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# Researchers set world record for highest surface area material

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(Phys.org)—Northwestern University researchers have broken a world record by creating two new synthetic materials with the greatest amount of surface areas reported to date.

Named NU-109 and NU-110, the materials belong to a class of crystalline nanostructure known as metal-organic frameworks (MOFs) that are promising vessels for natural gas storage for vehicles, catalysts, and other sustainable materials chemistry.

The materials' promise lies in their vast internal surface area. If the internal surface area of one NU-110 crystal the size of a grain of salt could be unfolded, the surface area would cover a desktop. Put another way, the internal surface area of one gram of NU-110 would cover one-and-a-half football fields.

A paper describing the findings, "Metal-organic Framework Materials with Ultrahigh Surface Areas: Is the Sky the Limit?" was published August 20 in the Journal of the American Chemical Society.

The research team, led by Omar Farha, research associate professor of chemistry in the Weinberg College of Arts and Sciences, has synthesized, characterized, and computationally simulated the behavior of the two MOFs that display the highest experimental Brunauer-Emmett-Teller surface areas of any porous material on record, 7,000 m2/g; that is, one kilogram of the material contains an internal surface area that could cover seven square kilometers. (Brunauer-Emmett-Teller, or BET, is an analysis technique for measuring the surface area of a material.)

The extremely high surface area, which is normally not accessible due to solvent molecules that stay trapped within the pores, was achieved using a carbon dioxide activation technique. As opposed to heating, which can remove the solvent but also damage the MOF material, the carbon dioxide-based technique removes the solvent gently and leaves the pores completely intact.

The development could rapidly lead to further advances. MOFs are composed of organic linkers held together by metal atoms, resulting in a molecular cage-like structure. The researchers believe they may be able to more than double the surface area of the materials by using less bulky linker units in the materials' design.

**More information:** pubs.acs.org/doi/abs/10.1021/ja3055639

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