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COLOR INDICATED RAPID CARBON CAPTURE IN METAL-ORGANIC FRAMEWORKS

Abstract.

The research objectives of this proposal are to: 1) use aromatic alkoxide to capture CO2 with a vivid color change; 2) engineer such alkoxides inside metal-organic frameworks (MOFs); and 3) model and test the CO2 capture and associated color transitions, revealing structural parameters to a desired performance. Sophisticated ex situ characterizations are often used to show MOFs' absorption to a variety of gases. Very little attention has been paid to allow such a capture with a direct change in color, adding risks and costs to toxic gas removal. Moreover, when naked metal centers are utilized in MOFs for CO2 absorption, little resistance toward other oxygen-containing molecules such as water and oxygen requests the capture to dried and filtered gas only. In other words, nonionic or noncovalent nature of the weak binding allowed minimum selectivity. To address these issues, we take a covalent binding approach for carbon capture. As a result, our MOFs will respond preferentially to the carbon-center of the CO2, and thus are much less reactive to water or other oxygen-rich compounds. Our initial gas capture revealed a drastic change in color (from dark green to light brown in less than a minute), suggesting in situ monitoring of the rapid capture process. We expect our colorful gas absorption advantageous to many engineering applications, satisfying both civilian and defense demands.