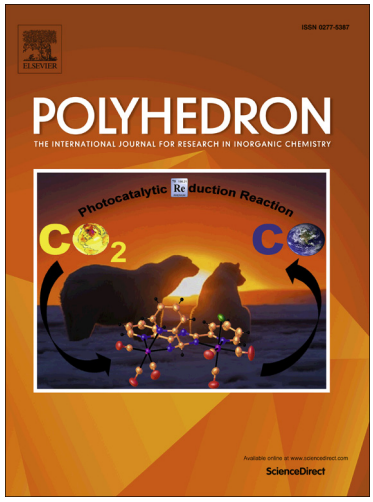

Synthesis, Characterization, and CO_2 Adsorption of three Metal-Organic Frameworks (MOFs): MIL-53, MIL-96, and Amino-MIL-53

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Synthesis, Characterization, and CO_2 Adsorption of three Metal-Organic Frameworks (MOFs): MIL-53, MIL-96, and Amino-MIL-53

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Abstract: In this study, MIL-53, MIL-96, and amino-MIL-53 were prepared, characterized, and tested for CO_2 adsorption. These metal-organic frameworks (MOFs) exhibit different characteristics, although MIL-53 and amino-MIL-53 have the same topology. The BET surface areas are 1519, 687, and 262 m^2/g for MIL-53, MIL-96, and amino-MIL-53, respectively. They exhibit different thermal stability with MIL-53 having the highest stability which starts to decompose at 773 K, while amino-MIL-53 and MIL-96 show lower thermal stability, decomposing upon heating up to 650 and 570 K, respectively. Static adsorption of CO_2 at 1 bar and 273 K was conducted, showing CO_2 adsorption capacities of 64, 124, and 48 cc/g for MIL-53, MIL-96, and amino-MIL-53, respectively. The heat of adsorption for CO_2 was found to be 39, 28.6, and 28 kJ/mol for MIL-53, MIL-96, and amino-MIL-53, respectively. Dynamic adsorption experiment shows that MIL-53 achieves the highest working capacity among all three materials around 169 cc/g at 1 bar and room temperature (304 K). Amino-MIL-53 shows a dynamic adsorption capacity of 121 cc/g at the same conditions and MIL-96 demonstrates a dynamic adsorption of 98.2 cc/g at 1 bar and 298 K. The higher working capacity demonstrated by MIL-53 and amino-MIL-53 are attributed to their larger pore size, making them promising candidate adsorbents for practicing carbon capture in real-world applications.

Keywords:

CO_2 Adsorption

MIL-53