (7/8" x 1 ¼" x 15") for Hamilton Castner in England for use as anodes in Castner's electrolytic cells. That year, Acheson produced 162,000 pounds of synthetic graphite. Although best known for his Carborundum Company, Acheson also founded the Acheson Graphite Company in 1899. The company initially produced graphite for incandescent light filaments and electrolysis anodes, but soon branched out into electrodes for arc furnaces.

The Notre Dame de Briançon, France, plant was founded as Societe des Carbures Metalliques in 1897 to produce carbon electrodes. In 1910, the company bought the rights to the Acheson graphite technology. In 1932, it joined National Carbon as a joint venture.

Our St. Marys, Pennsylvania plant was founded in 1899 as Speer Carbon by chemist John Speer and financier Andrew Kaul to make carbon brushes for electric motors. It entered the graphite electrode business in 1930 and became part of GrafTech in November 2010.

1900s-1930s:
From Arc Lighting to Graphite Electrodes

This era was marked by several significant events, including the rise and eventual decline in demand for lighting arc carbons; the increasing importance of the aluminum and steel industries; and the integration of the National Carbon Company to form a corporate giant, Union Carbide and Carbon Corporation.

In 1899, the number of arc carbons produced peaked at 158 million. Research efforts had produced a new arc carbon with a 20-time longer life, but incandescent lights were rapidly becoming the predominant electrically powered light.

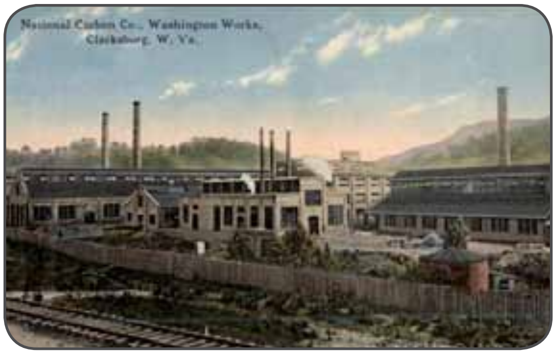
Movies provided the next market driver for arc lighting. In 1902, Factory A began to produce specialty arc lighting carbons for Thomas Edison's Nickelodeon projectors, which was the start of National Carbon's efforts in lighting for the motion picture industry. In 1917, National Carbon began to produce carbons specifically designed for use in motion picture projectors. Development in this area was very rapid to meet the pace at which motion picture film technology was also advancing. In 1917, arc light projectors could produce screen lighting of about 1,600 lumens; by 1940, the light output had increased to 10,300 lumens. Arc lights were also used for filming movies. Until 1917 low powered arc lights were the primary movie lighting source other than the sun. After 1917, high intensity arc lights, which had been developed for military searchlights, became dominant. These lights were used until the advent of sound movies in the late 1920s. Arc lights then quickly became obsolete because they gave off a distinctive sound that could not be easily masked. In 1936, National Carbon introduced a quiet arc light that made it possible for them to again be used for filming. Another boost was given to arc lights by the Technicolor process, introduced in the late 1920s, which needed light as close to sunlight as possible for proper color balance. The incandescent lights of the time could not match the light quality of the National Carbon arc lights but even with progress in movie arc lighting, by 1924 sales of arc carbons were down to two million, most of which were for specialty applications such as blueprinting, therapeutic lamps and photo engraving.

In 1923, National Carbon began research on the possibility of using the carbon arc for therapeutic and industrial applications requiring ultraviolet radiation, such as accelerated weathering machines and “Sunshine” tanning lamps. The basis of this work was the fact that carbon arcs of the flame type are particularly efficient and flexible as a source of ultraviolet light. In 1936, National Carbon developed the Sunshine Arc, a light that was adopted by agricultural experimental stations to provide uniform lighting 24 hours a day

Carbon brushes for electric motors were becoming a growing business and National Carbon began to implement innovations discovered in its research laboratories. In 1905, the company developed electro-graphic (calcined lamp black base) carbon motor and generator brushes. In 1908, National Carbon developed metal graphite motor and generator brushes.

Batteries were fast becoming essential to power a number of devices. One of the most important events in this era was the acquisition of the Eveready name and one of the major users of batteries.

In 1914, National Carbon acquired one of its major customers, the American Ever Ready Company, manufacturer of the Eveready line of flashlights. The company had been founded as the American Electrical Novelty and Manufacturing Company in 1899 and was the first commercial vendor of flashlights. This early flashlight was powered by two National Carbon D batteries, laid front-to-back, in a paper tube with the incandescent light bulb and a rough brass reflector at the end. As interest in batteries expanded, National Carbon and its battery division continued to push research and development into new battery technology. In 1907, the AA battery was developed, followed by the AAA in 1911. The mass-produced AC powered or “light socket” radio was introduced in 1927 and quickly became a highly successful status item; previous Eveready radios ran on large Eveready A and B batteries. In 1929, National Carbon produced the Eveready “Model 53” radio at its Lakewood plant. The radios sold for $220 each ($2,800 in 2010 dollars).



Carbon was becoming an increasingly important industrial material, being used in electrodes for the aluminum, calcium carbide, electric steel and graphite industries. To service the demand, National Carbon built a new carbon plant in Clarksburg, West Virginia in 1904. The “Washington Works” was the first petroleum coke electrode and anode facility of its kind in the world. The location was chosen partially on the availability of inexpensive natural gas in the area.

Taking advantage of the area’s inexpensive electricity costs and its growing importance in the carbon and graphite world, National Carbon built a production facility in Niagara Falls, New York, in 1910. There it produced carbon anodes for the aluminum industry, machined carbon shapes for Acheson to further graphitize, and 24-inch molded coal carbon electrodes.

In 1913, National Carbon entered the activated carbon industry by producing activated charcoal for use in sugar decolorizing.

National Carbon and its corporate predecessors were active in providing products for the military during wartime. For World War I, National Carbon developed high intensity lighting carbons for military searchlights. In 1916, the use of poison gas at the war’s outbreak prompted the governments of France and Britain to request National Carbon to develop activated carbon gas masks, made in part from carbonized coconut shells.

Union Carbide and Carbon Corporation was formed in 1917 from the Union Carbide Company, the National Carbon Company, the Electro-Metallurgical Company, the Linde Air Products Company, and the Prest-O-Lite Company. This was an early example of vertical integration as calcium carbide (Union Carbide) was used in the manufacture of acetylene (Prest-O-Lite) for acetylene automotive lamps. National Carbon’s part in this merger was to produce the anodes used in the production of calcium carbide. Even though National Carbon was part of Union Carbide, it operated as the National Carbon Company until 1963.

The electric arc steel making industry would be an important application for first carbon, then graphite electrodes. In 1906, the first steel made with electric power was manufactured in the United States by the Holcomb Steel Company (later called Crucible Steel) in Syracuse, New York. Many companies joined the electrode manufacturing business, mostly using carbon electrodes, but Acheson with its graphite electrodes was in the lead technologically. In 1909, the Acheson Company patented the improvement of the strength of electrodes using impregnation by pitch. By 1916, the International Acheson Graphite Company found it advantageous to contract all their machined carbon shapes from National Carbon Company and then further graphitize them in their own furnaces. The relationship was cemented when National Carbon acquired Acheson’s graphite electrode business in 1928.

In 1922, the AGX™ electrode brand was introduced. The largest size available was 14” in diameter. Today, GrafTech still sells electrodes for the steel industry under the AGX brand. By the end of the 1920s, 16” diameter graphite electrodes were being produced. In contrast, National Carbon was producing 40” diameter coal carbon electrodes (the next largest size of coal carbon electrodes, 45” diameter, did not debut until 1952).

In 1926, Electrografite di Marone was built in Malonno, Italy, to make graphite electrodes. To improve its technology, in 1931 the company merged with the Acheson division of Union Carbide. During World War II, the company was seized by the Italian government; after the war, National Carbon purchased it back.

1930s-1940s:

World War II and the Development of Nuclear Graphite

After the acquisition of Acheson Graphite, National Carbon was becoming the technology leader in graphite electrodes. For example, joining electrodes in a continuous column for use in arc furnaces was a long-standing problem. After failures using techniques such as dowelling and dovetailing, Acheson found a simple solution by threading opposite ends of the electrode in 1908. Subsequent modifications include the taper electrode joint and the connecting pin, introduced in 1931, which significantly improved joint strength and ease of assembly. This is still the standard for graphite electrodes today.

Specialty graphite products, those meant for industrial use outside of graphite electrodes for the steel industry, started to take off in the 1930s and 1940s. Grade ATJ was introduced in the early 1930s, which would become the flagship fine-grain grade for stringent military and other applications for the next 80 years. Porous carbon and graphite products were introduced in 1936 under the trade names Carbocell® and Graphicell® for filtration of chemical solutions, molten metals and fused salts. In 1937 the facility in Columbia, Tennessee, was built to supply electrodes for phosphorus and ferroalloy customers in the Tennessee Valley Authority area. In 1942, National Carbon Company began using chlorine purification to produce highly purified electrodes for use in spectroscopic electrodes used in spectrometers for the measurement of trace impurities in metals and other materials. By 1943, National Carbon introduced the CS specialty grade graphite, a popular multi-purpose grade that was (and is still) used in casting molds and furnace parts for hot metal, crucibles for melting and alloying, and resistance heating.

In 1939, the Academy of Motion Picture Arts and Sciences presented National Carbon with the first of two awards, this one for Achievement in Scientific or Technical, Class III (certificate). The award read: “Multiple Award: For important contributions in cooperative development of new, improved Process Projection Equipment: For improved and more stable high-intensity carbons.”

As it had done in World War I, the National Carbon Company helped the World War II effort by developing different forms of carbon used in milk irradiators, sun lamps, gas masks and in air conditioning installations. But National Carbon's World War II effort went far beyond arc carbons: in 1942, its graphite grade AGOT was used as a moderator in the first atomic pile built under the University of Chicago's Stagg Field, part of the enormous Manhattan Project. This high purity grade was easily machined into the intricate shapes required for reactor construction. National Carbon delivered 225 tons of AGOT and 30 tons of AGX for the Manhattan Project. The company received a "Chemical Engineering Achievement" award from the US Government in 1946 in recognition of the work it accomplished for the Manhattan Project. An original piece of graphite from the first atomic pile is now in the Smithsonian Museum.

In 1944, National Carbon introduced 24-inch diameter graphite electrodes, just in time for the post World War II economic recovery in Europe, which caused a dramatic increase in the number of electric arc furnaces, mainly for production of alloy steels from recycled scrap.

1950s - 1970s:

Cutting Edge Research, Cutting Edge New Products: Carbon Fiber, Fuel Cells and Alkaline Batteries

The fifties and sixties were exciting years for the National Carbon Company. In 1956, the familiar National trademark was adopted. By 1963, the National Carbon Company division of Union Carbide became the Carbon Products Division of Union Carbide. In 1967, the National trademark symbol was replaced with the UCAR symbol. On the technology front, a number of products, from tailored carbon and graphite solutions to carbon fibers and alkaline batteries, were developed in this era, many of them in the new research facility built in Parma, Ohio, in the mid-1950s.

In 1956, the Academy of Motion Picture Arts and Sciences presented National Carbon with an Academy Award for Achievement in Scientific or Technical, Class I (statuette): for development of a high efficiency yellow flame carbon for motion picture color photography. The carbon was important because it produced a yellow color specifically designed for the motion picture film of the time.

In 1956, the new National Carbon Company Parma Research Laboratory located in Parma, Ohio, near Cleveland, was opened. The $6 million facility contained 158 laboratory modules and an auditorium that was designed to double as a laboratory and project room for research on light sources for the motion picture industry, as an auditorium in a research building was considered unnecessary at that time. The facility was designed primarily for basic research in chemical and solid state physics. The building has been expanded several times, most notably in 1965 when a pilot plant was added and the facility's name was changed to Parma Technical Center.

Eveready Battery once again revolutionized the battery industry in the 1950s, introducing alkaline battery technology, a giant step toward longer battery life in portable, battery-powered devices. The original patent for alkaline batteries was filed by Lewis Urry (pictured, at right), Karl Kordesch and P.A. Marsal in 1957. In order to sell the idea to his managers, Urry put the battery in a toy car and raced it around the Parma Research Laboratory cafeteria against a car with conventional dry cell batteries. His invention had many times the durability. Alkaline batteries were commercialized in 1959. The original prototype of the alkaline battery is now in the Smithsonian Museum. Urry is considered "the father of the alkaline battery" and has 51 patents to his name. Other important innovations made throughout the 1950s and 1960s in batteries include the first 9-volt battery in 1956, the first rechargeable nickel-cadmium batteries in 1958, and the first silver oxide button cell for use in miniature hearing aids and watches in 1960.

National Carbon Company started research into carbon fibers during World War II by carbonizing rayon and polyacrylonitrile (PAN) yarns as a possible substitute material for control grids in vacuum tube power amplifiers. The modern era of carbon fiber development started at the Parma Research Laboratory in 1958 when Dr. Roger Bacon demonstrated very high strength and modulus fibers. Also that year, Dr. Bacon may have been the first person to make carbon nanotubes, hollow cylinders of graphite with diameters on the order of single molecules, which were not formally described until 1991 by a Japanese researcher. Dr. Bacon received the 2004 Benjamin Franklin Medal in Mechanical Engineering for his achievements.

It was not until the late 1950s that National Carbon began to commercialize carbon fiber cloth and felts for use in heating elements and rocket nozzle exit cones. In 1963, Union Carbide began the first commercial production of continuously processed carbon yarn, permitting for the first time the development of carbon fiber composites made by filament winding or by lay-up of pre-preg tapes. This was the initial entry of carbon fibers into the advanced composites industry, which had previously been dominated by glass and boron fibers. Until 1965, all commercial carbon fibers were relatively low strength and low modulus until the introduction of Thornel rayon based fibers from the work of Dr. Roger Bacon.

The next major breakthrough in carbon fibers was in 1970 when Dr. Leonard Singer produced the first truly graphite fibers from mesophase pitch. These high strength, high thermal conductivity fibers, commercialized in 1975 under the Thornel brand name, have found uses in military and space applications. Dr. Singer was inducted into the Polymer Hall of Fame based on the discovery of mesophase based carbon fibers. He was also named a Fellow of the American Carbon Society, the society's lifetime achievement award.

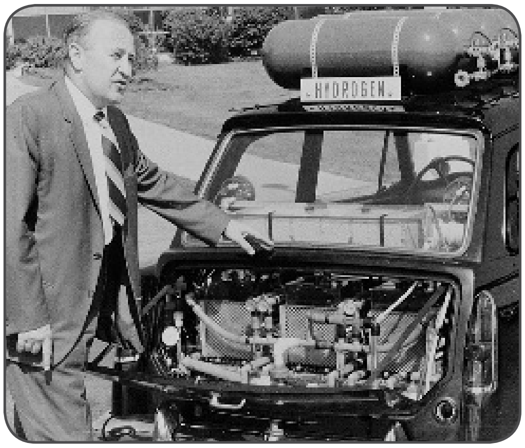
The rise of importance in mesophase pitch for the manufacture of high performance graphite fibers meant an increased interest in the manufacturing of mesophase pitch. In the early to mid 1970s, Dr. Irwin Lewis, made important contributions in both the chemical understanding of mesophase pitch as well as improvements in the manufacturing. He was named a Fellow of the American Carbon Society in recognition of his contributions to the carbon field.

In 2003, the American Chemical Society designated the development of high performance carbon fibers as a National Historic Chemical Landmark. The plaque reads "Scientists at the Parma Technical Center of Union Carbide Corporation (now GrafTech International) performed pioneering research on carbon fibers, for their weight the strongest and stiffest material known at the present time. In 1958 Roger Bacon demonstrated the ultrahigh strength of graphite in a filamentary form. Seven years later continuously processed high performance carbon yarn, from a rayon precursor, was commercialized. In 1970 Leonard Singer produced truly graphitic fibers, leading to the commercialization of carbon yarn derived from liquid crystalline pitch. Carbon fibers are used in aerospace and sports applications."

National Carbon had been developing graphite specifically for the molten metal industry since 1937. Graphite's properties of no metal adhesion, high heat transfer, dimensional stability, lack of warping, and purity make it a material into which molten metal can be poured. In 1950, a radically new method of controlled pressure pouring of steel into graphite molds was developed for the casting of railway car wheels, with National Carbon supplying the graphite for this application.

Refractory bricks, used as linings for blast furnace and submerged arc furnace linings, were first made in 1958 using a revolutionary hot press method implemented at the newly built Lawrenceburg, Tennessee, facility. NMA™ refractory brick was the first product to be introduced, and is now part of a family that includes NMD™ semi-graphite brick, NMH™, NML™, and NMP™.

In 1958, the Monterrey, Mexico, plant was built to supply the Mexican domestic steel industry with graphite electrodes, and is now the largest graphite plant in the world.



National Carbon's involvement with fuel cells started in 1955. The most well-known researcher in this area was Dr. Karl Kordesch, who started his career with National Carbon by contributing to the basic patents for the alkaline battery. He then branched out to alkali fuel cells with carbon gas-diffusion electrodes. He demonstrated fuel-cell-powered mobile radar set for the US Army, a fuel-cell-powered motorbike, and drew up plans for an undersea base that would run on fuel cells. Dr. Kordesch developed hydrogen fuel cells for the US Space program, the US Navy and the General Motors Electrovan. In the early 1970s he built a fuel cell city car (an Austin A 40, designed as a hybrid vehicle with rechargeable batteries) for his personal use and operated it on public roads for several years. Later he demonstrated a gasoline-lead battery hybrid car variation of the Austin at NASA test-track facilities.

In 1963, Union Carbide purchased High Temperature Materials Inc. of Lowell, Massachusetts, mainly for its expertise in high temperature pyrolytic graphite materials, used predominately for military missiles, rockets and space vehicles. Through this acquisition, GRAFOIL®, a pure, flexible, all-graphite material with highly directional properties was added to the product portfolio. GRAFOIL was launched as a commercial product in 1967. Its first sales were in high temperature spacecraft gaskets and valve packing applications for NASA and the Pentagon. It also found uses in automotive head gaskets and industrial gaskets as a replacement for asbestos. In 1975, a purified version of GRAFOIL was introduced, compatible with stainless steel pumps that could also be used in nuclear applications. In the early 1980s, asbestos gaskets were phased out due to health and environmental concerns. GRAFOIL materials became the preferred gasket material for applications above the temperature range of polymer based gaskets (>250 °C). GRAFOIL gaskets became standard on the GM-Buick 3.0 liter and later the GM-Buick 3.3 liter engines. GRAFOIL gaskets also became standard in the Honda Civic and for several years these gaskets were found on the majority of Japanese passenger cars.

During the late 1960s and the early 1970s, growth in the steel industry necessitated the increase in capacity for graphite electrodes. The Pamplona, Spain, graphite electrode manufacturing facility was built in 1968. In the same year, the Meyerton, South Africa, facility started as a joint venture between African Metals Corporation of South Africa and SIGRI; in 1971, Union Carbide replaced SIGRI in the joint venture and Meyerton subsequently became wholly owned by Union Carbide. In the following year the Salvador, Brazil, facility was built as the only South American manufacturer of graphite electrodes. Then in 1976, the Calais, France, site was chosen to supply the Northern European market with graphite electrodes; the location chosen in part due to the skilled workforce from a declining lace industry

Union Carbide began to produce Grade ATJS fine grain synthetic graphite in 1969 used for high performance applications, such as rocket nozzles and re-entry vehicle nose tips. In 1975, a dedicated facility was built under contract by the US Navy to produce ATJS. Named the "Controlled Line Facility," and located on the premises of the Parma Technical Center, this was an early example of a heavy industry plant that was completely computer controlled. The facility was in operation for ten years. Today, the building is used to make advanced flexible graphite products.

R&D Magazine established the R&D 100 Awards (then known as the IR-100 Awards) in 1963 to recognize the "100 Most Technologically Significant New Products & Processes of the Year." Over the years, the research team based at the Parma Technical Center has won 16 of these awards, starting in 1963 for GRAFOIL graphite tape. During this era of intense research and commercialization, we won awards for refractory metal (1964); high modulus Thornel graphite fibers (1966); Boralloy® pyrolitic boron nitride lab ware (1966); porous metal sheet (1966); UCAR graphite monochromator made from pyrolytic graphite for use in x-ray analysis (1968); carbon and graphite foams for use in aerospace applications (1968); code 114 treated graphite, which is an anti-oxidation treat (1970); and jet airplane brake discs (1970).

1980s – 1990s:
Rebuilding the Company

In the early 1980s, the company adopted the Deming quality philosophy throughout its global organization. It introduced SPC (Statistical Process Control), TQM (Total Quality Management), PIQ (Partners in Quality with Suppliers) and Best Practices (Definitions of Best Technology) for all processes. These methods, combined with strong technical relationships with suppliers and customers, established GrafTech as the world's leader as a stable, consistent and value add partner for our customers.

By the late 1980s, many of the product lines that had made up the National Carbon Company and the Carbon Products Division of Union Carbide were sold. Eveready Battery became part of Ralston-Purina and then Energizer. The carbon brushes, the carbon felt and cloth, and the National trade name were sold to Morgan Technologies. The pyrolytic graphite and boron nitride business became part of Advanced Ceramics, which has since become Momentive Performance Products. The carbon fiber technology was sold to Amoco, and later to Cytec. The graphite electrode and the other carbon and graphite businesses that remained became part of UCAR Carbon Company, a wholly owned subsidiary of Union Carbide Corporation, in 1989. Union Carbide sold a half-interest in the UCAR Carbon Company to Mitsubishi Trading Company in 1991, and the company became known as UCAR Carbon Company.

In 1995, the UCAR Carbon Company again became a publicly traded independent company, traded on the New York Stock Exchange as UCAR International.

In 1991, research into fuel cells was restarted. This time the basis for the research was the GRAFOIL flexible graphite platform, and the emphasis on developing bipolar plates for proton exchange membrane hydrogen fuel cells. In the mid-1990s UCAR Carbon collaborated with Ballard Power and by 2000 was in fuel cells for test cars and buses.

2000 to 2011:

Explosive Growth through New Product Innovation and Acquisition

As it was 125 years ago, GrafTech is poised for growth both through new product development and strategic acquisitions. The first decade of the 21st century coincided with a financial turnaround. In 2002, the company's name was changed from UCAR Carbon Company to GrafTech International to emphasize its technology capabilities in graphite materials. Due to wide industry recognition and acceptance, UCAR is still a brand name for many products of GrafTech.

In 2002, when Craig Shular became president of GrafTech, he headed a company that had sales of $613 million and debt obligations of $1.1 billion. He spearheaded a debt reduction and sales growth initiative that turned the company completely around in only six years. By 2008, sales were $1.2 billion with debt of only $182 million.

With a now-impressive balance sheet, GrafTech returned to something that it had not done in years: growth by acquisition. In 2010, GrafTech acquired graphite electrode producer C/G Electrodes LLC and needle coke manufacturer Seadrift Coke LP for an aggregate of $692 million. C/G Electrodes was originally founded in 1899 as the Speer Carbon Company in St. Marys, Pennsylvania. Seadrift Coke, located in Port Lavaca, Texas, was the second largest needle coke producer in the world at the time of its acquisition by GrafTech. The Seadrift plant was originally part of a vertical expansion program initiated by the Airco Carbon Division of British Oxygen Corporation (BOC), the forerunner of C/G Electrodes, and was completed in August 1983.

Seadrift Coke L.P.

In 2011, GrafTech acquired Micron Research. Founded in 2000 and headquartered in Emporium, Pennsylvania, Micron Research manufactures a family of premium fine grain graphite electrode materials specifically engineered for the Electrical Discharge Machining (EDM) industry.

Micron Research EDM Graphites

New product development ramped up this decade. Development work lead by Dr. Julian Norley and his colleagues for electronic thermal interface materials for electronic thermal management was begun in 1999. This material enabled the establishment of the ultra-thin laptop computer technology and has provided a lightweight, thin heat management solution for large panel displays (plasma and LCD), handset phone/PDA applications, notebook computers and LED lighting. The materials are sold under the SPREADERSHIELD® product line, which has won two R&D 100 Awards: in 2003 for HS-400® heat sinks and in 2004 for SPREADERSHIELD.

Since the 1930s, the standard for joining graphite electrodes for electric arc furnaces together has been the tapered pin, introduced by National Carbon. In 2004, GrafTech culminated years of research in improving graphite electrodes for extremely stringent electrode furnace operations by introducing Apollo® (now ALX™) electrodes, a pin-less joint design for large diameter graphite electrodes that eliminates premature tip losses and improves the customer's electric arc furnace productivity. The Apollo design electrodes won the 2005 R&D 100 Award.

GRAFOAM® carbon foam is a unique engineered material that is lightweight and can be used as an insulation material. It has applications for high temperature furnaces and tooling for aerospace carbon/carbon composites manufacturing. GRAFOAM carbon foam won the 2006 R&D 100 Award.

GrafTech's GRAFCELL® flow field plates are a natural graphite based solution that allows lighter and thinner designs for proton exchange membrane fuel cells. Today GRAFCELL products are found in 70% of fuel cell vehicles and more than 50% of bus programs worldwide. GRAFCELL products can be found in transportation, stationary and portable fuel cell applications. In 2007, GrafTech was awarded an R&D 100 Award for GRAFCELL. Also that year, GrafTech received its first visit by a US President when George W. Bush visited the Advanced Flexible Graphite manufacturing plant in Parma, Ohio, in support of his alternative energy policy and goal to reduce US dependence on foreign oil. In 2008, GrafTech became the first location in Northeast Ohio to install a hydrogen fueling station to power its fuel cell lift truck that has GRAFCELL components in it.

The use of graphite-based materials as flexible heat transfer plates for radiant floor applications was pioneered by GrafTech. This work, partially funded by a grant from the Ohio Third Frontier Program, won an R&D 100 Award in 2009.

Based on work by Dr. John Chang and colleagues, GrafTech launched eGRAF® SPREADERSHIELD™ SS1500 flexible graphite heat spreader, the highest thermal conductivity material for electronics and lighting applications, in 2010. This work was also partially funded by a grant from the Ohio Third Frontier Program. Dr. Chang is a Fellow of the American Carbon Society. The SS1500 product won the 2011 R&D 100 Award, our sixteenth in company history. As of mid-2011, the implementation of this product alone has meant numerous new jobs for the State of Ohio.

From the electric arc light to the advanced electronics of smart phones and other devices, GrafTech continues to be the industry leader in innovation and technology. The company and its corporate predecessors have a long, rich history of research and development expertise, acknowledged by the many patents and awards earned throughout the years. The driving force is forward-thinking, strong leadership focused on continually evolving and developing technological expertise well beyond what is currently imaginable.

GrafTech is committed to "Redefining Limits" in temperature, size, performance, thickness and the many other attributes necessary to enable its customers to advance and grow in this ever-changing world. GrafTech's advanced materials and broad-based solutions developed for the many industries it serves—including iron, steel, electronics, energy storage, solar, nuclear, oil & gas, aerospace and many others—will position the company and its customers to continue to grow and evolve well into the future. Based on its history of creating, innovating and manufacturing material science based solutions for a wide variety of applications, GrafTech proudly welcomes the challenges of the next 125 years!

Redefining limits