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Natural Gas to Fuel Cars

AIKEN, S.C. (February 4, 2014) – As part of his State of the Union Address, President Obama called for improved use of natural gas in transportation and industry. The President called for an Energy Security Trust Fund to finance research and development for advanced vehicle technologies that focuses on shifting our cars and trucks off oil and promotes vehicles that run on electricity, hydrogen, and domestically produced natural gas. Scientists at the Department of Energy's Savannah River National Laboratory (SRNL) are doing their part to help promote this effort.

Cars fueled by natural gas are not a new concept, but the challenge exists over finding a cost-effective, low pressure storage system that can be refueled at a gas pump, similar to today's vehicles. Researchers SRNL are investigating ways to remedy this problem. By working with a special material for use in gas storage tanks, scientists are using innovation to address concerns over both cost and safety.

Unlike today's vehicles where a gas tank acts as a reservoir to hold liquid gasoline, natural gas is, as its name implies, a gas. Gases take up much more room under normal conditions than liquids and thus must be stored at either high pressures or cold temperatures to reduce their volume. A material known as metal oxide framework can be used to help lower these pressures while minimizing volumes. "Current natural gas vehicles utilize either Liquefied Natural Gas at temperatures below -260oF or Compressed Natural Gas at pressures up to 3600 psi," explained SRNL researcher Dr. Donald Anton. "The use of metal oxide framework material will allow the storage of the same amount of gas at 450 psi in a comparable volume. The lower operating pressure results in lighter, less expensive tanks."



BASF Metal organic frameworks



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The lower pressures are possible by using a process known as adsorption in which gas molecules loosely adhere in a very dense manner to the surfaces of material. The gas molecules can be retrieved by applying heat from the engine. SRNL is also designing innovative vehicle systems that integrate the engine and the cooling system with the natural gas storage tank.

“A provisional patent has been granted for this unique design which uses both the heat generated from the internal combustion engine, as well as the cooling capacity of the air conditioning system to control the tank’s internal temperature. This should yield performance similar to a gasoline vehicle in both driving and refueling,” said Anton.

Researchers have also developed analytical models which accurately describe the temperatures and pressures within a typical natural gas tank during operation. “These models are used to design efficient and inexpensive concepts that meet the demanding requirements of the automotive customer. By using experimental data developed by our partners, these models can help determine which characteristics are most needed in creating metal organic framework materials to help the system operate more efficiently,” he said.

“In working toward the creation of an alternative fuel car, SRNL is building upon extensive experience and innovation in hydrogen storage materials and systems,” said SRNL Laboratory Director Dr. Terry Michalske. “This allows researchers to design and test high performance fuel systems for use in the next generation of alternative fuel vehicles. With improvements to the metal oxide framework materials and the integrated systems, natural gas fueled automobiles may soon be available for purchase. This will reduce our reliance on imported gasoline and minimize emissions of carbon dioxide.”

The Savannah River National Laboratory (SRNL) is a multi-program applied research and development laboratory for the U.S. Department of Energy. SRNL applies state-of-the-art science and engineering to provide practical, high-value, cost-effective solutions for our nation’s environmental cleanup, nuclear security and clean energy challenges. Visit us on the web at <http://srnl.doe.gov>

SRNS-2014-193