A Fluoropolymers Odyssey

Frank M. Chapman –From Sintering in Saginaw to Consulting in Elkton

By Frank Chapman and E. Robert Hill

I was born and raised in a small town in Vermont and graduated from the University of Vermont in 1952 with a degree in Chemistry. Following graduation, I joined DuPont and my first assignment was with Teflon®.

Early Years of Teflon®

Though Teflon was discovered in 1938, the commercialization was just beginning in 1952 when I was hired by DuPont to work in what became the Plastics Department. By chance, I was assigned to Teflon®, a material I had never heard of at that time. One of my first assignments was to determine where the product was being used by the few dozen customers that DuPont then had. When the assignment was completed, I had to wonder why they asked me to do the survey in the first place. All of the material was either going to either proximity nose cones for the Korean War or into gaskets. I now think of the thousands of applications today.

Frank Chapman

Throughout WWII, almost all of the material DuPont could make was being utilized by the Manhattan Project in the development and production of atomic bombs. Since PTFE was not melt processible, none of the plastic processing technologies of the day were suitable. Therefore DuPont had to develop new processes, in some cases utilizing technologies that had been developed for ceramics and powder metal fabrication. They needed to establish new processors and teach them new processing techniques, and I was trained to be the expert on the technology of processing granular PTFE resins. Being one of the world's experts on this new plastic, while still in my 20's, was an exciting time.

Sintering in Saginaw

I recall it was during my Christmas holidays of 1957 or 1958 that my boss called me at home and said that the President of General Motors had called the President of DuPont saying that Saginaw Power Steering was having a problem with the first application of a seal of Teflon®. The assembly line was down, and I was the man to handle the job. The next morning, I was on a plane to Ohio where I met the owner of Modern Industrial Plastics, Vic Reiling, who was manufacturing the rings, and we caught the sleeper train to Saginaw, Michigan.

The next morning, we met with Phil Ziegler, Saginaw's Chief Engineer at the time. The Teflon® ring was pushed down a cone, snapped into place on the piston, and was supposed to sufficiently shrink back into the ring groove in a few minutes so that it could be fitted into the cylinder. While this installation method had been developed in prototyping, when they started up the assembly line, the new production rings would not snap back. Less than a year before, DuPont had me studying the effect of the cooling rate on properties, and I had learned of its effect upon crystallinity and the great effect on PTFE's recovery. We packed up a barrel of rings and got back on the train to Ohio. The next day we had resintered the sealing rings and Saginaw was back in production.

Developing Hydrostatic Molding Technology to Make Missile Nose Cones

I left DuPont in 1961 to become General Manager of the Plastics Department of Parco in Los Angeles. Parco, which stood for Plastic and Rubber Products Company, was the largest manufacturer of rubber O-Rings in the world, and they hired this thirty year old "expert" from DuPont to solve the problems of starting up a plastic business in Teflon®. Ford Aeronautics had given out contracts to the three major processors of Teflon® at the time to manufacture missile nose cones and none of them were able to deliver a sound part. Then they heard of the new West Coast supplier, and we embarked on a crash program to get secret clearances for me and to set up a "classified" facility. I worked to develop a hydrostatic molding technology that I had only "thought" about when I was at DuPont's Chestnut Run facility. A prototype was delivered to Ford Aeronautics in 31 days, which led to successful contracts to mold hundreds of the largest complex shapes ever molded in PTFE.

Opportunities at Mather

About this same time, Henry (Hank) Mather, who was named after his father's friend Henry Ford, was president of The Mather Spring Company. They had been making leaf springs for Ford since the Model T, but production had fallen on hard times. Ford was no longer a family owned company, and cars had switched from leaf springs to coil springs. Hank hired a consultant who told him the new opportunities were in plastics. He decided to start up a facility to make components of Teflon® for the automotive industry in Milan, Michigan. They needed help, and I was offered a stock option to entice me to join the venture. There were seemingly no budgetary limits, and the best technology and equipment of the time were put in place. This included equipment for molding thin wall hydrostatically molded tubing, sintering ovens with rotating rollers, ram extruders with reciprocating mandrels to control back pressure, and state of the art automatic molding presses and screw machines from Germany. It was the ideal manufacturing facility, but the automotive industry was not yet ready to pay for Teflon® to make a better automobile, so orders were very slow in coming.

Fluorodynamics and Chapman Industries

Two years after I moved to Mather, Jim Shoffner of DuPont called and said there was an excellent opportunity for making larger diameter and longer length heat shrinkable tubing for the Paper Industry. My brother Harry and I started a business in the basement of our house. When the technology for sealing and making the roll covers heat shrinkable was worked out, we started Fluorodynamics Inc. in Wilmington, DE followed by the founding of Chapman Industries Inc. in Avondale, PA. This is where we pioneered many developments in linings for the chemical processing industries including lining columns, process vessels, storage tanks for ultra pure chemicals for the semiconductor industry, and chemical trailers. Both of these companies were eventually sold to Carborundum.

Formation of Chapman Associates

In 1980, I formed Chapman Associates Inc., a consulting company, and I am also a founder and director of Fluoron Inc. Fluoron provides release surfaces for rolls in the Pulp and Paper Industry. My son Randall and I have received a patent on a heat shrinkable roll cover based on Teflon® that has four times better wear than unmodified FEP and is static dissipative, which eliminates a static build up problem inherent in the original heat shrinkable tubing product.

Still Active in Fluoropolymers and SPI

My wife, Helen, and I live in Elkton, Maryland. We have four children and twelve grandchildren. I am still active in consulting, a director of Fluoron, and a member of SPI and the Fluoropolymers Division.

Mr. Frank M. Chapman is a pioneer in the Fluoropolymer Industry and in the development of fluoropolymer technologies and applications for the Pulp and Paper, Aerospace, and Chemical Industries. Mr. Chapman is a past Chairman of the Fluoropolymers Division of the SPI, a member of The Plastic Pioneers, The Plastics Academy, and has been inducted into The Plastics Hall of Fame. Frank is the inventor or co-inventor of twelve U.S. and foreign patents

Summary of Major Achievements

1957 - Developed automatic molding techniques and defined the shrinkage characteristics for molding Teflon® TFE resins.
1958 - Studied and reported on the frictional properties of TFE resins and their reinforcement within organic additives.
1959 - Initiated the most comprehensive study on the physical properties of Teflon® TFE, which is still the standard text today.
1960 - Developed an hydrostatic molding process and made the first such missile nose cones of PTFE.
1964 - Engineered the first sealer that would make continuous seals of FEP as strong as the base film. Led the development of the process to manufacture and install on a paper mill dryer the first FEP heat shrinkable roll cover.
1965 - Pioneered techniques and successfully lined chemical processing vessels with fluoropolymers.
1967 - Made the first glass backed melt processible fluoropolymer sheet and linings.
1981 - Pioneered in the development and application of wet sprayed ultra thick TFE and PFA coatings .
1996 - Co-inventor of heat shrinkable ultra high melt viscosity polymers such as UHMW PE.
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