TECHNICAL TIDBITS

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THE HISTORY OF PLASTICS

Many advancements have been made over the years in the materials used to make our everyday products, but none of them have equaled the rapid growth of plastics. Millions are spent each year in the ongoing research and refinement of plastic material as new applications for their use are constantly being found. This week, Tidbits looks back on the development of plastics and some of the timelines in its progress of becoming such an important part of our everyday lives.

1862: The world was first introduced to plastic at the Great International Exhibition in London by British chemist Alexander Parkes. Through his laboratory experiments, Parkes had formulated a material he called Parkesine, which was derived from organic cellulose -- part of the cell wall of green plants. He discovered that once heated, this substance could be molded and would retain its shape when cooled. The product failed, however, due to its high cost of production and the fact that it was dangerously flammable.

1869: A $10,000 prize was offered for the discovery of a new material to replace the use of ivory in the making of billiard balls. American printer John Wesley Hyatt entered the contest and discovered what he called “Celluloid.” Celluloid was synthesized from cotton fiber and the plant material camphor. He found that the substance could be molded and hardened into desired shapes.

But, like the problem with Parke’s cellulose product, Hyatt’s celluloid was also highly flammable and the billiard balls had a tendency to explode on contact. However, it was discovered that the plastic substance was useable as a substitute for amber and for photography and in motion pictures.

1907: The use of formaldehyde greatly advanced the technology of plastic. Belgian chemist Leo Hendrik Baekeland improved phenol-formaldehyde reaction techniques creating the first completely synthetic, man-made plastic trade-named Bakelite. The mixture was highly heat-resistant and extremely hard and could be added to most materials to make them more durable. In the ‘20s and ‘30s, manufacturers made Bakelite automobile parts, jewelry, kitchenware, clock and radio cases that were uniquely styled and modernistic for the day. Bakelite was indeed a breakthrough product and became a huge commercial success.

1920: Polyvinyl Chloride, or PVC, was developed to replace increasingly costly natural rubber. Approximately 75 percent of all PVC manufactured today is used in construction materials, as well as upholstery, clothing, piping, flexible hoses, tubing, flooring, roofing membranes, shower curtains and electrical cable insulation. Among other benefits, PVC is useful because of it’s resistance to fire and water.

1933: Polyethylene was discovered by accident by two chemists in Northwich, England. While heating a compound of diazomethane, they found it produced a white, waxy substance that later proved to have excellent insulating properties. After a number of refinements, it was used during World War II to insulate radar systems for airplanes. Today, polyethylene makes up the largest volume of plastic in the world with an annual production of approximately 80 million metric tons. Polyethylene is cheap, flexible, durable and chemically resistant. You will find it in everyday items such as pop bottles, milk jugs, plastic bags and food storage containers, to name only a few.

1933: Polyvinylidene Chloride was discovered at Dow Chemical. PVDC was found to be resistant to oxygen, water, acids, bases and solvents, and creates a barrier against oxygen, moisture, chemicals and heat. It was originally used to protect military equipment. The substance was sprayed on fighter planes to protect them against corrosion from saltwater. Years later, after Dow discovered PVDC would cling to almost any surface, the Saran Wrap product was developed and introduced to the public in 1953.

1937: Polyurethane was first developed as a replacement for rubber at the beginning of WWII. This organic polymer was invented by Friedrich Bayer of Germany. It is now used for mattresses, furniture padding and thermal insulation. It is also used for sports wear fabrics such as "lycra"

The Plastics Industry Trade Association calculates that every ton of plastic bottles that are recycled saves about 3.8 barrels of oil. A numbering system was created in 1988 to identify and categorize similar plastic types for recycling.

1938: A chemist working for DuPont named Roy Plunkett unintentionally discovered the product we all know today as Teflon. Plunkett pumped Freon gas into a cylinder and left it in cold storage overnight. The gas dissipated, leaving a slippery, solid white powder coating. Curious about the residual powder, he ran it through some tests and found it to be impervious to acids, cold and heat. It was ideal for use in the lining of pots and pans to make them stick-free and is widely used in kitchenware today.

1939: The first nylon today as Teflon. Plunkett by DuPont labs at the 1939-1940 New York World's Fair. During the 1940s, cheap synthetic polymers, such as nylon, acrylic, neoprene and polyethylene, began to replace the use of natural materials in many products. One example is the use of nylon bristles to replace animal hairs in toothbrushes.

1948: ABS, or Acrylonitrile Butadiene Styrene, was first discovered during World War II as an alternative to rubber. ABS was patented in 1948 and introduced to commercial markets in 1954. ABS is a tough, light-weight plastic, resistant to heat and has the ability to be injection molded and extruded, which makes it useful in the manufacture of many different products like piping, musical instruments, golf club heads, car parts and some toys, including Legos. Some tattoo inks even use minute particles of ABS finely ground to less than a micrometer in diameter to make the ink colors more vivid.

1953: Chemist Dr. Daniel Fox of GE became one of the discoverers of the resin that was patented as Lexan. He found that once the gooey substance hardened, it could not be broken or destroyed without great effort. In 1968, the company began using sheets of Lexan in bus and train windows and to make bullet-resistant laminates. Neil Armstrong and Buzz Aldrin wore pressure helmets made of Lexan as they took the first step on the moon. The material is also used in football helmets, traffic signal housing units, car headlights, fighter jet windshields, car dashboards, laptop housings, CDs, DVDs, and even cell phones.

1954: Polystyrene foam, more commonly known as Styrofoam, was actually discovered in 1839. It wasn't until 1954 that Dow Chemical introduced Styrofoam to the public. This lightweight material has myriad household and industrial uses, including insulation, packaging, building material, toys, and hundreds of other items.

1965: DuPont scientist Stephanie Kwolek developed a way to spin fiber from liquid crystalline solutions. The resulting material was lightweight, flexible and five times as strong ounce for ounce as steel. This later became known as Kevlar and is used today to make various military and police protection products including flak jackets, ballistics vests and other protective wear.

1979: Polar fleece is a soft, napped insulating synthetic fabric made from Polyethylene Terephthalate (PET) and other synthetic fibers. Polar fleece was first created in 1979 by Malden Mills, now Polartec LLC. The goal was to develop a new, light, yet strong, pile fabric that could mimic, and in some ways surpass, wool. The artificial fleece has some of wool's finest but weighs a fraction in comparison, is more lightweight than other polyester fabrics and doesn't hold moisture.

So much more could be said of plastics than space allows here, so we'll sum it up with a quote from Mr. McGuire in the 1967 movie "The Graduate": "I want to say one word to you -- just one word. Plastics!"