

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

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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

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Recent Advances In Carbonate Studies

**Tamara Baumberger, Martin
Scherwath, Ira Leifer, Samantha Joye**

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Recent Advances and Innovative Developments in Transportation Geotechnics Buddhima Indraratna, Chalachat

Rujikiatkamjorn, 2024-10-26 The book will contain the collection of keynote and invited papers of the 5th International

Conference on Transportation Geotechnics

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

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

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 *Recent advances in fish toxicology* Richard A. Tubb,1977 *Recent Advances in Infrastructure Development and Management - Volume 1* Y. K. Guruprasad,G. R. Dodagoudar,K. S. Nanjunda Rao,P. C. Pandey,H. B. Nagaraj,2025-08-11 This book presents select proceedings of Modern Trends in Civil Engineering Infrastructure Development Management MTCEIDM 2023 It sheds light on the current research on the applications of innovative tools and technologies in solving real life civil engineering problems The book presents the application of such new technologies in various domains including but not limited to structural health monitoring infrastructure and retrofitting futuristic and sustainable materials analysis and design of mega structures foundation design and safety assessment of structures and hydraulic and transportation structures This book would be a valuable resource for researchers and professionals dealing with innovative technologies in the field of infrastructure development and infrastructure management

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 *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

New Advances and Challenges in Shale Oil Exploration Min Wang,Guochang Wang,Jinbu Li,2022-08-04 [Recent Advances in the](#)

[Psychobiology of the Depressive Illnesses](#) Martin M. Katz,Thomas Andrew Williams,James Asa Shield,1969 *Recent Advances in the Psychobiology of the Depressive Illnesses; Proceedings of a Workshop Sponsored by the Clinical Research Branch, Division of Extramural Research Programs* National Institute of Mental Health (U.S.),1972

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 Quantitative Remote Sensing](#) José A. Sobrino,José Antonio

Sobrino Rodríguez,2002 **Recent Advances in Models of Siliciclastic Shallow-marine Stratigraphy** Gary J. Hampson,2008 Siliciclastic shallow marine deposits record the interface between land and sea and its response to a variety of forcing mechanisms physical process regime the internal dynamics of coastal and shelfal depositional systems relative sea level sediment flux tectonic setting and climate These deposits have long been the subject of conceptual stratigraphic models that seek to explain the interplay between these various forcing mechanisms and their preservation in the stratigraphic record This volume arose from an SEPM research conference on shoreline shelf stratigraphy that was held in Grand Junction Colorado on August 24-28 2004 The aim of the resulting volume is to highlight the development over the last 15 years of the stratigraphic concepts and models that are used to interpret siliciclastic marginal marine shallow marine and shelf deposits

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available at <http://www.ScholarlyEditions.com> *Recent Advances in the Psychobiology of the Depressive Illnesses* Thomas A. Williams, Martin M. Katz, James Asa Shield, 1972 **The Biology of Glial Cells: Recent Advances** Ishan Patro, Pankaj Seth, Nisha Patro, Prakash Narain Tandon, 2022-04-09

This book reviews the role of glial cells astrocytes microglia oligodendroglia satellite cells and Schwann cells in neuronal health and diseases It discusses the latest advances in understanding their origin differentiation and hemostasis The book also examines the role of microglial cells in central nervous system CNS development maintenance and synaptic plasticity Further the book presents the functions of astrocytes in healthy CNS and their critical role in CNS disorders including Parkinson s and Alzheimer s diseases Notably the book describes the pathobiology molecular pathogenesis stem cells and imaging characteristics of gliomas It defines the role of glial cells in regulating iron homeostasis and their effect on the neurodegeneration of neurons Lastly it covers the structure function and pathology of oligodendrocytes and their role in neuronal health and disease *Microbial Enhancement of Oil Recovery - Recent Advances* E.C. Donaldson, 1991-04-03

This conference was instituted to examine field activities in Microbial Enhancement of Oil Recovery The U S Department of Energy has sponsored several field projects and the details from some of these were presented as well as a few from industry The balance of the program was concerned with new developments in research Today s oil production technology leaves one third to one half of the original oil in place in the reservoir at abandonment of secondary recovery waterflooding This leaves a very large target for microbial enhanced oil recovery which was shown by the research papers of this conference to be capable of producing up to 50% of the residual oil The field trials show that the normal projected oil production decline curve can be reversed or leveled off by microbial enhancement of oil recovery This conference has shown that a variety of applications are possible to correct oilfield problems as well as to enhance oil recovery Among these is the suppression of hydrogen sulfide production which alone is a tremendous advance because of the large quantity of sour oil production If hydrogen sulfide production can be curtailed it would increase the value of the produced oil decrease its toxicity and largely decrease its corrosiveness All of these would be welcome both in the field and at the petroleum refinery where special precautions must be taken to process sour crude oil Another very important discovery is the ability of certain bacteria to eliminate paraffin deposition around the producing well and in the tubulars This is a welcome improvement for many producers who have considerable difficulty in controlling paraffin deposition Recent Developments In Civil Engineering Vijay Kumar, Anupam Rawat, R. P. Tiwari, A book on

Recent Developments in Civil engineering would likely focus on the latest advancements and innovations in the field of Civil Engineering The book would cover a wide range of topics related to Civil engineering such as sustainable infrastructure design construction materials and construction techniques transportation systems and infrastructure geotechnical engineering water resources and management environmental engineering and sustainability of structures and its design

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