REACTIVE CHEMISTRY

Skill in handling fluorine has allowed 60-year-old **HALOCARBON** to continue to build its product slate

"YOU'D NEVER THINK of some of the ideas that our customers come up with, but they make things quite interesting and challenging," says Peter Murin, chief executive officer of Halocarbon Products, a River Edge, N.J.-based producer of specialty fluorochemicals. Because of fluorine's size, high electronegativity, and bonding properties, it imparts unique and desirable features to the compounds in which it's incorporated. "We rely on our customers to come to us with their problems and we see what we can do to help. That has worked successfully since 1950," Murin says about how the business has expanded.

Responding to customer requests with its fluorine-handling skill has been part of Halocarbon's business model since Robert Ehrenfeld founded the company 60 years ago. He received a B.S. in 1942 and a Ph.D. in 1948, both from Cornell University. When Ehrenfeld was a student, his research adviser was tapped to develop inert oils needed for processing uranium hexafluoride for the Manhattan Project.

"When the war was over, the government needed a supplier, and so he and a group of colleagues started the company out of a garage," daughter Emily Ehrenfeld explains. Eventually buying out the others, Robert Ehrenfeld ran the company until his death in 2007 at the age of 86. Emily now serves as president, and her mother and two sisters are also involved in the company.

Inert fluorinated oils and lubricants remained Halocarbon's main products for about 10 years. By 1960, the company was the first U.S. producer of a fluorinated operating-room anesthetic, fluoroxene. Around that time, it became the first large-scale producer of trifluoroacetic acid and trifluoroethanol, which are building blocks for pharmaceutical, agricultural, and other chemicals. Later, Halocarbon made the first commercial quantities of hydrofluorocarbon refrigerants HFC-134a and HFC-32, which replaced chlorofluorocarbons in the 1990s.

About half of Halocarbon's business is in specialty fluorochemicals, primarily aliphatic ones, and about a quarter each in inert lubricants and inhalation anesthetics. As a privately held firm, it doesn't disclose annual sales figures, which Murin says are in the "tens of millions" of dollars. Between 40 and 50% of its sales are overseas.

"Our goal isn't to be the lowest-cost supplier," Murin says. Because of the company's technical expertise, reliable supply, and product quality, he believes it has been successful against competition from suppliers in low-cost geographies. And, although customer inquiries declined somewhat during the recession, business has been picking up again, he says.

All of Halocarbon's products are made at a facility in North Augusta, S.C., where it can operate anywhere from the bench scale to the thousands of metric tons per year level. Standard fluorochemicals and the anesthetics made at large volume occupy its biggest plant, whereas smaller pilot and semiworks units are used for testing or scaling up new products for customers.

HALOCARBON

MEETING NEEDS Halocarbon makes all its fluorochemical products at its North Augusta, S.C., plant.

Halocarbon doesn't compete in the biggest markets for commodity fluorochemicals, such as fluoropolymers, refrigerants, and blowing agents. Its competitors in the specialties area include Honeywell, Rhodia, Solvay Fluor, Tosoh, and several Japanese firms. Meanwhile, it competes against specialty gas and drug companies that make anesthetics. According to the market research firm Freedonia Group, demand for specialty fluorochemicals, such as those used in electronics manufacturing, will grow about 5% per year in the next decade.

CUSTOMER INTEREST has made electronics a newer focus area for Halocarbon. Fluorine performs particularly well in photoresists used for semiconductor patterning. Last year, the company announced that it had developed families of fluorosubstituted monomers, many of which are prepared by reacting alkenes with hexafluoroacetone (HFA), which Murin says requires special handling because of safety and health issues. These monomers can be polymerized to make photoresists with a good combination of transparency at short wavelengths, etch resistance, and solubility.

Although the volumes are small, the prices are high, and the market for all chemical-amplified photoresist materials, already at $865 million this year, is expected to show double-digit growth through 2014, says Mark Thirsk, managing partner of Linx Consulting. Despite some regulatory pressure to move away from fluorinated compounds, they'll continue to be used in semiconductor manufacturing, Thirsk believes, because the electronics industry is "reluctant to drop well-qualified and well-understood materials from their toolboxes."

For a long time, Halocarbon has produced hexafluoroisopropyl alcohol (HFIP), another HFA derivative, as a component in anesthetics production. A late 2009 licensing deal with IBM allows Halocarbon to leverage that capability in making HFIP-based photoresists. The IBM deal "has opened up a lot of doors," Murin says. "We've seen quite a bit of interest and have a number of projects under way, and so we'll see what comes of all that," he says about Halocarbon's evolution into making its next generation of specialty fluorochemicals.—ANN THAYER