Materials
From Pottery to Plastics

First Process for Making Aluminum

In 1885, Charles Martin Hall, a native of Thompson, Ohio, and graduate of Oberlin College, discovered the first pr actical process for making aluminum from bauxite ore. The process opened the way for widespread use of aluminum in consumer and other products.

The story goes that while attending Oberlin, Hall's professor, Frank Jewett, showed a small piece of aluminum to the students and predicted that anyone who could come up with an economical way to create aluminum would become quite rich. Hall apparently took the idea to heart, built a small lab at his home, and continued experimenting after graduating until he solved the puzzle. He figured out how to make aluminum. In February, 1886, Hall filled a carbon crucible with a cryolite bath containing alumina and passed an electric current through it. The resulting mass contained several pellets of pure aluminum.

The electrolytic method - the Hall-Heroult process – remains the basis of the world's aluminum industry. However, turning the experiment into an industry took a great deal of support and funding.

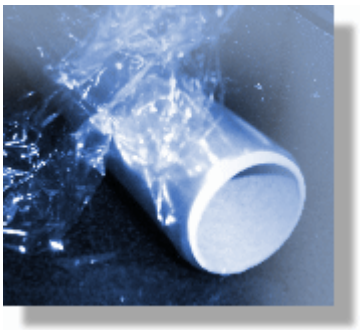
In 1888, Hall and financier Alfred E. Hunt founded the Pittsburgh Reduction Company, which now is the Aluminum Company of America (ALCOA). Aluminum once cost more per ounce than gold. By 1914, Hall's process reduced its price to 18 cents a pound.

Hall's professor was right. Hall made a fortune on the process. He left much of the proceeds to Oberlin College and other educational institutions. ALCOA has remained the world's leading aluminum company.

Find out more...

- ALCOA (www.alcoa.com)
- ALCOA History (www.alcoa.com/global/en/about_alcoa/dirt.asp)
- Aluminum Production Process Video (www.alcoa.com/global/en/about_alcoa/dirt_video.asp)
- It All Starts With Dirt - The Making of Alumunim at ALCOA (PDF) (www.alcoa.com/global/en/about_alcoa/dirt/pdf/startswithdirt.pdf)

Materials
From Pottery to Plastics



Cellophane Packaging

William Hale Charch (1898-1958), who received a doctorate in chemistry from The Ohio State University in 1922, invented moisture-proof cellophane while working at DuPont. Cellophane revolutionized the food packaging industry, allowing use of the inexpensive transparent material on meat, fruits, vegetables, and other products.

Charch joined DuPont in 1925, and one of his first assignments was to develop a way to moisture proof cellophane. The goal was to improve cellophane so that it could be marketed for food packaging. He tested ideas some 2000 times but was eventually successful in his attempt. Food packaging has never been the same. Good pricing, strong marketing, and a general belief that cellophane was synonymous with cleanliness pushed cellophane sales. By 1938 cellophane sales accounted for 25% of DuPont's annual profit.

Charch continued his career at DuPont, serving in several capacities including Associate Director of the Rayon Chemical Division and Director of the Rayon Pioneering Research Section. In 1947 he established the Textile Fibers Department's Pioneering Research Lab. He focused much of his career directing the development of Teflon® , Orlon® , Dacron® , and Lycra®. Along the way he received a variety of awards for his work.

Cellophane History

Cellophane was originally invented in 1908 by Jacques Brandenberger, who was a Swiss textile engineer inspired by watching wine spilled onto a tablecloth in a restaurant. He thought that a plastic film might be layered onto fabric for a waterproof table covering. Though his attempts to layer the fabric failed, Brandenberger noted that the clear coating would peel off in a film. The rest is history. Cellophane was first produced commercially in Switzerland in 1912. In 1923, DuPont acquired the U.S. patent rights and began production in Buffalo, NY, in 1924.

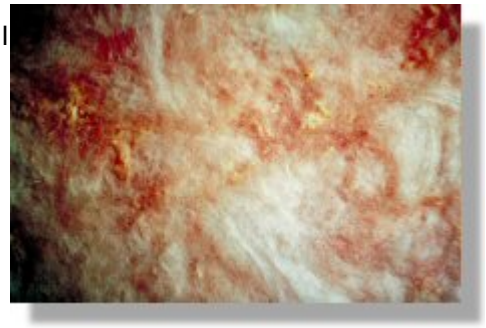
Find out more...

- DuPont Heritage: Cellophane (http://heritage.dupont.com/touchpoints/tp_1923-3/overview.shtml)

Materials
From Pottery to Plastics

Father of Fiberglas

In 1938, Games Slayter (1896-1964), a scientist with the Owens-Illinois glass company in Toledo, Ohio, invented a process for spinning molten glass into fine, thread-like fibers. At the time, Owens-Illinois was anxious to develop new products to increase sales, which had slowed during the Great Depression, and to use more of the company's glass-making capacity.



During his time at Owns-Illinois, Slayter noticed how small amounts of molten glass were stretched into glass fibers when the glass was pulled through openings in a melting furnace. From this, Slater invented fiberglas, which was first manufactured by Owens-Corning, where Slayter was up for research. The material is said to have been originally called "glass wool."

Often called "the Father of Fiberglas," Slayter secured over 100 patents that impacted industries ranging from agriculture to manufacturing to home construction.

Fiberglas Goes To War

In 1929, the U.S. Navy Bureau of Ships selected Owens-Corning insulation as the standard insulation for all horizontal and vertical spaces in all new warship construction. The war was an opportunity for Fiberglas to perform as an insulating material. In addition, it was a chance to showcase the capabilities of Fiberglas reinforcements and yarns. The war also inspired development of other Fiberglas products such as bonded mat, battery separators, staple wire insulation, and sewn-blanket and metal-mesh-blanket insulation.

One interesting application of Fiberglas was in the fabric used in parachute flares. On moonless nights, military aircraft dropped flares ahead of bombing runs to help crews identify the correct targets. The flares needed small parachutes to slow their descent. However, the traditional silk parachute material burned easily. Fiberglas fabric proved more effective because it was both fire-resistant and light-weight.

By the end of 1939, Owens Corning reported $3.8 million in net sales and employed over 1,000 people. Since then, the company has grown to $5 billion in sales and 20,000 employees.

What's New?

Owens-Corning has recently reinvented Fiberglas insulation at its research lab in Newark, OH. The new product - MIRAFLEX® Insulation - has exclusive, randomly twisted fibers that make the insulation cottony soft. It's virtually itch-free, so handling and installation are much easier than ever before. Compressed when packaged, it expands when installed, which makes transportation simpler too.

Did You Know?

- "Fiberglas," spelled with one "S," was first used as a trademark of Owens-Illinois in January, 1936, on all Owens-Illinois glass fiber products.

Find out more...

- Owens Corning History
  (www.owenscorning.com/acquainted/about/history)
- Owens Corning: Profile of Slater
  (http://pressroom.owenscorning.com/fertile_minds.html)

Materials
From Pottery to Plastics

Pottery Capital of America

John Bennett (1840-1907), a potter from Staffordshire, England, recognized that rich deposits of potters' clay existed in the East Liverpool, Ohio, area. In 1840, he built the first kiln in the area, launching Ohio's great ceramics industry. East Liverpool became "The Pottery Capital of America," and in the 19th Century produced and sold the majority of America's crockery.

By 1890, East Liverpool had eighteen potteries that employed 2,200 workers. The Knowles, Taylor & Knowles Pottery had more than 600 employees and was one of the largest in the world.

Antique Dakota Vase
by Knowles, Taylor, & Knowles

Though Bennett had trained in the Staffordshire pottery tradition, he also developed his own individual style. He taught pottery decoration classes in his studio, and also demonstrated underglaze china painting techniques at the Society of Decorative Art in New York City.

The Museum of Ceramics

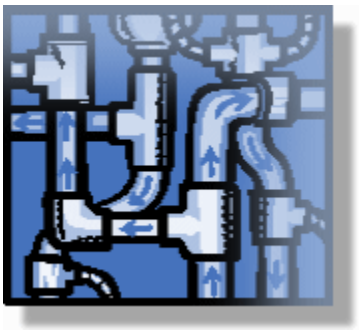
The Museum of Ceramics is managed by the Ohio Historical Society and is located in East Liverpool, Ohio. Its exhibits depict East Liverpool and its ceramic industry from 1840 to 1930, a period when the area's potteries accounted for about half of the ceramics manufactured in the United States. It is said that ceramic manufacturing was more important in East Liverpool during the late 1800's than is steel production in Pittsburgh or automobile manufacturing in Detroit today.

Find out more...

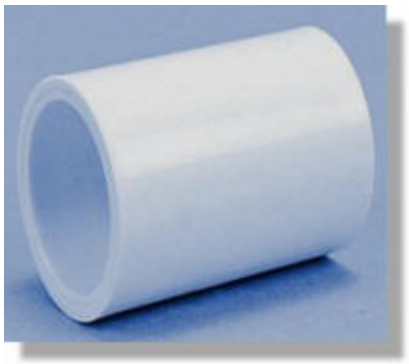
- "Decorative Pottery Of Cincinnati," 1881, Harper's New Monthly Magazine (www.oldandsold.com/articles02/article1003.shtml)
- The Museum of Ceramics, East Liverpool, OH (www.themuseumofceramics.org/pottery.html)
- The Ohio Ceramics Center (www.ohiohistory.org/places/ohceram)
- American Ceramics Society (www.ceramics.org)

Materials
From Pottery to Plastics

Invention of PVC Plastic



Waldo L. Semon (1898-1999), a native of Hudson, Ohio, was a young research chemist with the B.F. Goodrich Company in Akron in 1926 when he attempted to invent a method for converting a waste plastic (called polyvinyl chloride or PVC) into an adhesive that could bond metal to rubber. "People thought of PVC as worthless back then," Semon explained. "They'd throw it in the trash."



Semon did not succeed with this venture, but through the process of heating the PVC he inadvertently discovered a substance that was both flexible and elastic. Applications for the PVC did not come along instantly, but over time the substance has become the world's second-best-selling plastic, generating billions of dollars in annual sales.

In 1933, a U.S. patent was issued to Semon, titled "Synthetic Rubber-like Composition and Method of Making Same" (U.S. No. 1,929,453). The patent suggested a variety of uses for the product, including water-proofing and flooring. PVC is the key ingredient in plastic piping and was also used to manufacture phonograph records.

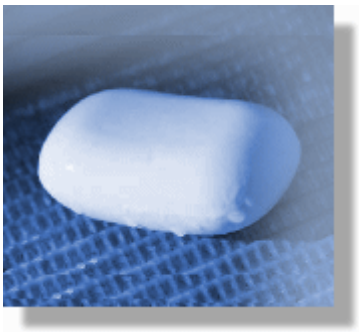
Down the road, Semon's research also helped lead to the discovery of thermoplastic polyurethane and the first oil-resistant synthetic rubbers. He also is said to have helped pioneer bubble gum.

Find out more...

- American Plastics Council: History of Plastics (www.americanplasticscouncil.org/s_apc/sec.asp?TRACKID=&SID=6&VID=86&CID=310&DID=920)

Materials
From Pottery to Plastics

Soap Industry Floated Out of Ohio



In 1837, William Procter and James Gamble formed a partnership in Cincinnati, Ohio to manufacture soap and candles. The two faced large obstacles, not the least of which were fourteen other soap and candle makers based in Cincinnati. However, by 1850, the Procter & Gamble star and crescent had become the best known trademark in the United States.

In 1861, to meet the needs of the Union Army during the Civil War, plant engineers introduced power-driven paddles to stir batches of soap. A miscalculation resulted in a foaming, frothing mass of raw material. Though plant officials expected the mass would produce poor-quality soap, the company chemist determined the soap was normal except for one unusual property: it floated. Customers who received some of the mistakenly made product soon clamored for more, specifically requesting "the kind that floats."

Harley Procter, William's oldest son and his sales manager, named the new soap "Ivory." The story goes that he read the words "out of ivory palaces" in the Bible, and thought the name Ivory would be a good match for the white soap's purity, mildness, and long-lasting qualities. In 1882, Harley also was behind an $11,000 effort to advertise Ivory nationally for the first time. By 1890, P&G was selling more than 30 different types of soap, including Ivory.

Although candles were originally a large part of P&G's product line, the invention of the electric light bulb took a toll on the candle market, and candles were discontinued in the 1920's.

P&G Today

P&G is a recognized leader in the development, manufacturing, and marketing of Fabric & Home Care, Baby Care, Feminine Care, Tissues & Towel, Beauty Care, Health Care, and Food & Beverages products.
P&G markets approximately 250 brands to nearly five billion consumers in over 130 countries. P&G also employs nearly 106,000 people worldwide.

Did You Know?

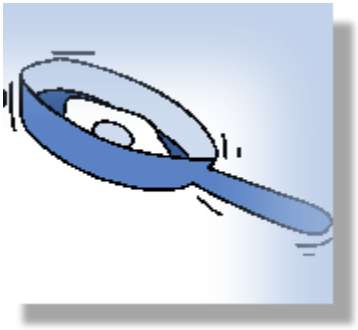
- William Procter, as a candlemaker, would have been unlikely to associate with James Gamble, who was apprenticed to a soapmaker. The two met because they married sisters, Olivia and Elizabeth Norris. Their father-in-law convinced the two men to become business partners.

Find out more...

- Procter & Gamble
  (www.pg.com)
- P&G History
  (www.pg.com.eg/history1.cfm)

Materials
From Pottery to Plastics

Teflon



Roy J. Plunkett (1910-1994), a native of New Carlisle and graduate of The Ohio State University (M.S., 1933; Ph.D., 1936), accidentally discovered the stick-resistant surface coating that became known as Teflon while doing research on refrigerants at the DuPont Company.

On April 6, 1938, at DuPont's Jackson Laboratory in New Jersey. Plunkett pumped freon gas into a cylinder which was left in cold storage overnight. Surprisingly, the gas had dissipated into a solid white powder. Rather than toss out the "mistake," Plunkett and his assistant decided to test the material. They found it had two interesting properties: it was very slippery, and it did not react with most chemicals. Because of both of these properties, the material would eventually revolutionize many processes, most notably cooking and cleanup.

Tetrafluoroethylene was both stick- and heat-resistant, leading to practical uses in products ranging from cookware to space suits. It was marketed for the first time as DuPont Teflon® in 1945. Molecularly speaking, Teflon is huge. The molecular weight of Teflon can exceed 30,000,000 atomic mass units. It is one of the largest molecules known to man. The surface of Teflon is so incredibly smooth that it quickly became the surface of choice for cooking pans.

After discovering Teflon® at the age of 27, Plunkett went on to a full career, working at DuPont for several decades on teams that developed myriad fluorochemical products and processes that have positively impacted the electronics, plastics, and aerospace industries, as well as many others.

Did You Know?

- Teflon® was first used by the U.S. military in artillery shell fuses and in the production of nuclear material for the Manhattan Project.
- Plunkett graduated with a B.A. in chemistry from Manchester College in Indiana in 1932. He earned his master's in 1933 and his Ph.D. in 1936, both from The Ohio State University.
- The molecular weight of a substance tells how many grams are in one mole of that substance. The mole is the standard method in chemistry for communicating how much of a substance is present. One mole is defined as 6.02 x 10^23 atoms or molecules of any substance. The atomic mass units (amu) of all the atoms in a given formula is the molecular weight. An amu is defined 1/12 the weight of the carbon-12 isotope. The symbol amu is referred to as u (a lower case letter u). Carbon-12 weighs exactly 12 amu.

Find out more...

- Dupont History - Roy Plunkett
  (http://heritage.dupont.com/touchpoints/tp_1938/depth.shtml)
- Teflon®
  (www.teflon.com)
- American Plastics Council: History of Plastics
  (www.americanplasticscouncil.org/s_apc/sec.asp?TRACKID=&SID=6&VID=86&CID=310&DID=920)

Materials
From Pottery to Plastics

All the Windows in the World

Harold McMaster and Norman Nitschke founded GlassTech Corp. in Perrysburg, Ohio, and invented a machine for making high-quality, tempered, break-resistant glass that is five times stronger than regular glass. The secret to tempered glass? When tempered glass breaks, it crumbles into bits less likely to cause serious cuts.

Glass is Stronger Than Steel

Based on its molecules alone, glass is a material five times stronger than steel. Defects, bubbles, and other irregularities that develop during production make glass weaker in the real world. For centuries, people strove to develop a way to form glass that lived up to its molecular promises.

The research and development team at Glasstech Inc. solved the problem. The resulting glass was not only extremely clear, but was the world's strongest. In addition to being acclaimed inventors, McMaster and his partners were smart business people as well. They received an ongoing royalty from glass produced by every machine they manufactured. They shared the wealth, however, and over the years have donated millions of dollars to northwest Ohio institutions including Defiance College (site of the McMaster School For Advancing Humanity), the University of Toledo, and the Medical College of Ohio.

Tempered Glass is Everywhere

Now, tempered glass is essential for windows in skyscrapers, automobiles, and other applications where huge broken panes of glass would cause significant damage. An estimated 80% of the world's automotive glass and about half of all architectural glass is manufactured using the company's machines.

McMaster also developed advances in the process of coating glass with photosensitive chemicals for use in solar cells, for converting sunlight into electricity. He had over 100 patents related to glass, rotary engines, and solar energy. In 1984, McMaster formed Glasstech Solar, Inc., to develop a more efficient solar cell.

In 1991, McMaster joined Thomas Edison and tiremaker Harvey Firestone as an inductee into the Ohio Science Hall of Fame.

Find out more...

- McMaster Motor - Profile of Harold McMaster
  (www.mcmastermotor.com/man.htm)
- About Tempered Glass
  (www.alumaxbath.com/tech/tgp.htm)