Advances and Technology Development in Greenhouse Gases: Emission, Capture and Conversion

CARBON DIOXIDE CONVERSION TO CHEMICALS AND ENERGY

Edited by
Mohammad Reza Rahimpour
Mohammad Amin Makarem
Maryam Meshksar

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Preface

As the global community grapples with the pressing issue of climate change, understanding and mitigating the effects of greenhouse gases have become paramount. This seven-volume collection titled "Advances and Technology Development in Greenhouse Gases: Emission, Capture and Conversion," aims to provide an in-depth exploration of the latest advancements and technological developments in this field and delves into the multifaceted realm of greenhouse gases, addressing crucial aspects of their formation, challenges, emissions, climate change impacts, storage, transportation, carbon capture technologies, and conversion processes. From fundamental concepts to cutting-edge methodologies, each volume is meticulously curated to offer a holistic perspective on the diverse challenges and opportunities associated with greenhouse gases. Whether you are a seasoned researcher, industry professional, or student, this series endeavors to be an invaluable resource, fostering a deeper understanding of the critical issues surrounding greenhouse gases and contributing to the ongoing global efforts toward a sustainable and resilient future.

This volume titled "Carbon Dioxide Conversion to Chemicals and Energy," immerses readers in the innovative realm of converting carbon dioxide into high-value chemicals and energy. As the global community grapples with the imperative of mitigating greenhouse gas effects, this volume serves as a beacon, offering insights into the transformative potential of harnessing carbon dioxide for productive applications.

Section 1, "Carbon Dioxide Conversion and Applications," initiates the exploration with a fundamental introduction to the production of high-value chemicals and energy from CO_2. Economic assessments and cost analyses delve into the financial landscape of CO_2 capture and utilization, addressing the economic viability of these technologies. Simultaneously, environmental impacts and challenges associated with CO_2 usage for synthesizing products and energy are scrutinized, emphasizing the importance of sustainable practices. The section culminates with an overview of the largest operating plants and pilots for carbon conversion, showcasing the practical applications of these cutting-edge technologies.

Section 2, "Carbon Dioxide to Products," extends the journey into the transformative realm of specific products derived from carbon dioxide. From CO_2 conversion to urea, methanol, and methane, the section explores diverse applications, offering a nuanced understanding of the intricate processes involved. Synthesis of carbon monoxide, salicylic acid, hydrocarbons, oxygenated hydrocarbons, and the sonochemical conversion of hydrocarbons expand the horizon of possibilities. Fuel production, oxalate and oxalic acid synthesis, carboxylic acid production, direct conversion to dimethyl ether, and the synthesis of ethylene, ethanol, polymers, and carbon nanotubes underscore the versatility of CO_2 conversion technologies.

Throughout this volume, recent advances and new concepts in CO_2 conversion and applications emerge as a common thread, highlighting the dynamic nature of research and innovation in this field. The exploration is not just theoretical; it extends to the practical realm with insights into the operational challenges, economic considerations, and environmental impacts associated with large-scale carbon conversion.

As readers traverse the rich tapestry of "Carbon Dioxide Conversion to Chemicals and Energy," they are invited to engage with a wealth of knowledge. The volume aims to be a comprehensive resource for seasoned researchers, industry professionals, and students alike, fostering a deeper understanding of the transformative potential within carbon dioxide. By presenting an in-depth examination of carbon conversion technologies, their economic feasibility, and environmental implications, this volume contributes to the ongoing discourse on sustainable environmental practices.

We invite readers to immerse themselves in this exploration, unlocking the complexities of carbon dioxide conversion and its profound impact on reshaping our approach to greenhouse gas management. As we embark on this intellectual journey, may the insights gained from this volume pave the way for innovative solutions and strategies, playing a pivotal role in our collective efforts toward a sustainable and resilient future.

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