Finally a Fuel for Now

In 1966, General Motors introduced the first fuel-cell vehicle, the Chevrolet Electrovan. Because the rear section of the van was completely taken up with hydrogen tanks and the large fuel cells of the time used to create electrical power, the Electrovan was doomed, according to a 2013 article in Fortune magazine.

In the decades since, automakers have spent billions in research and development money trying to come up with a solution.

Kyle Wald ‘14, who majored in chemistry, looks forward to the day he is walking down the street and sees a hydrogen fuel cell–powered car drive by. “I’ll be able to point to that vehicle, look at my buddies, and say, ‘I had a hand in making that happen.’ That will be an amazing feeling,” he says.

Wald was part of the team of students that worked with Andrew Craft, professor of chemistry in the University of Hartford’s College of Arts and Sciences, testing various metals and alloys to find the safest and most durable materials for storing the hydrogen for use in a fuel cell. Researchers have been trying to find a material that can contain the hydrogen without becoming brittle, a significant safety issue for hydrogen storage systems based on metals and alloys, notes Craft. Another key issue in the research is finding a material that will store enough hydrogen to allow significant distances to be covered between fill-ups.

The push for the development of hydrogen-fueled cars is growing stronger. Joel Rinebold, director of energy initiatives for the Connecticut Center for Advanced Technology in East Hartford, Conn., and a member of the Connecticut Hydrogen-Fuel Cell Coalition, notes that eight states, including Connecticut, have signed an agreement to dramatically increase the number of zero-emission vehicles (either electric or hydrogen fuel) on their roadways. Connecticut’s target is 40,000 such vehicles by 2018 and 1.2 million vehicles by 2025, according to Rinebold. The only emission from cars powered by hydrogen fuel cells is water vapor; however, the hydrogen itself can have a significant carbon footprint.

Automakers like Toyota and Hyundai are gearing up to bring hydrogen fuel-cell vehicles to America’s roadways as early as 2015. One key to creating consumer demand for these vehicles will be building a refueling infrastructure that will give drivers confidence that they can find a place to refill their tanks after they reach their 300-mile limit.

Another factor is the cost of the fuel, Rinebold says, noting that for a hydrogen fuel-cell car to be a more cost-effective option than a conventional gasoline-powered vehicle that gets 25 miles to the gallon, the price of hydrogen fuel needs to be less than $10 per kilogram. The U.S. Department of Energy’s target is to provide hydrogen fuel at a cost of $3 to $4 per kilogram, he says.

Though Craft’s research doesn’t address the cost of hydrogen, it certainly opens up the possibility of enhancing the safety of hydrogen-fueled vehicles. An attractive feature of storing hydrogen in a metal or alloy is that the highly flammable gas becomes nonflammable, which means that the risk of a fire occurring during a crash is virtually nonexistent. But the issue of embrittlement of metals needs to be addressed before hydrogen storage in metals becomes viable. As of now, the research is focused on an alloy that is a mix of palladium and silver. “We’re looking for the right combination in this alloy to reduce embrittlement,” says Craft.

His latest paper on the research, which is about to be published in the Journal of Energy Engineering, has eight undergraduate student coauthors. “At the University of Hartford, I haven’t published a research paper that hasn’t had a student coauthor,” he adds.

“It’s really wonderful to see how they’ve matured,” says Craft of his students. “I want them to reach a level where they can work independently, and they’ve done that quite nicely.” He adds that the research skills these students have learned are readily transferable to any field. “If our students are doing work that’s of publishable quality, and it clearly has been, that sends a clear sign to any potential employer or graduate school about the quality of their work.”

“We’ll be part of the legacy of how these cars came to be in people’s driveways,” says Joe Kubik ‘14. “The research we’ve been doing—others will take it and build on it, but we definitely played a part.”