Keplerate functionalization in humidity-regulated room temperature CO_2 adsorption

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The burning of fossil fuels causes large emissions of CO_2, and the rising concentration of CO2 in the atmosphere contributes to climate change.[1] It is imminent to capture CO_2 from the major sources of CO_2 emissions (cement plants, thermoelectric power plants, etc.).[2] The Keplerate-type capsule $(NH_4)_{42}[Mo_{72}^{VI}Mo_{60}^{V}O_{372}(CH_3COO)_{30}(H_2O)_{72}]\cdot{\sim}300H_2O\cdot{\sim}10CH_3COONH_4$, denoted as **{Mo$_{132}$}**, is a member of the polyoxometalates (POMs) family. Since it was first reported by Müller et al. in 1998, {Mo_{132}} capsules have been extensively studied, especially as nanocontainers.[3,4] However, due to water solubility of {Mo_{132}}, which seriously limits its application prospect as adsorbent in practical industry. It is necessary to design functionalized {Mo_{132}} that is more suitable for practical application requirement, which has the potential to provide new opportunities for environmental chemistry and energy chemistry.

We have previously reported that Keplerate can introduce Cs^+ via ion exchange progress, which provides a simple design idea for synthesis of water-insoluble Keplerate. In this work, we choose new-synthetic Cs^+-{Mo_{132}} with Cs^+ as counter-cation, and TBA-{Mo_{132}}[5], which has been reported by Lan et al., as candidates for CO_2 capture, which showed excellent adsorption isotherms in low-temperature adsorption. We will discuss two candidates' CO_2 capture performance under room temperature in following presentation.

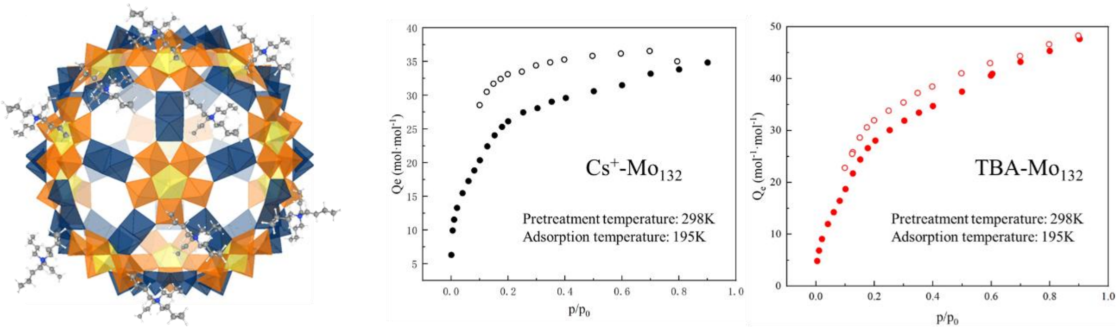

Figure 1. (left) Polyhedral structure of TBA-{Mo_{132}} and (right) isotherm of two candidates in low-temperature CO_2 adsorption experiment.

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