

# More Domestic Chip-Making Means More 'Forever Chemicals'

Mark Newman, CEO of Chemours, the only American PFA manufacturer, says the company is ramping up production to meet the demands of reshored semiconductor fabrication.

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October 5, 2023 • Online Edition

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“**I** brought some show-and-tell,” Mark Newman, CEO of chemical maker Chemours, told *Forbes* during a recent interview in a midtown Manhattan conference room. He pulled a valve assembly out of a bag. The innocuous piece of plastic, he explained, is made of fluoropolymer known as PFA – a type of controversial “forever chemical” and an essential tool in the production of semiconductors.

“You cannot make chips without a whole PFA infrastructure,” he said. “We estimate that in a modern-day fab, there’s a half-kilo of PFA in every square foot. So in a 400,000- to 600,000-square-foot fab, that’s 200 to 300 metric tons of this stuff.”

It’s not just valves, of course, but all types of pipes, tubes and pumps in semiconductor equipment. Fluoropolymers are particularly key for filtering out small particles from fluids during chip production. Few factories need to be as clean as chip fabs, where particles as tiny as human skin cells can contaminate production. Chemours’ PFA is in much of that equipment and material, providing a big, and largely unseen, part of a semiconductor fab’s processes.

Wilmington, Delaware-based Chemours, a spinout of DuPont, is the only U.S. manufacturer of PFA. For Chemours, advanced materials including fluoropolymers represent roughly one-quarter of its total \$6.3 billion (latest 12-months revenue) business,



**Mark Newman, President and CEO**

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with refrigerants and titanium dioxide, used in paints and aerospace coatings, making up the bulk of the rest. Within that, semiconductors are part of its performance-solutions segment, which accounted for \$493 million in sales for 2022, up 53% from \$322 million in 2020. On its website, Chemours says flat-out that “without PFA, domestic semiconductor manufacturing would not be possible.”

Last year, President Biden signed into law the CHIPS Act, which provides \$52 billion in funding to spur domestic semiconductor manufacturing with a goal of improving national security by decreasing reliance on

nations like China for critical technology. Chips are essential not just for our phones and computers, but also for medical devices and fighter jets. “Geopolitics has been defined by oil over the last 50 years,” Intel CEO Pat Gelsinger said at an MIT event earlier this year. “Technology supply chains are more important for a digital future than oil for the next 50 years.”

But our insatiable desire for electronic devices and American policymakers’ push for more domestic manufacturing of semiconductors relies on the industry’s access to large amounts of “forever chemicals.”

## Ongoing Litigation

Forever chemicals, or PFAS, comprise thousands of synthetic chemicals. They’re long-lasting and resistant to heat, corrosion and moisture, making them popular for a variety of products that include nonstick pans, stain-resistant upholstery, firefighting foam – and semiconductor production. Studies, however, have linked PFAS to a variety of diseases, including cancers and reduced immune system response, as well as to contaminated groundwater, air and soil that can lead to a host of health problems. PFAS are an enormous category. Fluoropolymers, like those that Chemours manufactures for industrial uses, are just one class.

Litigation over their impact is ongoing. In June, Chemours, along with DuPont and another spinoff, Corteva, reached a \$1.2

billion settlement with public water systems. Meanwhile, legislators and regulators have been cracking down on the chemicals' use, particularly in consumer products such as clothing, furniture and textiles, where they can be more easily replaced. Minneapolis-based 3M, which in 2018 agreed to pay \$850 million for damaging drinking water and natural resources in the Twin Cities area, announced that it would cease production of PFAS by the end of 2025.

The semiconductor industry has pushed back against regulations here and in Europe, where regulators had proposed a ban on PFAS. When the U.S. Environmental Protection Agency asked for comments on tightened oversight on PFAS earlier this year by revoking certain low-volume exemptions, the microelectronics trade group SEMI called it "catastrophic" for domestic chip manufacturing. In a letter to the EPA, it said that such a rule "would significantly hamper the domestic semiconductor industry despite express goals of the Administration to the contrary and to the detriment of the U.S. economy."

## Doubling Down

In this landscape, Chemours' Newman is doubling down. In a wide-ranging interview with *Forbes* during a trip to New York for Climate Week, Newman said that the \$4 billion (market cap) company was expanding production of fluoropolymers, driven by the critical need for the chemicals in semiconductors and electric vehicles. Further, he said, such production could be done safely with investments that his company is making. It has, for example, invested more than \$100 million in emissions control technology at its Fayetteville, North Carolina plant.

"We're currently sold out and working to expand capacity here in the United States," Newman said. Chemours plans to enlarge its West Virginia production facility, he said. Located just across the river from Ohio, the factory is well positioned to supply Intel's giant chip fab near Columbus, now under construction. "Imagine making something for the semiconductor industry in what people think of as coal country," Newman said. All told, the company is investing up to \$1 billion in fluoropolymers, including those for use in semiconductors.

The combination of reshoring and PFAS is "a very complicated discussion," said Zh-

anyun Wang, a scientist and PFAS researcher with EMPA-Swiss Federal Laboratories for Materials Testing and Research. "There's a lot of resistance from the industry because, of course, if we want to do the change, it costs." That's especially problematic if the United States and the European Union impose regulations and other parts of the world do not. However, he said, such regulations could be designed to spur new innovations. "The semiconductor industry has a lot of R&D power," he said.

In July 2015, when industrial giant DuPont spun off its performance chemicals division and named it Chemours for "chemistry" plus the "Nemours" part of DuPont's full name, the new company was saddled with debt and potentially toxic assets. "I think investors were worried if we were going to be solvent," then-CEO Mark Vergnano told *Fortune* in 2016. "Were we going to make it through this or not?" Vergnano proceeded to pull off a dramatic turnaround by slashing costs, selling off non-essential businesses and gaining market share for its refrigerants business.

## Big Expense

Newman, who had been the company's chief financial officer during those years and is one of the country's top Black executives, became CEO in 2021. The company's revenue ballooned to a peak of \$6.8 billion in 2022, driven by strong pricing. Its advanced performance materials business, which includes the Teflon lineup of fluorine chemicals, gained price increases of 18% and reached total sales of \$1.6 billion as it focused on high-tech markets including advanced electronics and clean energy.

The semiconductor industry "didn't want to use fluoropolymers, not because they were concerned about them, but because fluoropolymers are expensive," said Gerardo Familiar, president of Chemours' Advanced Performance Materials division, which includes fluorine chemicals. But alternatives have been scarce because of fluoropolymers' resistance to corrosion and ability to work at high temperatures and to last for a long time. He said that fluoropolymers like PFA are "substances of low concern," and that they should be considered differently than PFAS. "Those materials last a very, very, very long time, but they make your manufacturing very, very, very safe for the people who are there because you don't have an issue

with corrosion," he said. The conundrum, he said, is how to manufacture them responsibly and what to do with the materials at the end of their life.

Some smaller companies are working on replacing PFAS in electronics manufacturing. Danvers, Massachusetts-based Transene, a privately held business founded in 1965, partnered with Toxics Use Reduction Institute (TURI) researchers at University of Massachusetts Lowell to develop alternatives for its etching solutions used in the semiconductor industry. The vast majority of customers have made the switch, and others are working through their qualification process. "You keep hearing from the industry, 'We need 10 or 15 years to make a change,'" said Greg Morose, research professor at UMass Lowell and research manager at TURI, who worked with Transene. "We basically did the research in 18 months, which is really rapid."

## Phasing Out PFAS

But that's just one small company, and one use of PFAS within a semiconductor fab. David Zamarin, founder of venture-backed DetraPel, which works on sustainable coatings for food packaging and textiles, said he received inquiries from semiconductor and electronics manufacturers, but that the cost and time didn't make it economically viable. In the electronics industry, even companies that have set goals of getting rid of PFAS are moving slowly. Apple, for example, has promised to "thoughtfully phase out PFAS in a way that does not result in regrettable substitutions."

Newman said that fluorine chemicals can be made responsibly. Chemours has committed to eliminating at least 99% of PFAS air and water emissions from its manufacturing processes by 2030. Chemours is also working on sustainable technologies, he said, such as renewable membranes for green hydrogen production marketed under the Nafion brand name and low-global-warming refrigerants for heating and cooling buildings.

"We felt because of our legacy we needed to lean into this mantra of being a different kind of chemistry company and showcasing the fact that we could be a leader in emissions reduction," Newman said. "Our chemistry really enables a lot of the future economy."