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The Liquid Fueled Electric Car

Recent laboratory breakthroughs at the US Defense Advanced Research Projects Agency (DARPA) Office of Strategic Technology could be a game changer as to how future electric cars are fueled. DARPA partnered with Influit Energy (https://www.influitenergy.com/) and Influit is now taking the lead to bring this technology to market. The goal of the project was to develop a fast way of charging electric military vehicles.

The culmination of the DARPA/Influit project was the development of a new liquid fueled battery that refills at a pumping station. It can be charged to much larger capacities than the energy storage of the lithium-ion batteries now found in electric vehicles.

They are not the only company that wants to create EVs that can replenish their energy by pumping in nano electric liquids. The Quantino by Nano Flowcell (https://www.nanoflowcell.com/) is an experimental vehicle that might soon go into production here in the US. It does appear that DARPA/Influit and Nano Flowcell have both developed their own fuel chemistries.

The Quantino Twenty Five by Nano Flowcell is an experimental liquid fueled EV that might soon go into production here in the US.

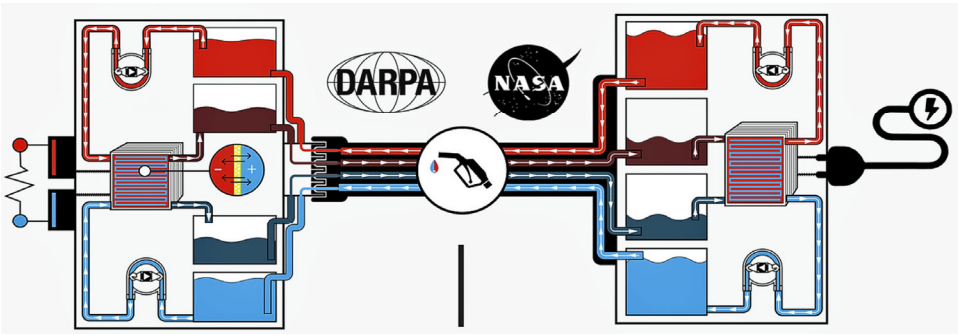
A vehicle powered by liquid energy can be refueled quickly by just pumping in fresh charged solutions. A vehicle using DARPA fuel could also be directly recharged. The illustration shows how the DARPA/Influit batteries can be liquid replacement fueled or electrically recharged.

The refueling takes about three or four minutes longer than a gasoline fill up at your local gas station. The biggest difference between pumping gasoline and pumping DARPA nano-electrofuels is the condition of the fuel tank when you go to the pump. Driving a gasoline powered vehicle consumes the gasoline. The Nano Flowcell (see photo again) electrofuel is water based and the water is evaporated, so you arrive at the filling station with an empty tank. A DARPA Influit fueled vehicle would only consumes the positive and negative ions of the solutions. Depleted electrolyte solutions would first be pumped out before the fresh fill-up begins. Repeat recharging of the old liquids at the fueling station could make this fuel cheaper to purchase at the pump.

It is important for me to point out the breakthrough is the nano-electrofuel not the flow battery. Very large flow batteries, with limited energy capacity, have been around since the 1960's. The nano-electrofuels are the game changer. Both companies indicate that their fuel chemistries are stable and nano particles are permanently suspended in their solutions. The amount of electricity that can be stored in these solutions are extremely high. The driving range can be increased by using larger fuel tanks. The DARPA and Nano Flowcell solutions are non-flammable, non-toxic, and environmentally safe. If there is ever a spill you just need to let the solution evaporate and sweep up the nano particles. DARPA's can once again be turned into new fuel by adding fresh liquid. The spent DARPA fuel remains in the tanks so it can be charged without replacing the fluids by plugging the vehicle into an electric outlet. Another advantage is the fuel itself can be recharged indefinitely.

To turn the nano-electrofuel into electric power (see illustration again) the anode (anolyte solution) and the cathode (catholyte solution) are pumped around to the redox cell stack membranes. The stack is colored purple in the illustration. At the membranes only the positive and negatively charged ions can pass. At this point an electrochemical reaction takes place generating the electricity needed to power the vehicle.

These videos could further your understanding of this technology.
DARPA Nano-electrofuel Flow Battery Video: https://youtu.be/8333g246i3o
Refueling a Nano Flowcell Vehicle: https://www.youtube.com/watch?v=9u8p25vtFvA&pp=ygUMbmFub2Zsb3djZWxs



Taking it a Step Further

1. DARPA/Influit nano-electrofuel and the Nano Flowcell electrofuel vehicles have significant differences that are pointed out in the article. What do you feel makes one system superior to the other?
2. Student research – Flow batteries have been around since the 1960's. Where are Flow Batteries being used today and why were they chosen over other methods of storing or producing electricity?
3. Recharging stations for Lithium-ion EVs are now popping up everywhere. Do you feel people will be willing to switch to these EVs even though when they first go on sale refilling stations won't exist? Why?

Alan Pierce, EdD, CSIT is a technology education consultant. Visit www.technologytoday.us for past columns and teaching resources