Pitt professor designs less-risky reactor for clean, safe energy

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Reactors that burn hydrogen or natural gas to generate energy can be dirty and dangerous. The mix of air with hydrogen or natural gas can explode easily if composition and temperature are not carefully controlled. And reactors often produce polluting byproducts.

Now, University of Pittsburgh chemical engineering professor Goetz Veser has created a safer alternative--microreactors that won't explode, no matter what the gas composition or how hot they get, and that can keep undesirable pollutants, like nitrogen oxides (NO_x), from forming. His results could be used to design processes for safe, clean energy production and hydrogen storage. Veser will discuss his findings today during a presentation at the 232nd American Chemical Society National Meeting in San Francisco, Calif.

Reactor explosions can happen either when the reaction gets too hot or when atoms called "free radicals" break away and start to split the bonds of other molecules. In both cases, the reaction speeds up and the temperature increases until--kaboom!

But Veser's microreactors are actually "inherently safe," he says. "Even if the temperature goes completely through the roof, based on the kinetics of the system, explosions cannot happen."

Veser, who also is a researcher in Pitt's Gertrude E. and John M. Petersen Institute of NanoScience and Engineering, created the reactors by etching tiny channels into silicon chips, using a platinum wire catalyst and running a mix of hydrogen and air through the channel. "It's one of the toughest systems you can imagine," he says. "If anything would blow up, this would." (Think Hindenburg.)

But nothing happened--other than the controlled burning of hydrogen. The walls did indeed adsorb any pesky radicals floating around, keeping the reaction running smoothly.

Veser has since extended the technology to burning methane; he has found that not only can the walls stave off explosions, they also can steer the course of the reaction. For example, some NO_x is formed by the heat and some by radicals. Veser found that at a particular size, the microreactor walls adsorb the radicals that cause NO_x, while letting the reaction go ahead. "This is a completely different way of approaching a clean combustion technology," he says.

Source: University of Pittsburgh