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Review

Carbon capture by physical adsorption: Materials, experimental investigations and numerical modeling and simulations – A review

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HIGHLIGHTS

- A review on carbon capture by physical adsorption is provided.
- The review covers carbon capture materials, experimental and numerical research.
- Challenges for the post combustion adsorption materials are presented.
- Gaps are found in the research of carbon dioxide adsorption of post-combustion.
- Materials of high selectivity, CO_2 uptake with water vapor stability are needed.

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ABSTRACT

This review focuses on the separation of carbon dioxide from typical power plant exhaust gases using the adsorption process. This method is believed to be one of the economic and least interfering ways for post-combustion carbon capture as it can accomplish the objective with small energy penalty and very few modifications to power plants. The review is divided into three main sections. These are (1) the candidate materials that can be used to adsorb carbon dioxide, (2) the experimental investigations that have been carried out to study the process of separation using adsorption and (3) the numerical models developed to simulate this separation process and serve as a tool to optimize systems to be built for the purpose of CO_2 adsorption. The review pointed the challenges for the post combustion and the experiments utilizing the different adsorption materials. The review indicates that many gaps are found in the research of CO_2 adsorption of post-combustion processes. These gaps in experimental investigations need a lot of research work. In particular, new materials of high selectivity, uptake for carbon dioxide with stability for water vapor needs significant investigations. The major prerequisites for these potential new materials are good thermal stability, distinct selectivity and high adsorption capacity for CO_2 as well as sufficient mechanical strength to endure repeated cycling.

Contents

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