Burning plastic as cleanly as natural gas

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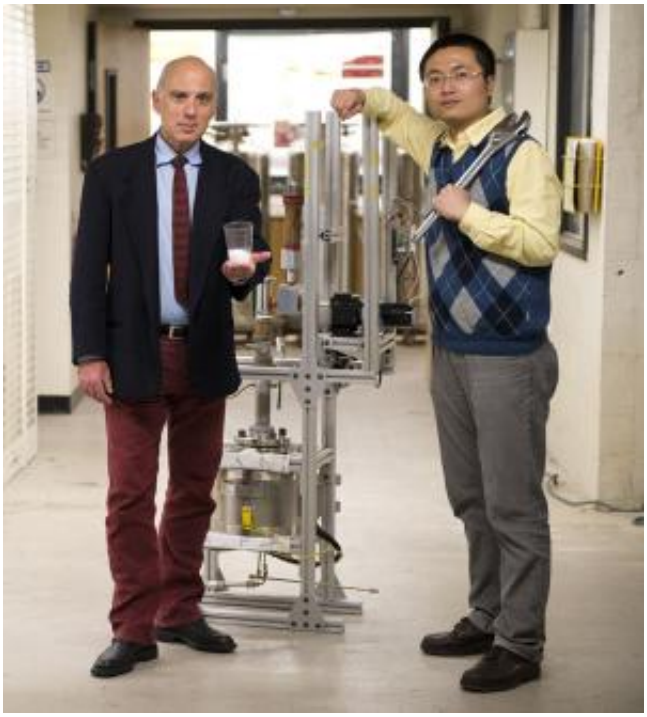

Professor Yiannis Levendis and doctoral candidate Chuanwei Zhou with their reactor. Credit: Brooks Canaday.

Yiannis Levendis, Distinguished Professor Mechanical and Industrial Engineering at Northeastern, keeps a photograph of a burning plastic foam cup tacked to the wall above his desk. Thick black smoke emanates from the receptacle, which, subsequent pictures reveal, was reduced to a sooty powder by the end of the combustion process.

The photo represents a mission for Levendis, whose expertise in

combustion and device design has led to the development of dozens of clean energy products.

Consider these statistics: In 2011, global plastic production reached 280 million tons. The U.S. swept aside 32 million tons as waste, and just 8 percent of that waste was recovered for recycling. The rest found its way into landfills and some into the oceans, accounting for countless seabird and marine mammal deaths.

"Instead of throwing them away," Levendis wondered, "could we make use of them in a cleaner way?" The answer, it turned out, was yes.

Burning plastic in the traditional manner creates extremely polluting byproducts, as evidenced by the black smoke produced by the cup. But this didn't thwart Levendis, who noted that plastic contains the same amount of energy per pound as premium fuel.

"We wanted to tackle the problem by preprocessing the plastics," said Chuanwei Zhuo, a doctoral candidate in Levendis' lab. Toward that end, the team developed a combustion system that adds a simple step to the burning process that allows for turning plastic into a fuel that burns just as cleanly as natural gas.

That simple step has a daunting name: pyrolytic gasification. Instead of directly setting the cup aflame with a match in the open air, the team's reactor heats the material to a whopping 800 degrees Celsius in a completely oxygen-free environment. This causes the plastic to become a gas, which is then mixed with air before it is burned as a clean fuel.

The patent-pending process gave way to another surprising result: when the researchers introduced a bit of stainless steel into the reactor, they found it acted as a catalyst for growing uniform carbon nanotubes. Thus, not only can our plastic waste problem be rerouted to generate

electricity, it can also be upcycled to generate one of the market's most popular new materials.

The researchers have also shown that the same process works for burning biomass, a leading alternative fuel source that is rapidly gaining traction as our global energy demand reaches new heights.

"Using plastic as fuel is not a new idea," Zhuo said. But this is the first time anyone has burned them so cleanly.

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