Technology from Kyoto University

Method for Molding Structurally Flexible MOFs Using Freeze-Drying

We are looking to out-license the technology for its commercialization.

Novel method to mold flexible MOFs that suppresses pulverization during adsorption while maintaining the adsorption performance of gases such as CO_2

◆Background

Metal-organic frameworks (MOFs), porous materials with numerous pores, have been attracting attention as promising materials for CO_2 adsorption. In particular, structurally flexible MOFs having flexible frameworks exhibit excellent CO_2 adsorption and separation performance due to their unique adsorption behavior accomplished by volume expansion (gate adsorption). However, it has been practically challenging to mold such structurally flexible MOFs as their shapes as well as their gas adsorption behavior need to be maintained both before and after their volume expansion.

◆Description

Researchers at Kyoto University have found that freeze-drying structurally flexible MOFs during the molding process can suppress pulverization caused by volume expansion even when the amount of used binder was reduced. This freeze-drying method enables the molding of structurally flexible MOFs with excellent CO_2 adsorption and separation performance. Furthermore, it is expected to be applied to mold various structurally flexible MOFs with enhanced adsorption and separation performance for gases other than CO_2.

➢ **Excellent adsorption characteristics and suppressed pulverization**

Because MOF bodies molded by the novel method using freeze-drying are not pulverized even when only a small amount of binder is used, they retain adsorption performance similar to that in powder form. As shown in Fig. 1, samples fabricated by the novel method were not pulverized even after multiple adsorption and desorption cycles, while maintaining high adsorption performance as shown in Fig. 2.

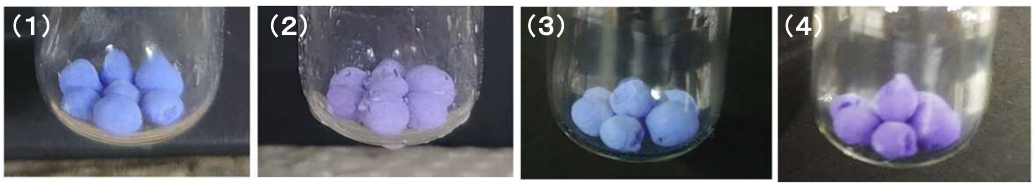

Fig. 1 Durability of the molded bodies by the present invention.
Images of the molded bodies (1) before adsorption/desorption, (2) after the 1st CO_2 adsorption, (3) after the 9th CO_2 desorption, and (4) after the 10th CO_2 adsorption.

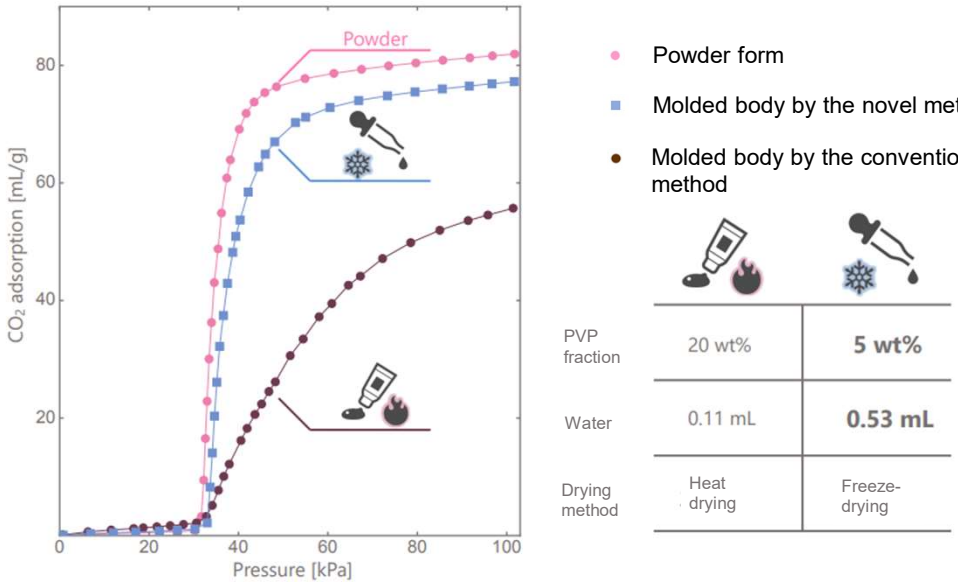

Fig.2 Comparison of CO_2 adsorption of flexible MOFs in powder form, molded body by the novel method and molded body by the conventional heat-drying method

◆Development Status

The MOF bodies molded by the novel method were confirmed to be capable of repeatedly adsorbing and desorbing gas (Figs. 1 and 2).

◆Publication

SCEJ (The Society of Chemical Engineers, Japan) 53rd Autumn Meeting (Sep. 14-16, 2022)

◆Applications

- Industrial exhaust gas recovery
- Gas adsorption and separation

◆Offer

- Patent License
- Option for Patent License

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