

Chemical engineers invent portable hydrogen reactor for fuel cells

May 23 2011

Chemical Engineering students at Stevens Institute of Technology are transforming the way that American soldiers power their battery-operated devices by making a small change: a really small change. Capitalizing on the unique properties of microscale systems, the students have invented a microreactor that converts everyday fossil fuels like propane and butane into pure hydrogen for fuel cell batteries. These batteries are not only highly efficient, but also can be replenished with hydrogen again and again for years of resilient performance in the field.

With batteries consuming a substantial amount of a soldier's gear weight, the Army has a high interest in replacing the current paradigm of single-use batteries with a reliable, reusable power source. The Stevens-made microreactors thus have the potential to not only reduce waste from disposable batteries, but also provide American soldiers with a dependable way to recharge the batteries for the critical devices that keep them safe.

Current methods for generating fuel cell hydrogen are both sophisticated and risky, requiring [high temperatures](#) and a vacuum to produce the necessary chemical-reaction-causing plasmas. Once in a container, hydrogen is a highly volatile substance that is dangerous and expensive to transport.

The Stevens [microreactor](#) overcomes both of these barriers by using low temperatures and [atmospheric pressure](#), and by [producing hydrogen](#) only as needed to avoid creating explosive targets in combat areas. These

advanced reactors are created using cutting-edge microfabrication techniques, similar to those used to create plasma television screens, which use microscale physics to produce plasma under normal atmospheres.

The team has already had success producing hydrogen from methanol. After gasifying methanol by suspending it in hot [nitrogen gas](#), the mixture is drawn into a 25 μ m channel in the microreactor. There, it reacts with plasma to cause thermal decomposition, breaking down the methanol into its elemental components. Now the team is conducting tests to see what kind of yields are realizable from various starter fuels. Eventually, soldiers will be able to convert everyday liquid fuels like propane or butane, commonly found on military bases, into high-potency juice for portable fuel cell batteries.

Provided by Stevens Institute of Technology

Citation: Chemical engineers invent portable hydrogen reactor for fuel cells (2011, May 23)
retrieved 27 April 2024 from

<https://phys.org/news/2011-05-chemical-portable-hydrogen-reactor-fuel.html>

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