Researchers discover one of the most porous materials to date

January 4 2012

The delivery of pharmaceuticals into the human body or the storage of voluminous quantities of gas molecules could now be better controlled, thanks to a study by University of Pittsburgh researchers. In a paper published online today in *Nature Communications*, a team of chemists and colleagues from Pitt's Kenneth P. Dietrich School of Arts and Sciences and the Pitt School of Medicine and Northwestern and Durham universities have posed an alternative approach toward building porous materials.

Working with metal-organic frameworks—crystalline compounds comprising metal- cluster vertices linked together by organic molecules to form one-, two-, or three-dimensional porous structures—researchers addressed changing the size of the vertex (the metal cluster) rather than the length of the organic molecule links, which resulted in the largest metal organic framework pore volume reported to date.

"Think of this the way you imagine Tinkertoys®," said Nathaniel Rosi, principal investigator and assistant professor in Pitt's Department of Chemistry in the Dietrich School. "The metal clusters are your joints, and the organic molecules are your linkers. In order to build a highly open structure with lots of empty space, you can increase the linker length or you can increase the size of the joint. We developed chemistry to make large joints, or vertices, and showed that we could link these together to build a material with extraordinarily large pores for this class of materials.

"Essentially, we're like architects. We first make a blueprint for a target material, and we then select our building blocks for construction," added Rosi. "We develop methods for designing structures and controlling the assembly of these structures on a molecule-by- molecule basis."

Rosi and Jihyun An, who graduated with a PhD degree in chemistry from Pitt in 2011 and is lead author of the paper, said this new approach could have an impact on storing large quantities of gas such as carbon dioxide or methane, an important development for alternative energy, or large amounts of drug molecules, which could impact the drug-delivery field. Since joining Pitt five years ago, Rosi has developed a lab that includes students and postdoctoral researchers from various chemistry-related disciplines and focuses on new methods for materials' design and discovery.

Provided by University of Pittsburgh