Making an alternate fuel usable in cars: Researcher tackles natural gas storage

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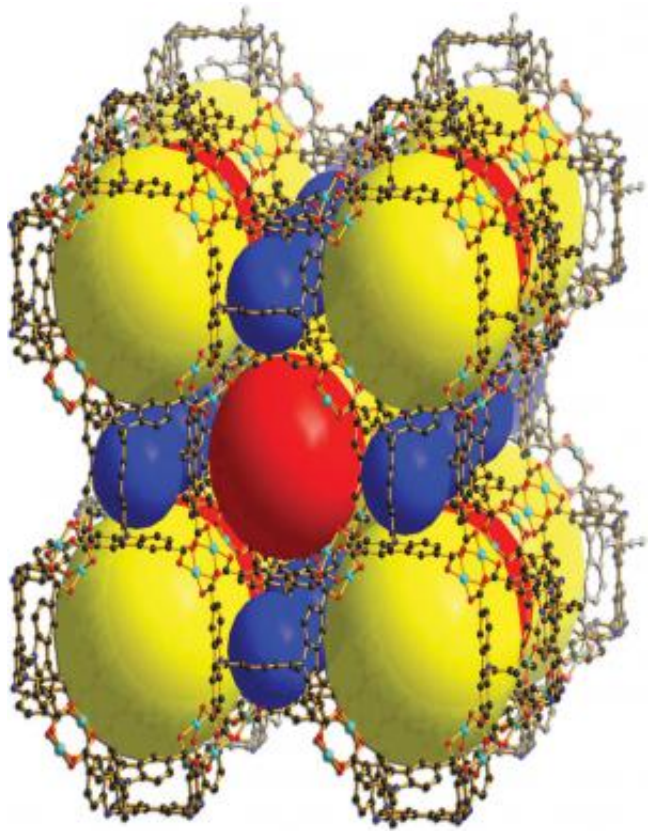


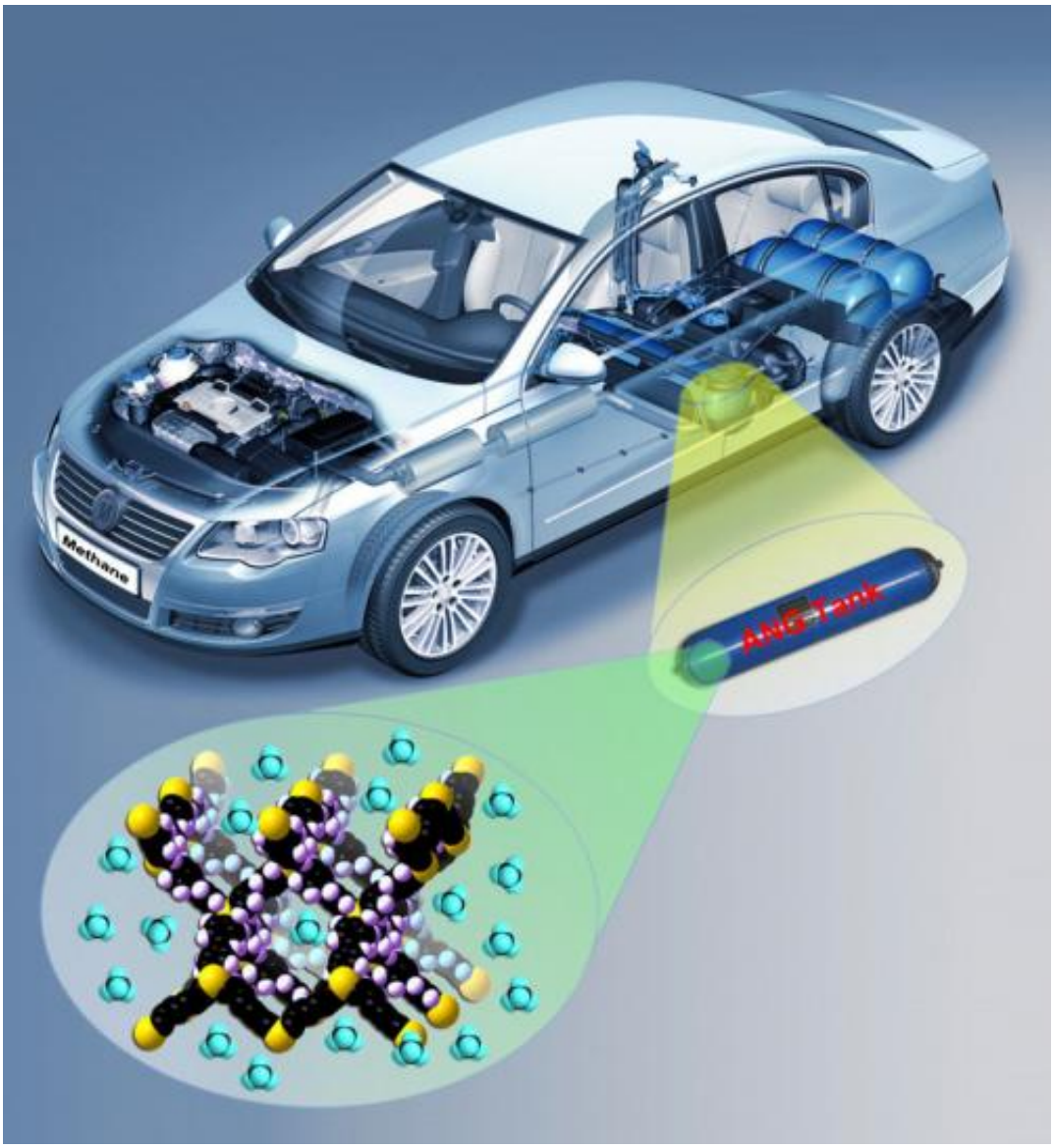
An example of a metal-organic frameworks (MOF) assembled in Dr. Hongcai Joe Zhou's world-class laboratory within the Texas A&M Department of Chemistry.

When it comes to American consumers' vehicular preferences, Texas A&M University chemist Hongcai Joe Zhou says the choice often boils

down to simple economics more so than availability, environment or altruism.

And while passenger vehicles that run on natural gas may be an option for the financially well-off, Zhou says a more cost-efficient system will be necessary to drive a nationwide shift from petroleum to cleaner-burning fuels.

Zhou's goal is to solve the technical hurdles related to natural gas storage—answers that bode well for sectors ranging from energy and economics to global relations and preservation.



An illustration of a prototype 6-liter adsorbed natural gas (ANG) fuel tank that relies on innovative advanced porous materials and Texas A&M's proven expertise in metal-organic frameworks (MOF) and porous-polymer networks (PPN) to deliver low-pressure, high-density natural gas storage in vehicles.

"We should invest in this for security reasons so we don't have to rely on countries that may not be our allies for petroleum and for environmental reasons, since a large part of air pollution comes from the transportation

sector," Zhou said. "Government policy can help. However, the ultimate determining factor is that it has to be commercially viable. If it's too expensive, few will use it."

Natural gas tanks for passenger vehicles currently are large and clunky, and no one wants to buy an ugly car, Zhou says. He says a key technical hurdle is making the natural gas, which is less dense than petroleum because it's in the gaseous state, fit in roughly the same space that a conventional petroleum gas tank occupies. With the help of a recent $3 million Department of Energy grant, Zhou and his team are collaborating with automobile giant General Motors (GM), Lawrence Berkeley National Laboratory (LBNL) and Research Triangle Institute (RTI) to figure out how to take such a fuel tank from concept to reality.

Creating the necessary infrastructure to store and pump natural gas into vehicles would be prohibitively costly, so Zhou believes the solution is to use the existing natural gas infrastructure that runs through the homes and garages of millions of Americans for household uses, such as heating, cooling and cooking. The problem is that natural gas from those lines comes out at such a low pressure that it needs to be compressed to get it to the pressure it needs to be stored at in the fuel tank, a costly process. The trick: build a fuel tank that can store low-pressure natural gas, which is precisely what Zhou is using his considerable expertise in inorganic chemistry to do.

Zhou and his Texas A&M research group are working to adapt porous material to store a larger amount of the gas in the fuel tank and then let it out when needed. The key is to find the right kind of adsorbent, a type of substance that attaches atoms, ions or molecules to its surface. Zhou specializes in porous polymer networks (PPN) and metal-organic frameworks (MOF), which are crystalline frameworks consisting of metal ions along with ions or molecules that bind to the metal ions called organic ligands. Pores inside the MOF can be used for gas storage.

"This is high-risk, high-reward research," Zhou said. "It's going to take some time to overcome some of the technical challenges."

Provided by Texas A&M University