Ceramic microreactors developed for on-site hydrogen production

September 19 2006

Scientists at the University of Illinois at Urbana-Champaign have designed and built ceramic microreactors for the on-site reforming of hydrocarbon fuels, such as propane, into hydrogen for use in fuel cells and other portable power sources.

Applications include power supplies for small appliances and laptop computers, and on-site rechargers for battery packs used by the military.

"The catalytic reforming of hydrocarbon fuels offers a nice solution to supplying hydrogen to fuel cells while avoiding safety and storage issues related to gaseous hydrogen," said Paul Kenis, a professor of chemical and biomolecular engineering at Illinois and corresponding author of a paper accepted for publication in the journal *Lab on a Chip*.

In previous work, Kenis and colleagues developed an integrated catalyst structure and placed it inside a stainless steel housing, where it successfully stripped hydrogen from ammonia at temperatures up to 500 degrees Celsius.

In their latest work, the researchers incorporated the catalyst structure within a ceramic housing, which enabled the steam reforming of propane at operating temperatures up to 1,000 degrees Celsius. Using the new ceramic housing, the researchers also demonstrated the successful decomposition of ammonia at temperatures up to 1,000 degrees Celsius. High-temperature operation is essential for peak performance in microreactors, said Kenis, who also is a researcher at the university's

Beckman Institute for Advanced Science and Technology. When reforming hydrocarbons such as propane, temperatures above 800 degrees Celsius prevent the formation of soot that can foul the catalyst surface and reduce performance.

"The performance of our integrated, high-temperature microreactors surpasses that of other fuel reformer systems," Kenis said. "Our microreactors are superior in both hydrogen production and in long-term stability." Kenis and his group are now attempting to reform other, higher hydrocarbon fuels, such as gasoline and diesel, which have well-developed distribution networks around the world.

Source: University of Illinois at Urbana-Champaign