

A New Generation of “Molecular Basket” Sorbents (MBS) for Separation of CO₂ and H₂S from Various Gas Streams

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ABSTRACT

A new generation of “molecular basket” sorbents (MBS) has been developed by the optimum combination of the nano-porous material and CO₂/H₂S-philic polymer sorbent to increase the accessible sorption sites for CO₂ capture from flue gas (Post-decarbonization), and for CO₂ and H₂S separation from the reduced gases, such as synthesis gas, reformat (Pre-decarbonization), natural gas, coal/biomass gasification gas and biogas. The sorption capacity of 140 mg-CO₂/g-sorb was achieved at 15 kPa CO₂ partial pressure. In addition, exceptional dependence of MBS sorption performance on temperature for CO₂ and H₂S was found and discussed at a molecular level via computational chemistry approach. On the basis of the fundamental understanding of MBS sorption character, an innovative sorption process was proposed and demonstrated at the laboratory scale for removing and recovering CO₂ and H₂S, respectively, from a model gas. The advantages of the developed MBS for CO₂ capture and H₂S removal are also discussed. The present study provides a new approach for development of the novel CO₂/H₂S sorbents, and may have a major impact on the advance of science and technology for CO₂/H₂S capture and separation from various gases.