Synthesis and characterization of porous polymer-based adsorbents for CO2 capture [Abstract]

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Synthesis and Characterization of Porous Polymer-Based Adsorbents for CO₂ Capture

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This study investigates a series of porous polymer-based materials (PPMs) synthesizing using methacrylamide, ethylene glycol dimethacrylate, azobisisobutyronitrile, and acetonitrile as monomer, cross-linker, initiator and porogen, respectively. The PPMs were characterized by XPS, FTIR, and TGA and their CO₂ uptake capacities were measured in a fixed bed adsorption column. The effect of porogen and cross-linker on the surface area and sorption capacity was also investigated. The FTIR and XPS spectra revealed a high density of NH₂ groups on the surface of the PPMs, which enhanced the ability of the material to selectively bind CO₂. The PPM particles show porosity, and exhibit Brunauer-Emmett-Teller (BET) surface area of up to 297 m²/g, and were thermally stable up to 240 °C. The CO₂ capacities of the PPM reached 0.64 mmol/g at 313 K and 0.15 bar CO₂ partial pressure. The isotherms of all the samples exhibited a typical shape of type II featuring a non-uniform distribution of pore sizes, and possessed an average density of 1.3 g/cm³ as measured with helium pycnometer. Thus, the PPMs are promising candidate for post combustion CO₂ capture owing to their thermal stability, porosity, selectivity, ease of regeneration, reproducibility, inexpensiveness and suitable density for fluidized bed applications.

Keywords

CO₂ capture, Nitrogen-functionality, Adsorption, Methacrylamide

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