Grooving crystal surfaces repel water

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Bead of water sitting on top of water resistant porous coordination polymer crystals. Credit: Kyoto University iCeMS Public Relations

Researchers from Kyoto University in Japan have developed a novel way to waterproof new functionalized materials involved in gas storage and separation by adding exterior surface grooves. Their study, published in the journal *Angewandte Chemie*, provides a blueprint for researchers to build similar materials involved in industrial applications, such as high performance gas separation and energy storage.

The materials, also known as porous coordination polymers (PCPs), are hollow nanoscale cage-like structures with the ability to house molecules within their empty cavities. This behavior is particularly useful when selectively isolating chemicals of interest from mixtures such as gases. However, one drawback of using PCPs and other materials typically created in the laboratory, is their practical use in natural situations where water is abundantly present.

"These materials are highly reactive with water, leading to their instability and subsequent decomposition," said Masakazu Higuchi, who was involved in the study. "Thus, in order to use them in real life situations, we need to develop PCPs with the ability to keep water out while allowing organic molecules of interest in."

To do this, the scientists—from Kyoto University's Institute for Cell-Material Sciences (iCeMS)—designed grooves onto the exterior surface of PCPs, thereby introducing a rough texture that in turn highly repelled water. At the same time, organic substances could enter PCPs based on size, demonstrating selectivity.

"The new PCPs we synthesized were highly stable, and incredibly water resistant as they specifically removed organic solvents like benzene and toluene from mixed solutions," said Koya Prabhakara Rao, another author involved in the study.

"Our method is the first to be conducted at the nanoscale, and serves as a simpler means to maintain functional properties of PCPs while preventing them from breaking down in the presence of water," said iCeMS Director Susumu Kitagawa, who was the principal investigator of the study.

More information: Design of Superhydrophobic Porous Coordination Polymers via Introduction of External Surface Corrugation using an

Aromatic Hydrocarbon Building Unit, *Angewandte Chemie*, Published Online 27 June 2014. DOI: 10.1002/anie.200