

微生物诱导固化技术研究进展

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摘 要:微生物诱导固化(Microbial induced carbonate precipitation, MICP)技术因其环境友好性已成为近年来研究的热点。本文对 MICP 的固化机理进行了介绍, 阐述了细菌、成核位点和生物膜对 MICP 矿化反应的影响, 并对相关理论模型进行了总结, 包括该技术涉及到的溶液的传输与分布、尿素水解速率和孔隙模型等。通过对相关文献进行总结发现, 基于 MICP 具有良好的流动性并且可以生成具有胶结性沉淀的特点, MICP 能够在砂土固化、地基改良、防渗封堵、混凝土修复等领域发挥出良好的改善效果, 具有广阔的应用前景。最后, 在已有研究成果的基础上, 对 MICP 当前研究的问题以及未来的研究方向进行了讨论与展望。

关键词:微生物固化技术; 理论模型; 砂土固化; 地基改良; 防渗封堵; 混凝土修复

中图分类号: TU443

文献标志码: A

Research Advances in Microbially Induced Carbonate Precipitation

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Abstract: Microbially induced carbonate precipitation (MICP) has become a research hot spot due to its environmental friendliness in recent years. This paper introduces the mechanism of MICP, and expounds the influence of bacteria, nucleation microdots and Extracellular Polymeric Substances (EPS) on the reaction of MICP. Similarly, the relevant theoretical models involved in this technology are summarized, including the model of solution transmission and distribution, the model of urea hydrolysis rate and the model of pore. In addition, through summarizing the relevant literature, it is found that, based on MICP better fluidity and cemented precipitation, MICP can play a good improvement effect in broadly application fields, such as sand solidification, foundation improvement, anti-seepage plugging, concrete repair. Finally, the current research problems and future research directions of MICP are discussed and prospected based on the current research results.

Key words: microbially induced carbonate precipitation; theoretical model; sand solidification; foundation improvement; anti-seepage plugging; concrete repairing

近年来为满足快速工业化和日益增长的城市化需求,受人类活动影响,环境恶化加剧,因此绿色、天

* 收稿日期:2020-01-10

基金项目:国家自然科学基金资助项目(51578147), National Natural Science Foundation of China(51578147)

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Recent Advances In Carbonate Studies

T. Torvela, R.J. Chapman, J. Lambert-Smith



Recent Advances In Carbonate Studies:

Carbonate Sequence Stratigraphy Robert G. Loucks, J. Frederick Sarg, 1983-04-15 Hardcover plus Foldouts **Recent Advances and Innovative Developments in Transportation Geotechnics** Buddhima Indraratna, Cholachat Rujikiatkamjorn, 2024-10-26 The book will contain the collection of keynote and invited papers of the 5th International Conference on Transportation Geotechnics Recent Sedimentary Carbonates J.D. Milliman, G. Müller, F. Förstner, 2012-12-06 Few fields of research in the earth sciences have produced as much data and literature as the study of carbonate sediments and rocks The past 25 years in particular have seen a significant increase in studies concerning modern marine and fresh water carbonates With the present worldwide interest in oceanographic research marine carbonates have received the bulk of the attention particularly with respect to shallow water sediments However in terms of the variety of environments compositions and modes of formation non marine carbonates probably encompass a wider spectrum than do marine types Our purpose is to present a two volume treatise on carbonate sediments and rocks both marine and non marine We have confined ourselves to the discussion of modern Holocene environments sediments and components assuming that the compilation of these data will not only be relevant to those working with modern carbonates but will also serve as a necessary reference source for those interested in ancient analogs The first volume by MILLIMAN deals almost exclusively with marine environments while the second volume by MULLER and FORSTNER will concentrate on the non marine carbonates Recent Advances in Carbon Capture and Storage Yongseung Yun, 2017-03-08 Carbon capture and storage CCS has been considered as a practical way in sequestering the huge anthropogenic CO₂ amount with a reasonable cost until a more pragmatic solution appears The CCS can work as a bridge before fulfilling the no CO₂ era of the future by applying to large scale CO₂ emitting facilities But CCS appears to lose some passion by the lack of progress in technical developments and in commercial success stories other than EOR This is the time to go back to basics starting from finding a solution in small steps The CCS technology desperately needs far newer ideas and breakthroughs that can overcome earlier attempts through improving modifying and switching the known principles This book tries to give some insight into developing an urgently needed technical breakthrough through the recent advances in CCS research in addition to the available small steps like soil carbon sequestration This book provides the fundamental and practical information for researchers and graduate students who want to review the current technical status and to bring in new ideas to the conventional CCS technologies

Chronic Kidney Diseases - Recent Advances in Clinical and Basic Research K. Nitta, 2015-05-21 Chronic kidney disease CKD is a growing worldwide public health problem resulting from the increasing number of patients with diabetes and hypertension but also from the aging of the population As the pathology associated with CKD appears to become more complex with age it is essential to improve the prognosis of patients suffering from CKD by developing effective measures to prevent and control complications for the elderly The publication at hand makes a significant contribution to achieving this

goal with renowned Japanese scientists presenting their recent research results. Papers cover various aspects of CKD and related morbidities ranging from dialysis and access related issues to bone disorders, tissue engineering or hyperphosphatemia. Due to the wide range of topics presented, this book will be of interest to readers in various clinical and research settings connected with the care for the elderly.

Recent Advances in Natural Methane Seep and Gas Hydrate Systems Tamara Baumberger, Martin Scherwath, Ira Leifer, Samantha Joye, 2023-02-13

Carbonate Seismology Ibrahim Palaz, K. J. Marfurt, 1997. In this volume, the geologic framework is established with review papers by experts in carbonate generation, rock properties, sequence and seismic stratigraphy, and structural deformation. Then, seismic expression of carbonate terranes is explored in case studies showing the importance of integrating seismic and petrophysical control with geologic models.

Heavy Metals - Recent Advances Basim Almayyahi, 2023-10-18. Heavy metals can be found everywhere on Earth, in water, in the food we eat, and even inside our bodies. It is very important to learn more about heavy metals and how they can improve human life, including how to use them and how to avoid harm. This book covers several topics on heavy metals to enrich our knowledge about their effects, removal, and protection.

Recent Advances in Understanding Gold Deposits T. Torvela, R.J. Chapman, J. Lambert-Smith, 2022-12-06. Gold occurs in many settings, but the dynamic nature of Earth's crust means overlapping and overprinting deposit styles are common. Characterization of mineralization from an early stage becomes important, particularly where the mineralization is complex, in order to maximize exploration and project development success and mining productivity. Various techniques are used at different stages of a project to characterize gold deposits. This Special Publication offers a cross-section of some specific techniques used to investigate a variety of gold deposit types. The papers highlight both the breadth of the available techniques and their utility in deposit characterization, but also the many significant remaining questions and problems related to the exploration and research of gold deposits. Several papers include suggestions of avenues for fruitful further research, including a paper discussing a new approach to classifying orogenic gold deposits and a paper describing archaeological applications of natural gold analyses.

Geology and hydrogeology of carbonate islands Leonard H.L. Vacher, Terrence M. Quinn, 2004-04-13. This book on geology and hydrogeology of carbonate islands is volume 54 in the Developments in Sedimentology series.

Minerals at the Nanoscale F. Nieto, K.J.T. Livi, 2013-05-24. The editors have gathered in this book reviews of past and current studies of mineral groups that have played important roles in geology, environmental science, and health science. The various chapters cover the application of TEM and related techniques to mineral groups in which TEM investigations have been extensive and crucial to the understanding of their mineralogy, namely pyroboles, serpentines, clays, micas, and other metamorphic phyllosilicates, oxides, and oxyhydroxides, sulfides, and carbonates. Some research fields for which TEM is particularly suitable and which have produced significant advances in particular are inclusions and traces, extraterrestrial material, deformation processes, non-stoichiometry, and superstructures and biominerals. Nowadays, we are witnessing the

push for the improvement of detectors for imaging direct detection of electrons and X rays silicon drift detectors and annular high solid angle of collection detectors the development of new support materials e g graphene and liquid cells for TEMs Most of these new technologies have not yet been applied to mineralogical problems but we hope they will be in the near future *New Advances and Challenges in Shale Oil Exploration* Min Wang,Guochang Wang,Jinbu Li,2022-08-04

Recent Advancement in Prodrugs Kamal Shah,Durgesh Nandini Chauhan,Nagendra Singh Chauhan,Pradeep Mishra,2020-05-13 Recent Advancement in Prodrugs Drugs used as medicines have many limitations like low chemical stability aqueous solubility or oral absorption bioavailability rapid presystemic metabolism toxicity inadequate site specificity or poor patient acceptance compliance unwanted adverse effects unacceptable taste or odor irritation or pain Prodrugs design is an approach to overcome these limitations Key features Covers recent advancements in development of prodrugs Presents balanced synthesis and applications of prodrug chemistry Discusses broad spectrum of prodrug categories and outlines industrial applications Reviews prodrugs in cancer nanomedicine its therapy and treatment Elucidates mathematical models to study the kinetics of prodrugs This book covers recent advances in the design of prodrugs It contains all the significant recent examples of prodrug chemistry developments and will aid academics and researchers seeking to generate new projects in the field

Recent Advances in Complex Functional Materials Elson Longo,Felipe de Almeida La Porta,2017-07-12 In this book we explore new approaches to understanding the physical and chemical properties of emergent complex functional materials revealing a close relationship between their structures and properties at the molecular level The primary focus of this book is on the ability to synthesize materials with a controlled chemical composition a crystallographic structure and a well defined morphology Special attention is also given to the interplay of theory simulation and experimental results in order to interconnect theoretical knowledge and experimental approaches which can reveal new scientific and technological directions in several fields expanding the versatility to yield a variety of new complex materials with desirable applications and functions Some of the challenges and opportunities in this field are also discussed targeting the development of new emergent complex functional materials with tailored properties to solve problems related to renewable energy health and environmental sustainability A more fundamental understanding of the physical and chemical properties of new emergent complex functional materials is essential to achieving more substantial progress in a number of technological fields With this goal in mind the editors invited acknowledged specialists to contribute chapters covering a broad range of disciplines

Carbonate Reservoirs Clyde H. Moore,William J. Wade,2013-08-12 The 2nd Edition of Carbonate Reservoirs aims to educate graduate students and industry professionals on the complexities of porosity evolution in carbonate reservoirs In the intervening 12 years since the first edition there have been numerous studies of value published that need to be recognized and incorporated in the topics discussed A chapter on the impact of global tectonics and biological evolution on the carbonate system has been added to emphasize the effects of global earth processes and the

changing nature of life on earth through Phanerozoic time on all aspects of the carbonate system The centerpiece of this chapter and easily the most important synthesis of carbonate concepts developed since the 2001 edition is the discussion of the CATT hypothesis an integrated global database bringing together stratigraphy tectonics global climate oceanic geochemistry carbonate platform characteristics and biologic evolution in a common time framework Another new chapter concerns naturally fractured carbonates a subject of increasing importance given recent technological developments in 3D seismic reservoir modeling and reservoir production techniques Detailed porosity classifications schemes for easy comparison Overview of the carbonate sedimentologic system Case studies to blend theory and practice **Beyond**

Current Research Trends in CO2 Utilization Michele Aresta,Andrew B. Bocarsly,Angela Dibenedetto,2022-03-08

Recent Advances in Symbiosis Research: Integrative Approaches M. Pilar Francino,Mónica Medina,2017-02-02

Traditionally symbiosis research has been undertaken by researchers working independently of one another and often focused on a few cases of bipartite host symbiont interactions New model systems are emerging that will enable us to fill fundamental gaps in symbiosis research and theory focusing on a broad range of symbiotic interactions and including a variety of multicellular hosts and their complex microbial communities In this Research Topic we invited researchers to contribute their work on diverse symbiotic networks since there are a large variety of symbioses with major roles in the proper functioning of terrestrial or aquatic ecosystems and we wished the Topic to provide a venue for communicating findings across diverse taxonomic groups A synthesis of recent investigations in symbiosis can impact areas such as agriculture where a basic understanding of plant microbe symbiosis will provide foundational information on the increasingly important issue of nitrogen fixation climate change where anthropogenic factors are threatening the survival of marine symbiotic ecosystems such as coral reefs animal and human health where unbalances in host microbiomes are being increasingly associated with a wide range of diseases and biotechnology where process optimization can be achieved through optimization of symbiotic partnerships Overall our vision was to produce a volume of works that will help define general principles of symbiosis within a new conceptual framework in the road to finally establish symbiology as an overdue central discipline of biological science Advances in Carbonic Acid Research and Application: 2013 Edition ,2013-06-21

Advances in Carbonic Acid Research and Application 2013 Edition is a ScholarlyBrief that delivers timely authoritative comprehensive and specialized information about ZZZAdditional Research in a concise format The editors have built Advances in Carbonic Acid Research and Application 2013 Edition on the vast information databases of ScholarlyNews You can expect the information about ZZZAdditional Research in this book to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Advances in Carbonic Acid Research and Application 2013 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions

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