EEVC NEWSLETTER

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MY STORY ON THE ACCESSORY BATTERY IN MY '01 PRIUS
Pete Gruendeman

The original battery lasted four years. Due to customer complaints, a larger replacement battery ($140) + installation kit ($25-50) was offered. That was a disaster as the larger battery lasted only 18 months. I could get another for $150 or more but said no way. Fool me once and that's enough. Since 2005 I have been using 12 volt garden tractor batteries. These are sealed, 25 Ah batteries that come from the home centers for $25.00. The accessory battery in the '01 Prius needs only to provide 35 amps of current for ten or so seconds to bring up all the electronics on the car and cue the starting circuit. That's all it does. The garden tractor batteries are plenty capable of this and do so for one to two years. Then I get another. It's annoying that the starting battery in my Prius can't last the same ten years that the starting battery has lasted in my Tercel, but that's how it is.

Someone mentioned tires for the early Prii. I use Cooper Lifeliner 175R70-14 tires and have had excellent service from them. I tried one type of Goodrich and one type of Goodyear and possibly another brand as well. With all of these tires there was a cord failure before the tread wore out. Some only lasted 20,000 miles before failure. Only with the Coopers am able to wear out the tread before replacing the tires because of cord failure. These last 3-4 years, at something close to 10,000 miles/year.

NEWS UPDATE

With computation, researchers identify promising solid oxide fuel cell materials

Adam Malecek, University of Wisconsin-Madison College of Engineering

Using advanced computational methods, University of Wisconsin-Madison materials scientists have discovered new materials that could bring widespread commercial use of solid oxide fuel cells closer to reality.

A solid oxide fuel cell is essentially an engine that provides an alternative way to burn fossil fuels or hydrogen to generate power. These fuel cells burn their fuel electrochemically instead of by combustion, and are therefore more efficient than any practical combustion engine.

As an alternative energy technology, solid oxide fuel cells are a versatile, highly efficient power source that could play a vital role in the future of energy. Solid oxide fuel cells could be used in a variety of applications, from serving as a power supply for buildings to increasing fuel efficiency in vehicles.

However, solid oxide fuel cells are current-

ly more costly than conventional energy technologies, and that has limited their adoption.

"Better cathode catalysts can allow lower temperature operation, which can increase stability and reduce costs, potentially allowing you to take your building off the electrical grid and instead power it with a solid oxide fuel cell running on natural gas," says Dane Morgan, Harvey D. Spangler Professor of materials science and engineering at UW-Madison. "If we can get to that point with solid oxide fuel cells, the infrastructure of power to many buildings in the country could change, and it would be a very big transformation to a more decentralized power infrastructure."

Led by Morgan and Ryan Jacobs, a staff scientist in Morgan's research group, a team of UW-Madison engineers has harnessed quantum mechanics-based computational techniques to search for promising new candidate materials that could enable solid oxide fuel cells to operate at lower temperatures, with higher efficiency and longer lifetimes.

Their computational screening of more than 2,000 candidate materials from a broad class of compounds called perovskites yielded a list of 52 potential cathode materials for solid oxide fuel cells—a discovery that could lead to more economical and efficient solid oxide fuel cells. The researchers published details of their advance Jan 11, 2018, in the journal Advanced Energy Materials.

"With this research, we've provided specific recommendations of promising compounds that should be explored further," Morgan says. "Some of the new candidate cathode materials we identified could be transformative for solid oxide fuel cells for reducing costs."

In addition to identifying new materials, the researchers' approach allowed them to codify material design principles that had previously been based on intuition and to offer suggestions for improving existing materials.

Typically, solid oxide fuel cells must operate at high temperatures of around 800 degrees Celsius. But operating at these high temperatures means materials in the fuel cell degrade quickly, limiting device lifetime. The goal, says Jacobs, is to enable solid oxide fuel cells to operate at a lower temperature, which would improve the device's lifetime by slowing that degradation. Fuel cells with long lifetimes wouldn't need frequent replacements, making them more cost-effective.

To achieve this goal, the researchers set out to find stable compounds with high activity to catalyze the oxygen reduction reaction, a chemical process key to solid oxide fuel cell energy applications.

"If you can find new compounds that are both stable under the operating conditions of the fuel cell and highly catalytically active, you can take that stable, highly active material and use it at a reduced temperature while still achieving the desired performance from the fuel cell," explains Jacobs, who was the lead author on the paper.

However, using computational modeling to quantitatively calculate the catalytic activity of a perovskite compound is prohibitively difficult because of the high complexity of the oxygen reduction reaction. To overcome this challenge, the researchers used an approach where they selected a physical parameter that was more straightforward to calculate and then showed empirically that it correlated with the catalytic activity, thus serving as an effective proxy for the catalytic activity. Once they established these correlations with data from experiments, the researchers were able to use high-throughput computational tools to effectively screen a large group of materials for high catalytic activity.

The UW-Madison researchers are collaborating with a group at the National Energy Technology Laboratory (NETL), which conducted initial testing on one of the team's candidate cathode materials. "This research is ongoing, but the early tests by our NETL collaborators found the material to be quite promising," Morgan says.

Morgan says this project is an example of the kind of advances that are aided by the Materials Genome Initiative, an ongoing national effort that aims to double the speed with which the country discovers, develops and manufactures new materials.

"This project integrated correlations from experiments with online digital databases and high-throughput computational tools in order to design new solid oxide fuel cell materials, so it's exactly the kind of thing that gets

enabled by the infrastructure and approaches that have been developed and put in place by the Materials Genome Initiative," Morgan says.

Ditch coal: solar is cheaper

An op-ed piece by Justin Gillis and Hal Harvey in the *New York Times* for February 6 suggests that some parts of the country, at least, have reached a tipping point: alternate energy (with perhaps some natural gas stirred in) is now a less-costly way to generate electricity than is coal. "Xcel Energy is a utility company with millions of electric customers in the middle of the country, from Texas to Michigan. In booming Colorado, the company asked for proposals to construct big power plants using wind turbines and solar panels.

"The bids have come in so low that the company will be able to build and operate the new plants for less money than it would have to pay just to keep running its old, coal-burning power plants.

"You read that right: In parts of the country, wind and solar plants built from scratch now offer the cheapest power available, even counting old coal, which was long seen as unbeatable."

Part of the reason for this, the piece notes, is federal subsidies, which will likely go away in the next few years. Excel, then, is jumping ahead to take advantage of them while they're still available, but the company will reap additional benefits as well, with lower greenhouse gas emissions and the like, but it's certainly an encouraging sign.

BMW to build electric Minis in China

Source: BMW

The BMW Group is in advanced discussions to ramp up the global success of its MINI brand through a new joint venture in China. A key element of the brand's continued strategic development will be local production of future battery-electric MINI vehicles in the world's largest market for electromobility. To this end, the BMW Group has signed a "letter of intent" with the Chinese manufacturer Great Wall Motor. In addition to production of the first battery electric MINI at the main plant in Oxford starting in 2019, this signals a further clear commitment to the electrified future of the MINI brand.

IT'S GETTING HARDER TO LEAVE
By California Pete

There are reports that in-migration to the Bay Area has succumbed to out-migration: more people are moving away (mostly due to high costs for housing, taxes, gasoline, etc.) than are moving in. It has become so bad, says a February 15 *San Francisco Chronicle* piece by Michelle Robertson, that the cost of a U-Haul truck to make one's escape has escalated like the price of real estate or prescription drugs:"Rent a moving truck from Las Vegas to San Jose and you'll pay about $100. In the opposite direction, the same truck will cost you 16 times that, or nearly $2,000." Seems that all those one-way rentals have resulted in a shortage here.

Park at your own risk

Last month I discussed the car burglary epidemic in the Bay area; since that time there have been a few development. The first is that police seem to have actually caught some of the leaders of an organized gang of car looters. A January 31 *San Francisco Chronicle* article by Jenna Lyons reports that police in Fremont (in the East Bay, north of San Jose), in a joint effort with the Santa Clara County district attorney's office, have arrested eight people from San Francisco and San Jose and seized more than $2 million in stolen goods, mostly laptops and tablets stolen from parked cars and destined for sale on the black market in Vietnam. In one incident, says the article, "[d]etectives followed a semitruck ... to Interstate 880 to Fremont, where they pulled it over and discovered nearly $1 million worth of stolen electronics, authorities said. Investigators believe the equipment was bound for the Port of Oakland and a cargo ship that would take it to the Far East."

Gov doubles down on ZEVs

A January 27 AP story by Jonathan Cooper reports that California governor Jerry Brown has signed an executive order aiming to expand the state's goal of 1.5 million zero-emission vehicles by 2025 to 5 million by 2030, and asking for $2.5 million in addition-

al funds to make it happen. Will it? As the article points out, "The $2.5 billion in spending needs legislative approval."

Does Starbucks cause cancer?

Visitors to the Golden Sate may notice signs that read "This area contains chemicals known to the State of California to cause cancer, or birth defects or other reproductive harm." That sign is required if any of about 900 listed chemicals can be found in the facility. Now, it seems, an activist has decided that Starbucks, 7-Eleven and other places that sell coffee should post warnings as well, because roasting coffee creates small amounts of acrylamide, a listed chemical, and the stuff can be found in a cup of coffee. How likely it is to cause cancer seems to be beside the point.

COMING EVENTS

WCX: SAE World Congress Experience
April 10-12, Detroit, MI. http://wcx18.org/
Electric Vehicles 2018
April 11-12, Berlin. www.idtechex.com/electric-vehicles-europe/show/en/
Green Transportation Summit & Expo
April 17-19, Tacoma, WA. https://www.eventbrite.com/e/green-transportation-summit-expo-tickets-36660048191?discount=EMC30
Montreal Electric Vehicle Show
April 24-27, Ottawa. https://emc-mec.ca/ev2018ve/
EEVCongress
March 14, Geneva, in the framework of the Geneva International Motor Show, March 8-18. https://www.gims.swiss/en/
Movin' On, the international summit on sustainable mobility (successor to the Michelin Challenge Bibendum)
May 30-June 1, Montréal. https://movinon.michelin.com/en/
European EV Batteries Summit
June 20, 21, Munich. www.wplgroup.com/aci/event/european-electric-vehicle-batteries-summit/
American Solar Challenge 2018
July 6-22, beginning with the Formula Sun Grand Prix, then across North America. americansolarchallenge.org/the-competition/american-solar-challenge-2018
Intersolar North America 2018
July 9-12, San Francisco. www.intersolar.us/en/home.html
The MAGLEV 2018 Conference, together with MTST 2018 Conference
Sept 5 - 8, St. Petersburg, Russia. http://rus-maglev.com/en/
National Drive Electric Week
Sept 8-16, nationwide. https://driveelectricweek.org/
Electric & Hybrid Vehicle Technology Expo & Conference
Sept 11-13, Novi, MI. https://evtechexpo.com/
Electric Vehicle & Plug-in Hybrid Vehicle Exhibition
Sept 26-28, Tokyo. https://10times.com/evex
SAE Range Extenders for Electric Vehicles Symposium
Nov 14-15, Dearborn, MI. www.sae.org/events/rex/

NOTICE ON DUES

Annual dues are $20 with electronic delivery of the Newsletter, or $25 for a printed copy. Make checks payable to EEVC and mail to James Natale, 3307 Concord Dr, Cinnaminson NJ, 08077, or pay via PayPal to www.paypal.me/EEVC.

MEETING SCHEDULE

Meetings are held in Room 49, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

March 14

April 11

May 9

June 13