

World Scientific e-Journal User Guide




1. Main Page




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World Scientific Remembers Its Late Author Stephen Hawking

World Scientific is saddened to hear of the passing of our author, Stephen Hawking, on 14 March 2018. Prof Hawking is best known for his work on black holes and relativity, and had gained fame worldwide for publishing several popular science books.




NEW TITLES

새로 출간된 타이틀



Financial Engineering
Selected Works of Alexander Lipton
by Alexander Lipton



Vibration-Based Techniques for Damage Detection and Localization in Engineering Structures
edited by Ali S Nobari & M H Ferri Aliabadi



Ludwig Faddeev Memorial Volume
A Life in Mathematical Physics
edited by Mo-Lin Ge, Antti J Niemi, Kok Khoo Phua & Leon A Takhtajan

More »

PRESS RELEASES

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NEWS



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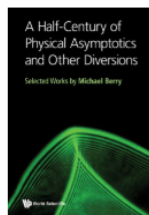


Exclusive Publisher
of Nobel Prize, Wolf Prize and Fields Medallists' Lectures

1. Main Page

1

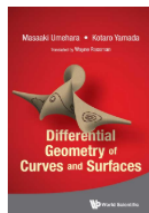
NEW REVIEWS



A Half-Century of Physical Asymptotics and Other Diversions Selected Works by Michael Berry
by Michael Berry

"Comments made on the philosophy and conduct of science are valuable and have been influenced strongly by academic contacts at the University of Bristol, and indeed worldwide; The variety of papers and their intended readerships make much of this volume appropriate and enjoyable for general readers, as well as for specialists."

Contemporary Physics



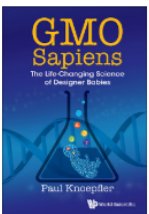
Differential Geometry of Curves and Surfaces
by Masaaki Umehara & Kotaro Yamada
translated by Wayne Rossman

"In a class populated by students who already have some exposure to the concept of a manifold, the presence of chapter 3 in this text may make for an unusual and interesting course. The primary function of this book will be as a text for a more conventional course in the classical theory of curves and surfaces."

MAA Reviews

2

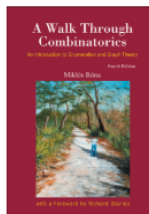
BESTSELLERS



An Introduction to Black Holes, Information and the String Theory Revolution
The Holographic Universe
by Leonard Susskind & James Lindesay



Marketing for Competitiveness: Asia to the World
In the Age of Digital Consumers
by Philip Kotler, Hermawan Kartajaya & Den Huan Hooi



A Walk Through Combinatorics
An Introduction to Enumeration and Graph Theory
4th Edition
by Miklós Bóna

More »

1. 새로 등록된 리뷰
2. 베스트셀러 타이틀
3. 주요 원문

3

FEATURED ARTICLES

Early examples of topological concepts in physics

C. N. Yang

Vol. 33, No. 22, 19 Jul 2018

CALCULATION OF TAKEOFF AND LANDING PERFORMANCE UNDER DIFFERENT ENVIRONMENTS

YAJUAN ZHU, JIANGFENG WANG, YONGLIANG CHEN and YIZHAO WU

Vol. 42, 21 Jun 2016

DIGITAL TRANSFORMATION OF BUSINESS MODELS — BEST PRACTICE, ENABLERS, AND ROADMAP

DANIEL SCHALLMO, CHRISTOPHER A. WILLIAMS and LUKE BOARDMAN

Vol. 21, No. 08, 11 Dec 2017

Central Bank Currency Swaps and Their Implications to the International Financial Reform

Xu Mingqi

Vol. 02, No. 01, 14 Apr 2016

ANALYSING UBER IN SOCIAL MEDIA — DISRUPTIVE TECHNOLOGY OR INSTITUTIONAL DISRUPTION?

CHRISTOFER LAURELL and CHRISTIAN SANDSTRÖM

Vol. 20, No. 05, 15 Jun 2016

Review of the Synthetic Techniques and Applications of the Quantum Dots/Graphene Composites

Yong Duan, Tianjian Zeng, Tao Sun, Ling Tong, Anran Chen, Jin Zhang, Rongfei Wang, Chong Wang and Yu Yang

Vol. 13, No. 05, 30 May 2018

POLICY INSIGHTS FROM THE EMF 32 STUDY ON U.S. CARBON TAX SCENARIOS

ALEXANDER R. BARRON, ALLEN A. FAWCETT, MARC A. C. HAFSTEAD, JAMES R. MCFARLAND and ADELE C. MORRIS

Vol. 09, No. 01, 21 Mar 2018

Predicting Model and Algorithm in RNA Folding Structure Including Pseudoknots

Zhendong Liu, Daming Zhu and Qionghai Dai

Vol. 32, No. 10, 20 Jun 2018

2-1. Browse – by Subject

World Scientific
Connecting Great Minds

Subject Journals Books E-Pre

1 **Publication Type**

- Books 12548
- Book Series 394
- Journals 173

2 **Publication Date**

- Last Year 601
- Last 6 Months 279
- Last 3 Months 148
- Last Month 35

3 **Subjects**

- Architecture / Building Management 59
- Asian Studies 939
- Business & Management 924
- Chemistry 1205
- Computer Science 1490

4 **Book types**

- Textbook 1570

5 **RESULTS: 1 - 20 of 12721**

PER PAGE: 20 50 100 **SORT:** ALPHABETICALLY

Book No Access
The (1+1)-Nonlinear Universe of the Parabolic Map and Combinatorics
By (author): Mar...
Sep 2

Book No Access
The (Pre-)Dawning of Functional Specialization in Physics
By (author): Terrance J Quinn (Middle Tennessee State University, USA)
May 2017

Book Full Access
The "Thermodynamic" Universe
Exploring the Limits of Physics
By (author): B G Sidharth (International Institute of Applicable Mathematics & Information Sciences, India)
May 2008

Book Full Access
1,1'-Binaphthyl-Based Chiral Materials
Our Journey
By (author): Pu Lin (University of Virginia, USA)
Aug 2009

Financial Engineering
Selected Works of Alexander Lipton
by Alexander Lipton

- 모든 주제별 선택 시
- 1. 출판 종류: 책, 책 시리즈, 저널
- 2. 출판 연도: 작년, 6개월/3개월/한 달 전
- 3. 세부 주제: 건축/건축 경영, 아시아 연구 등
- 4. 책 종류: 교재
- 5. 결과 나열 방법: 한 페이지 당 결과 수, 정렬 방법

2-1. Browse – by Subject

특정 주제 선택 시

1. 세부 주제
2. 해당 저널
3. 새로 출간된 타이틀
4. 새로 등록된 리뷰
5. 베스트셀러 타이틀
6. 교재
7. 북 시리즈

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All Subjects
Asian Studies
Business & Management
Chemistry
Computer Science

Chemistry

Browse by subdiscipline

Analytical Chemistry	Physical Chemistry	Computational Chemistry	Environmental / Atmospheric Chemistry
General Chemistry	Organic Chemistry	Inorganic Chemistry	Biochemistry
» view more			

E-CATALOGUES

TEXTBOOKS

ANNUAL CATALOGUE

BESTSELLERS

NEW TITLES

Journals » See all

Journal of Porphyrins and Phthalocyanines (JPP)

Journal of Theoretical and Computational Chemistry (JTCC)

Molecular Frontiers Journal (MFJ)

Functional Materials Letters

New Titles » See all

Forthcoming

Forthcoming

Forthcoming

Forthcoming

New Reviews » See all

Applied Theoretical Organic Chemistry
edited by Dean J Tantillo

Atmospheric Chemistry
From the Surface to the Stratosphere
by Grant Ritchie

Bestsellers » See all

Reminiscences of Ahmed H. Zewail: Photons, Electrons and What Else?

Wonders of Water
The Hydrogen Bond in Action
by Ivar Olovsson

The Chemistry of Inkjet Inks
edited by Shlomo Magdassi

Entropy
The Truth, the Whole Truth, and Nothing But the Truth
by Arieh Ben-Naim

Textbooks » See all

Problems of Instrumental Analytical Chemistry
A Hands-On Guide
by JM Andrade-Garda, A Carlosena-Zubietta, MP Gómez-Carracedo, MA Maestro-Saavedra, MC Prieto-Bianco & RM Soto-Ferreiro

Bioanalytical Chemistry
2nd Edition
by Andreas Manz, Petra S Dittrich, Nicole Pamme & Dimitris Iossifidis

Basic Physical Chemistry
The Route to Understanding
Revised Edition
by E Brian Smith


Carbohydrate Chemistry
Fundamentals and Applications
by Raimo Alén

Book Series » See all

Essential Textbooks in Chemistry

Catalytic Science Series

2-2. Browse – by Journals



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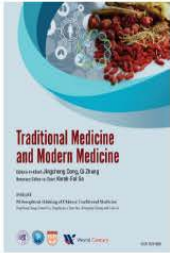
1

AnywhereType in here

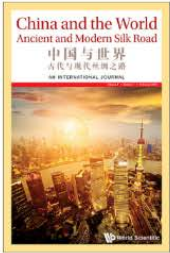
As of now, we have over 135 journals and will continue to add more even as we continue to bring you the latest developments in your field in the shortest time possible. Register now and make full use of the features of the platform today!

- 저널 항목 선택 시
- 1. 검색창
- 2. 새로 출간된 저널
- 3. 주제별 브라우징
- 4. 최신 원문

2 New Journals



Traditional Medicine and Modern Medicine (TMMM)



China and the World (CWSR)
Ancient and Modern Silk Road



International Journal of Big Data Mining
Global Warming (IJBDMGW)

3 Browse by Subject

Asian Studies	Business & Management	Chemistry
Economics & Finance	Engineering / Acoustics	Environmental Science
Materials Science	Mathematics	Medicine
Nonlinear Science, Chaos & Dynamical Systems	Physics and Astronomy	Social Sciences

4 LATEST ARTICLES

Analysis of s-wave, p-wave and d-wave holographic superconductors in Hořava–Lifshitz gravity

Kai Lin, Xiao-Mei Kuang, Wei-Liang Qian, Qiyuan Pan and A. B. Pavan

Modern Physics Letters A
Online ready

The structural, elastic and thermodynamic properties of intermetallic phases in Mg–Sn–Si–Ca(Sr) alloys: A first-principles study

Yan Li, Yuhong Zhao, Hua Hou and Xiaomin Yang

International Journal of Modern Physics B
Online ready

Elastic properties of the charge density wave system HoTe₃

M. Saint-Paul, C. Guttin, P. Lejay, O. Leynaud and P. Monceau

International Journal of Modern Physics B
Online ready

tCG torsion pairs

Daniel Bravo and Carlos E. Parra

Journal of Algebra and Its Applications
Online ready

Editorial Note

Reviews in Mathematical Physics
Online ready

Simulation and experimental study of binder droplet infiltration in 3DP technology

Yuanyuan Wang, Pengfei Jia, Weidong Yang, Kai Peng and Sixiang Zhang

Modern Physics Letters B
Online ready

Hydrogen energy-level shifts induced by the atom motion: Crossover from the Lamb shifts to the motion-induced shifts

A. I. Agafonov

Modern Physics Letters B
Online ready

An integrated framework for anomaly detection in big data of medical wireless sensors

Bharti Saneja and Rinkle Rani

Modern Physics Letters B
Online ready


Effects of oxygen partial pressure on the microstructure, electrical and optical properties of the Sn-doped In₂O₃ thin films

Xiaochan Liu, Yukai An, Zhen Lin and Jiwen Liu

Modern Physics Letters B
Online ready

Nanotechnology & Nanoscience

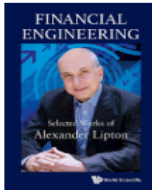
2-3. Browse – by Books




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Subject Journals **Books** E-Products Partner With Us Open Access

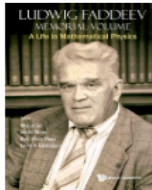
1 **New Titles** » See all




Financial Engineering
Selected Works of Alexander Lipton
by Alexander Lipton



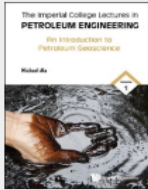
Vibration-Based Techniques for Damage Detection and Localization in Engineering Structures
edited by Ali S Nobari & M H Ferri Aliabadi



Ludwig Faddeev Memorial
A Life in Mathematical Physics
edited by Mo-Lin Ge, Antti J T Phua & Leon A Takhtajan



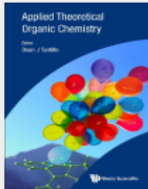
2 **New Reviews**



The Imperial College Lectures in Petroleum Engineering
Volume 1: An Introduction to Petroleum Geoscience
by Michael Ala

"The book achieves its aim of communicating a common set of principles and a structured approach to petroleum geoscience; it also provides a helpful glossary and at the end of each chapter, a useful set of references for those readers wishing to delve into further detail. Good use is made of illustrations from around the world to demonstrate concepts and principles. The book is thus compact and well laid-out, meeting the challenge on containing the key information for ready reference without running to a considerably larger tome."

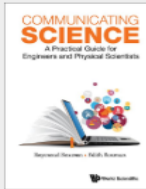
Dr John F Bell
Director Asia Operations
Ophir Energy



Applied Theoretical Organic Chemistry
edited by Dean J Tantillo

"The chapters are each interesting in their own way, the coverage of the field is superb, and so is the underlying expertise. This book will be very, very useful to the organic community as quantum and computational chemistry fulfil their promise of becoming true partners in exploring synthesis and mechanism in organic chemistry."

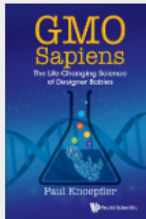
Roald Hoffmann
Cornell University
Nobel Prize Winner in Chemistry 1991




3 **Browse by Subject**

Asian Studies	Business & Management	Chemistry	Computer Science
Economics & Finance	Education	Engineering / Acoustics	Environmental Science
Life Sciences / Biology	Materials Science	Mathematics	Medicine
Nanotechnology & Nanoscience	Nonlinear Science, Chaos & Dynamical Systems	Physics and Astronomy	Popular & General Science
Social Sciences	Chinese Titles		


4 **Bestsellers** » See all




An Introduction to Black Holes, Information and the String Theory Revolution
The Holographic Universe
by Leonard Susskind & James Lindesay



Marketing for Competitiveness: Asia to the World
In the Age of Digital Consumers
by Philip Kotler, Hermawan Kartajaya & Den Huan Hooi



A Walk Through Combinatorics
An Introduction to Enumeration and Graph Theory
4th Edition
by Miklós Bóna



An Introduction to Black Holes, Information and the String Theory Revolution
The Holographic Universe
by Leonard Susskind & James Lindesay

- 책 항목 선택 시
- 1. 새로 출간된 타이틀
- 2. 새로 등록된 리뷰
- 3. 주제별 브라우징
- 4. 베스트셀러 타이틀

3-1. Search – Basic Search

The screenshot shows the World Scientific website header and search bar. The World Scientific logo is at the top left. Navigation links include Subject, Journals, Books, E-Products, Partner With Us, and Open Access. In the top right corner, there are links for Search, My Cart, and Sign in. The search bar is located below the navigation links and contains a dropdown menu set to 'Anywhere' and a text input field with the placeholder 'Enter words / phrases / DOI / ISBN / keywords / authors / etc'. A magnifying glass icon is on the right of the search bar. Two red boxes with numbers are used as annotations: box 1 points to the search bar area, and box 2 points to the 'Advanced Search' link next to it.

1

2

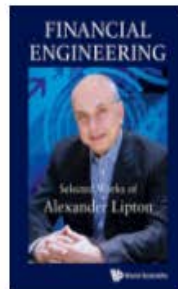
Anywhere

Enter words / phrases / DOI / ISBN / keywords / authors / etc

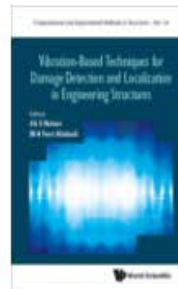
Advanced Search

- 간편 검색 시
- 1. 돋보기 아이콘의 검색 버튼을 클릭하여 전체/인용구 중 선택, 단어/구절/DOI/ISBN/키워드/저자 등을 입력, 엔터 및 돋보기 아이콘 클릭
- 2. 고급검색: 보다 복합적인 검색 가능

NEW TITLES



Financial Engineering
Selected Works of Alexander Lipton
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Vibration-Based Techniques for
Damage Detection and Localization
in Engineering Structures
edited by Ali S Nobari & M H Ferri
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A Life in Mathematical Physics
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Khoo Phua & Leon A Takhtajan

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3-1. Search – Basic Search

The screenshot shows the World Scientific search interface. On the left is a sidebar with filters for Author, Publication, Keyword, Subjects, and Book types. The main area displays search results for the keyword 'Carbon'. Annotations 1 through 5 highlight specific features: 1. 'Narrow Results' button; 2. 'Articles/Chapters' and 'Books Titles' tabs; 3. 'Follow results' button; 4. 'REFINE SEARCH' button; 5. 'PER PAGE' and 'SORT: RELEVANCE' options. The search results list includes 'Stable Carbonium Ions. LXIV: Protonated Carbonic Acid (Trihydroxycarbonium Ion) and Protonated Alkyl (Aryl) Carbonates and Hydrogen Carbonates, and Their Cleavage to Protonated Carbonic Acid and Carbonium Ions. The Possible Role of Protonated Carbonic Acid in Biological Carboxylation Processes' by George A. Olah and Anthony M. White.

Author

- Olah, George A. 142
- Kadish, Karl M. 125
- Rao, C N R. 116
- Chan, Kim Seng. 108
- Tan, Jeanne. 108
- MORE (20) ▾

Publication

- Default Book Series. 14754
- Journal of Porphyrins and Phthalocyanines. 1172
- International Journal of Modern Physics B. 1109
- Surface Review and Letters. 798
- Nano. 625
- MORE (20) ▾

Keyword

- Graphene. 249
- Carbon Nanotubes. 230
- Carbon Nanotube. 154
- Porphyrin. 129
- Phthalocyanine. 125
- MORE (20) ▾

Subjects

- Architecture / Building Management. 244
- Asian Studies. 1081
- Business & Management. 1145
- Chemistry. 12007
- Computer Science. 1234
- MORE (14) ▾

Book types

- Textbook. 2152

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Subject ▾ Journals Books E-Products Partner With Us ▾ Open Access

Anywhere ▾ Carbon 🔍 Advanced Search

Narrow Results 1

2 Articles/Chapters Books Titles

Results: 1 - 20 of 30050 Carbon

3 Follow results: α* 📧

4 REFINE SEARCH ▾

5 PER PAGE: 20 50 100 SORT: RELEVANCE ▾

Chapter No Access

Stable Carbonium Ions. LXIV: Protonated Carbonic Acid (Trihydroxycarbonium Ion) and Protonated Alkyl (Aryl) Carbonates and Hydrogen Carbonates, and Their Cleavage to Protonated Carbonic Acid and Carbonium Ions. The Possible Role of Protonated Carbonic Acid in Biological Carboxylation Processes

George A. Olah and Anthony M. White

Across Conventional Lines | 01 Jan 2003

Preview Abstract ▾

Chapter No Access

A Research on Selective Carburization Process of Low Carbon Steel

Soil Carbon and Climate Change

Publication Type

- Journals and Books. 30050
- Books. 20205
- Journals. 9847

Article Type

- Chapter Item. 18359
- Research Article. 8836
- Back Matter. 1052
- Front Matter. 791
- Review Article
- MORE (13) ▾

Publication Date

- Last Year
- Last 6 Months
- Last 3 Months
- Last Month

■ 검색 결과

1. 출판 종류, 원문 종류, 출판 연도, 저자, 출판물, 키워드, 주제, 책 종류로 결과 필터
2. 원문 및 챕터, 혹은 책 제목에 한하여 검색 결과 나열
3. 검색 결과 저장(개인 계정 필요) 및 RSS 설정
4. 고급 검색, 검색 기록, 검색 저장소를 이용하여 검색 구체화
5. 한 페이지 당 결과 수, 정렬 방법 지정하여 결과 나열 방법 선택

3-2. Search – Advanced Search

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Advanced Search Search History Saved Searches

Anywhere carbon nanotube NOT conductivity

Published in e.g. Journal of Theoretical Biology

Publication Date

☐ All dates

☒ Last year

☐ Custom range Month Year Month Year

Advanced

☒ include Articles in Ahead of Print

SEARCH TIPS

Boolean searches

You can use the Boolean Operators AND, OR and NOT within search fields. By default an AND relationship is assumed between search terms unless another operator is specified.

Searching for authors

To search for multiple authors, separate each author name with either AND or OR. Using AND will search for content that has been co-authored by the authors. Using OR will search for content that has been authored by either of the authors.

인쇄본 출판 이전에
출간된 원문들 포함 여부

■ 고급 검색 팁

1. 불리언 연산자 검색: AND, OR, NOT의 불 연산자 이용(미 지정 시, AND로 자동설정)
2. 저자 검색: 여러 저자 검색 시 AND와 OR 응용 가능
3. 구문 검색: ""(따옴표) 활용으로 해당 구문과 정확히 일치하는 단어 검색 가능
4. 와일드카드: ? 사용 시 하나의 특징에 제한, * 사용 시 그 이상의 특징에 제한하여 검색
예) Europe* -> Europe and European, Europe? -> Europe
(단, 검색어 시작과 인용 부호로 된 구문 검색 시 사용 불가능)
5. DOI 검색: 10.3366/code.2016.0000 형식을 사용하여 DOI 검색

4-1. Access Journal

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Journal of Porphyrins and Phthalocyanines

ISSN (print): 1088-4246 | ISSN (online): 1099-1409

1 2 3 4

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2018 2017 2016 2015 2014 2013 2012 2011 2010 2009-2000 1999-1990

Vol. 22, No. 07
CURRENT ISSUE
pp.535-618

Vol. 22, No. 06
pp.461-534

Vol. 22, No. 05
pp.371-460

Vol. 22, No. 04
pp.291-370

Vol. 22, No. 01n03
pp.1-290

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Journal of Porphyrins and Phthalocyanines

Vol.22 Iss.1-3
Jan - Mar

Journal of Porphyrins and Phthalocyanines

Vol.22 Iss.4
Apr

May Jun

- 특정 저널 선택 시
- 1. 온라인 제공 가능: 검토가 끝난 최종 버전, Volume/원문/DOI로 검색 및 인용 가능
- 2. 최근 Issue: 가장 최근에 발행된 Issue
- 3. 저널 Issue: 저널에서 제공 가능한 Issue
- 4. 도구 및 공유:기관 도서관에 추천/RSS 외 다양한 SNS 공유 기능
- 5. 개요: 'here' 클릭 시, 명시된 연도에 대한 모든 원문 개요 열람 가능

4-1. Access Journal

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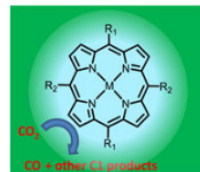
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Abstract

This review summarizes research on the electrochemical and photochemical reduction of CO₂ using a variety of iron and cobalt porphyrins, phthalocyanines and related complexes. Metalloporphyrins and metallophthalocyanines are visible light absorbers with extremely large extinction coefficients. However, yields of photochemically-generated active catalysts for CO₂ reduction are typically low owing to the requirement of a second photoinduced electron. This requirement is not relevant to the case of electrochemical CO₂ reduction. Recent progress on efficient and stable electrochemical systems includes the use of FeTPP catalysts that have prepositioned phenyl OH groups in their second coordination spheres. This has led to remarkable progress in carrying out coupled proton-electron transfer reactions for CO₂ reduction. Such ground-breaking research has to be continued in order to produce renewable fuels in an economically feasible manner.



Keywords: CO₂ reduction ■ porphyrin ■ phthalocyanine ■ cobalt ■ iron

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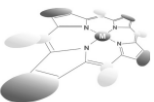
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Journal of Porphyrins and Phthalocyanines
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A review of iron and cobalt porphyrins, phthalocyanines and related complexes for electrochemical and photochemical reduction of carbon dioxide

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Dedicated to Professor Shunichi Fukuzumi on the occasion of his retirement

Received 14 November 2014
Accepted 23 December 2014

ABSTRACT: This review summarizes research on the electrochemical and photochemical reduction of CO₂ using a variety of iron and cobalt porphyrins, phthalocyanines and related complexes. Metalloporphyrins and metallophthalocyanines are visible light absorbers with extremely large extinction coefficients. However, yields of photochemically-generated active catalysts for CO₂ reduction are typically low owing to the requirement of a second photoinduced electron. This requirement is not relevant to the case of electrochemical CO₂ reduction. Recent progress on efficient and stable electrochemical systems includes the use of FeTPP catalysts that have prepositioned phenyl OH groups in their second coordination spheres. This has led to remarkable progress in carrying out coupled proton-electron transfer reactions for CO₂ reduction. Such ground-breaking research has to be continued in order to produce renewable fuels in an economically feasible manner.

KEYWORDS: CO₂ reduction, porphyrin, phthalocyanine, cobalt, iron.

1. INTRODUCTION

The global carbon cycle is a closed system with all fossil fuels currently burned originating from photosynthetic carbon dioxide fixation over millions of years. An imbalance in the rates of consumption vs. natural fixation with increasing human demand for energy leads to two major concerns: the rising concentration of atmospheric CO₂, and the inevitable decline of extractable fossil fuels. The problem of atmospheric concentrations can be alleviated to some extent through CO₂ capture/sequestration technology [1]; however, a conversion/utilization or recycling scheme is perhaps more ideal since the need for energy is also addressed. If the recycling technology is ultimately powered by inexhaustible, although intermittent, solar energy, CO₂ is then viewed as a redox mediator in which diffuse solar energy is stored in the form of chemical bonds by its reduction and electrical energy is obtained by oxidation of the reduced products.


The foremost challenge to CO₂ recycling is its chemically inert nature. Direct electrochemical reduction to CO₂^{•-} (Equation 1) is highly unfavorable due in part to the geometric rearrangement from linear to bent. This difficulty is reflected by the standard potential of -1.90 V vs. NHE [2]. Energy requirements for proton assisted multi-electron reductions at pH 7 (Equations 2-6) are substantially lower; however, catalysts are necessary to mediate the microscopic steps involved in the multi-proton, multi-electron reductions. Transition metal complexes with a variety of accessible oxidations states (including ligand-localized reductions) are well-suited for this task and often provide product selectivity and tunable activity [3-5]. Nevertheless, reduction beyond formic acid or CO remains rare and further developments are needed.

CO₂ + e⁻ → CO₂^{•-} E^{0'} = -1.90 V (1)
CO₂ + 2H⁺ + 2e⁻ → CO + H₂O E^{0'} = -0.53 V (2)
CO₂ + 2H⁺ + 2e⁻ → HCO₂H E^{0'} = -0.61 V (3)

[†]SPP full member in good standing
*Correspondence to: Gerald F. Manbeck, email: gmanbeck@bnl.gov, Etsuko Fujita, email: fujita@bnl.gov

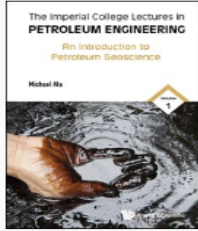
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The Imperial College Lectures in Petroleum Engineering
Volume 1: An Introduction to Petroleum Geoscience
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Pages: 324
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As the first volume in the *Imperial College Lectures in Petroleum Engineering*, and based on a lecture series on the same topic, *An Introduction to Petroleum Geoscience* provides the introductory information needed for students of the earth sciences, petroleum engineering, engineering and geoscience.

This volume also includes an introduction to the series by Martin Blunt and Alain Gringarten, of Imperial College London.

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Chapter 1

Introduction to Geology

1.1. Introduction

Geology is the study of rocks and Earth history. The Earth is a dynamic and ever changing body; earthquakes, volcanoes, moving continents and expanding and contracting oceans are all surface phenomena providing evidence of an active interior. They also provide clues to the internal processes, structure and composition of the Earth.

A unique feature of the Earth is that it has liquid water. Figure 1.1 presents a view of the Earth from space.

1.2. Shape, Internal Structure, and Composition of the Earth

In terms of its shape, the Earth is an oblate sphere; it is relatively

■ 옵션

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