Metal-organic and covalent organic frameworks (MOFs and COFs) as adsorbents for environmentally significant gases (H2, CO2, and CH4)

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A series of metal-organic frameworks (MOFs) and covalent organic frameworks (COFs) possessing various functionalities, pore structures, and surface areas were evaluated for sorption and storage properties of environmentally significant gases (H_2, CO_2, and CH_4). It was concluded that the gas sorption behavior follows a general trend that materials with high surface area show enhanced gas uptake performance. For example, MOF-177 (SA = 5200 m^2/g) captures 7.2 wt% of H_2 at 77 K and 19 wt% of CH_4 at 298 K. In addition, MOF-177 exhibits exceptionally high gravimetric CO_2 uptake up to 120 wt% at 298 K. Similarly, the gas storage capacity for COFs seems to follow the same trend and it is determined by the apparent surface area. The architectural stability of both COFs and MOFs upon high pressure H_2 and CH_4 gas sorption measurements were manifested by isotherms which reach saturation without significant hysteresis.