

PROFESSOR OMAR M. YAGHI

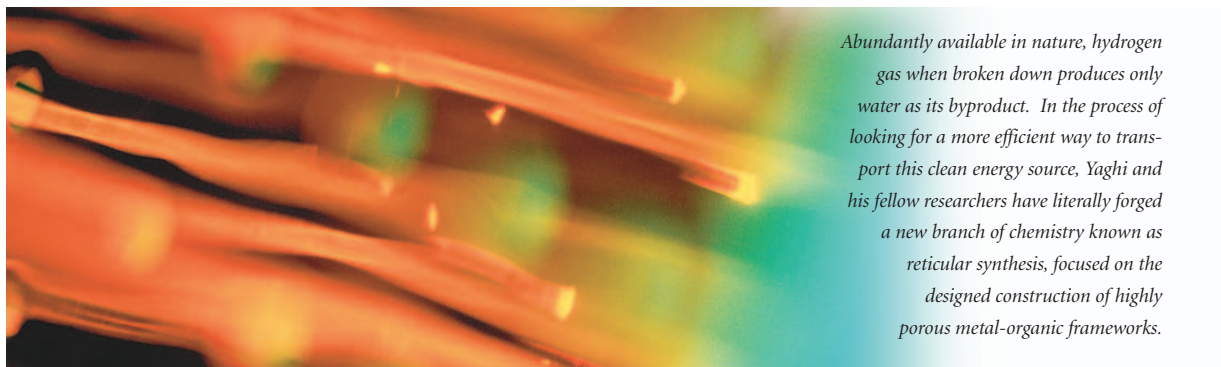
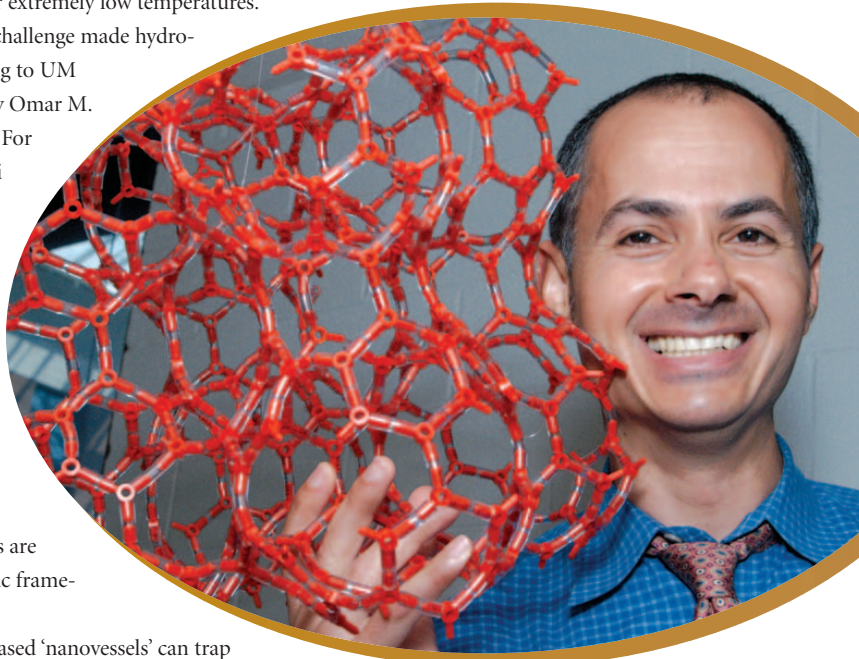
Making an Impact on Fuel Cell Technology

Hydrogen could well be the ultimate fuel—a plentiful, clean-burning, planet-healthy alternative to oil. But first, numerous obstacles must be overcome. Heading the list of challenges is storage. Currently, storing hydrogen in sufficient quantities for use in vehicles or electronic devices requires either dangerously high pressures or extremely low temperatures.

That particular challenge made hydrogen especially appealing to UM Professor of Chemistry Omar M. Yaghi (pictured right). For the past 14 years, Yaghi has been producing structures from molecular building blocks—essentially stitching together highly porous molecules of organic and inorganic materials to create containers on a nanometer scale. The resulting new materials are known as metal organic frameworks, or MOFs.

“These crystal-based ‘nanovessels’ can trap and store small and large molecules or cause them to react within the pores of the structure,” Yaghi explains. “By custom-designing the walls of these storage vessels to attract hydrogen, we’re able to stack molecules and make it practical to store the element in large volumes.” He notes that one key factor has been the ability to develop strategies for creating greater surface area of materials. “Using the metaphor of a parking structure,” he says, “we’ve created more parking spaces for molecules. One gram of MOF contains the surface area of 17 tennis courts, or approximately 5,000 square meters.”

With the assistance of UM Tech Transfer, Yaghi and his research team have patented designs and production protocols for hundreds of materials. Currently, BASF is producing MOFs in kilogram quantities. Other license agreements are being forged with automotive companies. And while much of the research is funded by the U.S. Department of Energy, major corporations are also stepping forward to provide financial support.



Abundantly available in nature, hydrogen gas when broken down produces only water as its byproduct. In the process of looking for a more efficient way to transport this clean energy source, Yaghi and his fellow researchers have literally forged a new branch of chemistry known as reticular synthesis, focused on the designed construction of highly porous metal-organic frameworks.