

Preface

Carbon capture and storage (CCS) and potentially carbon capture and utilization (CCU) have received increasing attention from both the scientific community and industry during the past several decades, because day-to-day carbon dioxide (CO_2) emissions arising from fossil fuel combustion may cause detrimental changes to the earth's environment. To reach the CCS and CCU goals, the primary step is CO_2 capture, through which CO_2 is separated from gas mixtures. CO_2 also represents a ubiquitous, renewable carbon source that enables the production of methanol and dimethyl ether and efficient alternative transportation fuels, as well as their various derived products. Furthermore, sequestration of low-partial-pressure CO_2 from an enclosed space is of importance in life-support systems for submarines and space vehicles. Hence, the selective capture and separation of CO_2 in an economical, energy-efficient fashion is of positive significance not only in terms of academic interest but also to social and economic progress. Compared with liquid phase ammonia scrubbing, adsorption processes based on porous solids are considered to be a promising alternative separation technique because of their low energy consumption, ease of regeneration, and superior cycling capability. The critical factor in these processes is the design and synthesis of high-performance sorbents. With rapid developments in novel sorbent materials, CO_2 capture-based sorption, separation, and purification have become more and more dominant for carbon capture. In view of their past, current, and potential future importance, it is time to assemble key achievements in relevant aspects of CO_2 capture materials and methods that underpin progress in this field.

The book *Porous Materials for Carbon Dioxide Capture* is aimed at providing researchers with the most pertinent and up-to-date advances related to the fields of porous materials design and fabrication and subsequent evaluation in innovative cyclic CO_2 adsorption processes, with special emphasis on uncovering the relationships between structural characteristics and CO_2 capture performance. The book is divided into seven chapters that provide a resume of the current state of knowledge of porous CO_2 capture materials, which include ionic liquid-derived carbonaceous adsorbents, porous carbons, metal-organic frameworks, porous aromatic frameworks, microporous organic polymers, sorption techniques such as cyclic calcination and carbonation reactions, and membrane separations.

The main benefit of the book is that it highlights the synthesis principles, advanced characterization methods, and structural merits of most of the advanced

CO₂ capture solids and presents some of the most important CO₂ separation methods and related computational simulations. It may serve as a self-contained major reference that appeals to scientists and researchers. The book can be used in the classroom for graduate students who focus on CO₂ separation processes. The material in this book will also benefit engineers active in the research and development of CO₂ capture technologies.

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