

# Fuel cell breakthrough: Team reports success with low-cost nickel-based catalyst

January 14 2016, by Diane Kukich

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University of Delaware Distinguished Engineering Professor Yushan Yan, at the wheel of a fuel cell vehicle, is conducting research on the use of nickel as a catalyst in an alkaline electrolyte that promises to bring down the cost of hydrogen fuel cells. Credit: Jie Zheng/University of Delaware

"Planes, Trains and Automobiles" is a popular comedy from the 1980s,

but there's nothing funny about the amount of energy consumed by our nation's transportation sector.

This sector—which includes passenger cars, trucks, buses, and rail, marine, and air transport—accounts for more than 20 percent of America's energy use, mostly in the form of fossil fuels, so the search is on for environmentally friendly alternatives.

The two most promising current candidates for cars are fuel cells, which convert the chemical energy of hydrogen to electricity, and rechargeable batteries.

The University of Delaware's Yushan Yan believes that fuel cells will eventually win out.

"Both fuel cells and batteries are clean technologies that have their own sets of challenges for commercialization," says Yan, Distinguished Engineering Professor in the Department of Chemical and Biomolecular Engineering.

"The key difference, however, is that the problems facing battery cars, such as short driving range and long battery charging time, are left with the customers. By contrast, [fuel cell](#) cars demand almost no change in customer experience because they can be charged in less than 5 minutes and be driven for more than 300 miles in one charge. And these challenges, such as hydrogen production and transportation, lie with the engineers."

Yan is prepared to address the biggest challenge fuel cells do face—cost.

He and colleagues recently reported a breakthrough that promises to bring down the cost of [hydrogen fuel cells](#) by replacing expensive platinum catalysts with cheaper ones made from metals like nickel. The

work is documented in a paper published Jan. 14 in *Nature Communications*.

The researchers achieved the breakthrough by switching the operating environment from acidic to basic, and they found that nickel matched the activity of platinum.

"This new hydroxide exchange [membrane fuel cell](#) can offer high performance at an unprecedented low cost," Yan says.

"Our real hope is that we can put hydroxide exchange membrane fuel cells into cars and make them truly affordable—maybe \$23,000 for a Toyota Mirai. Once the cars themselves are more affordable, that will drive development of the infrastructure to support the hydrogen economy."

**More information:** "Nickel Supported on Nitrogen-doped Carbon Nanotubes as Hydrogen Oxidation Reaction Catalyst in Alkaline Electrolyte," *Nature Communications*, 2016.

Provided by University of Delaware

Citation: Fuel cell breakthrough: Team reports success with low-cost nickel-based catalyst (2016, January 14) retrieved 25 April 2024 from <https://phys.org/news/2016-01-fuel-cell-breakthrough-team-success.html>

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