

Leaching Of Rare Earths Elements From Clay Materials

REWAS 2016 Extraction 2018 Rare Metal Technology 2015 Metal Recovery from Electronic Waste: Biological Versus Chemical Leaching for Recovery of Copper and Gold Rare Metal Technology 2016 Rare Earths Industry Separation Hydrometallurgy of Rare Earth Elements Geobiotechnology I Applications of Ion Exchange Materials in the Environment Rare Earth Elements in Groundwater Flow Systems Lanthanides Noble and Precious Metals Rare Earth Element Mines, Deposits and Occurrences Hydrometallurgy of Rare Earths Rare Earths Evolutionary and Revolutionary Technologies for Mining Cerium Oxide Rare Metal Technology 2020 Mechanochemistry in Nanoscience and Minerals Engineering Hydrometallurgy of Rare Earths Uranium in the Environment Rare Chemical Process Engineering Rare Earth Elements Agromining: Farming for Metals Hydrogeology of Crystalline Rocks Separation Hydrometallurgy of Rare Earth Elements Rate Processes of Extractive Metallurgy Critical and Rare Earth Elements Extractive Metallurgy of Rare Earths Hydrometallurgy in Extraction Processes Rare Earth Elements Weathered Crust Elution-deposited Rare Earth Ores Rare Metal Technology 2019 Critical Mineral Resources of the United States Rare Earth Element Geochemistry Rare Earth Elements in Human and Environmental Health Rare Earth Element Rare-Earth Metal Recovery for Green Technologies Ionic Liquids

REWAS 2016

Rare Earths elements are composed of 15 chemical elements in the periodic table. Scandium and yttrium have similar properties, with mineral assemblages, and are therefore referred alike in the literature. Although abundant in the planet surface, the Rare Earths are not found in concentrated forms, thus making them economically valued as they are so challenging to obtain. Rare Earths Industry: Technological, Economic and Environmental Implications provides an interdisciplinary orientation to the topic of Rare Earths with a focus on technical, scientific, academic, economic, and environmental issues. Part I of book deals with the Rare Earths Reserves and Mining, Part II focuses on Rare Earths Processes and High-Tech Product Development, and Part III deals with Rare Earths Recycling Opportunities and Challenges. The chapters provide updated information and priceless analysis of the theme, and they seek to present the latest techniques, approaches, processes and technologies that can reduce the costs of compliance with environmental concerns in a way it is possible to anticipate and mitigate emerging problems. Discusses the influence of policy on Rare Earth Elements to help raise interest in developing strategies for management resource development and exploitation Global contributions will address solutions in countries that are high RE producers, including China, Brazil, Australia, and South China End of chapter critical summaries outline the technological, economic and environmental implications of rare earths reserves, exploration and market Provides a concise, but meaningful, geopolitical analysis of the current worldwide scenario and importance of rare earths exploration for governments, corporate groups, and local stakeholders

Extraction 2018

This book focuses on the chemical structure and applications of CeO₂. It covers the recent developments in a wide range of CeO₂ applications, particularly catalysis corrosion protection, fuel cells, sensors, and UV-blocking. It also provides a concise but thorough coverage of the chemical structure and applications of CeO₂. Thus, this book provides an overview of chemical structure, applications, and recent attributes of CeO₂ for a broad audience, including beginners, graduate students, and specialists in both academic and industrial sectors.

Rare Metal Technology 2015

This two-volume set provides a full account of hydrometallurgy. Filled with illustrations and tables, this work covers the flow of source material from the mined or concentrate state to the finished product. It also highlights ion exchange, carbon adsorption and solvent extraction processes for solution purification and concentration. The extensive reference list-over 850-makes this set a valuable resource for extraction and process metallurgists, researchers, and practitioners.

Metal Recovery from Electronic Waste: Biological Versus Chemical Leaching for Recovery of Copper and Gold

This book describes in a comprehensive manner the technical aspects of separation of rare earth elements into individual elements for industrial and commercial use. The authors include details on and differentiate among the effective separation of rare earth elements for various parts of the world. They introduce new applications of separation of rare earth elements from concentrates of diverse ore types.

Rare Metal Technology 2016

Hydrometallurgy of Rare Earths: Extraction and Separation provides the basic knowledge for rare earth extraction and separation, including flow sheet selection criteria and related technology. The book includes the latest research findings on all rare earth separation processes, methods of controlling operation costs, and strategies that help lower wastewater and waste solid discharge. It discusses many real process parameters and actual situations in rare earth separation plants, also examining the basic principles, technologies, process parameters and advances and achievements in the area of rare earth extraction and separation. In addition, the book covers extraction separation theory as developed by Professor Guanxian Xu and Professor Chunhua Yan and the creative use of a computational simulation program to replace the bench scale and pilot plant tests and directly design rare earth extraction separation processes. Outlines the theory of solvent extraction and separation of rare earths (REs) Provides the necessary tools for a REs separation plant design Includes a unique simulation program for the calculation of all process parameters Includes Chinese nomenclature that is useful for identifying the various processes, also comparing it to the global literature

Rare Earths Industry

This edited book *Lanthanides* is a collection of research chapters, offering an excellent review of recent applications in our lives. It consists of a number of interesting chapters by scientists and researchers from different parts of the world. The book is divided into six chapters. The first chapter is a short introduction that explains the nature and purpose of the book and the logic and significance of its contents. In the second chapter, Katarzyna Kiegiel et al. introduce novel apparatus solutions, for example membrane contactors in the extraction stage and different types of matrices (uranium ore, phosphorites, etc.). The third chapter by Dariusz Sala and Bogusław Bieda from AGH University of Science and Technology, Management Department, Poland, describes the development of the life cycle inventory to rare earth elements (REEs) based on secondary sources, conducted according to ISO 14040 (2006) guidelines. Chapter 4 concentrates on lanthanide soil chemistry and shows how the soil chemistry of REEs may support soil science investigations. Dmitry V. Ladonin in Chapter 5 studies the content of forms of lanthanides in soddy-calcareous soils at different distances from the Cherepovets steel mill (Vologda region, Russia). The author concludes that the individual properties of lanthanides are clearly manifested in their interaction with soil components. The largest part of the fraction, bound to organic matter, contains medium lanthanides, while the heavy lanthanides are bound to Fe and Mn (hydr)oxides. The last chapter discusses ecological and physiological impacts of lanthanides on algae as primary producers in aquatic environments. This book will definitely encourage readers, researchers, and scientists to look further into the frontier topics of lanthanides and opens new possible research paths for further novel development.

Separation Hydrometallurgy of Rare Earth Elements

New Edition Now Covers Recycling, Environmental Issues, and Analytical Determination Employing four decades of experience in the rare metal and rare earths industry, the authors of *Extractive Metallurgy of Rare Earths, Second Edition* present the entire subject of rare earth elements with depth and accuracy. This second edition updates the most important developments from the past 10 years. It emphasizes advances made in rare-earth materials processing (converting a rare-earth metal, alloy, or compound to a device-ready material), breakthroughs in the area of rare-earth separation, and now includes a chapter on the recycling of rare earth elements from magnets, batteries, and phosphors among others, covering both manufacturing scrap or materials in end of life devices. Essential to Your Collection This second edition presents comprehensive, detailed, and up-to-date coverage that includes: All aspects of rare earth extractive metallurgy A status of rare earth extraction from various world resources Flow sheets that can be used for rare earths separation, metal reduction, alloy making, refining and end product materials preparation Techniques of various rare earths recycling options An outline of environmental issues in rare earths mining and processing Methods of rare earths determination and analyses of components and impurities in rare earth materials Information extensively linked to primary literature with a complete listing of references A narration of the changing scenario of world rare earth resources and possibility of their exploitation An indispensable resource, *Extractive Metallurgy of Rare Earths, Second Edition* explains the many aspects of rare earth extractive metallurgy clearly and systematically. The text reveals process

implementation possibilities and research opportunities, and considers potential solutions to the challenges impacting this rapidly changing industry.

Geobiotechnology I

Chemical Process Engineering presents a systematic approach to solving design problems by listing the needed equations, calculating degrees-of-freedom, developing calculation procedures to generate process specifications- mostly pressures, temperatures, compositions, and flow rates- and sizing equipment. This illustrative reference/text tabulates numerous easy-to-follow calculation procedures as well as the relationships needed for sizing commonly used equipment.

Applications of Ion Exchange Materials in the Environment

Mechanochemistry as a branch of solid state chemistry enquires into processes which proceed in solids due to the application of mechanical energy. This provides a thorough, up to date overview of mechanochemistry of solids and minerals. Applications of mechanochemistry in nanoscience with special impact on nanogeoscience are described. Selected advanced identification methods, most frequently applied in nanoscience, are described as well as the advantage of mechanochemical approach in minerals engineering. Examples of industrial applications are given. Mechanochemical technology is being applied in many industrial fields: powder metallurgy (synthesis of nanometals, alloys and nanocompounds), building industry (activation of cements), chemical industry (solid waste treatment, catalyst synthesis, coal ashes utilization), minerals engineering (ore enrichment, enhancement of processes of extractive metallurgy), agriculture industry (solubility increase of fertilizers), and pharmaceutical industry (improvement of solubility and bioavailability of drugs). This reference serves as an introduction to newcomers to mechanochemistry, and encourages more experienced researchers to broaden their knowledge and discover novel applications in the field.

Rare Earth Elements in Groundwater Flow Systems

Computer technology in the past fifteen years has essentially revolutionized engineering education. Complex systems involving coupled mass transport and flow have yielded to numerical analysis even for relatively complex geometries. The application of such technology together with advances in applied physical chemistry have justified a general updating of the field of heterogeneous kinetics in extractive metallurgy. This book is an attempt to cover significant areas of extractive metallurgy from the viewpoint of heterogeneous kinetics. Kinetic studies serve to elucidate fundamental mechanisms of reactions and to provide data for engineering applications, including improved ability to scale processes up from bench to pilot plant. The general theme of this book is the latter-the scale-up. The practicing engineer is faced with problems of changes of order of magnitude in reactor size. We hope that the fundamentals of heterogeneous kinetics will provide increasing ability for such scale-up efforts. Although thermodynamics is important in defining potential reaction paths and the end products, kinetic limitations

involving molecular reactions, mass transport, or heat flow normally influence ultimate rates of production. For this reason, rate processes in the general field of extractive metallurgy have been emphasized in this book.

Lanthanides

This book review series presents current trends in modern biotechnology. The aim is to cover all aspects of this interdisciplinary technology where knowledge, methods and expertise are required from chemistry, biochemistry, microbiology, genetics, chemical engineering and computer science. Volumes are organized topically and provide a comprehensive discussion of developments in the respective field over the past 3-5 years. The series also discusses new discoveries and applications. Special volumes are dedicated to selected topics which focus on new biotechnological products and new processes for their synthesis and purification. In general, special volumes are edited by well-known guest editors. The series editor and publisher will however always be pleased to receive suggestions and supplementary information. Manuscripts are accepted in English.

Noble and Precious Metals

Rare Earth Element Mines, Deposits and Occurrences

This book presents the results from the Uranium Mining and Hydrogeology Congress held in September 2005, in Freiberg, Germany. It addresses scientists and engineers involved in the areas of uranium mining and milling sites, clean-up measures, emissions of nuclear power plants and radioactive waste disposal, as well as political decision-makers. The topics covered are: impact on groundwater from radionuclide emission, analytical specification techniques, chemical toxicity, radioisotope plant uptake, microbiology, geochemical and reactive transport, case studies on active and abandoned uranium mines and milling sites, long-term storage of radioactive waste, passive in situ treatment techniques and risk assessment studies. The accompanying CD-ROM includes all papers in colour.

Hydrometallurgy of Rare Earths

This collection presents papers from a symposium on extraction of rare metals as well as rare extraction processing techniques used in metal production. Topics include the extraction and processing of elements such as rare earth metals including yttrium and scandium, gold, vanadium, cesium, zinc, copper, tellurium, bismuth, potassium, aluminum, iridium, titanium, manganese, uranium, rhenium, and tungsten. Rare processing techniques covered include supercritical fluid extraction, direct extraction processes for rare-earth recovery, biosorption of precious metals, and recovery of valuable components of commodity metals such as zinc, nickel, and metals from slag.

Rare Earths

This three volume set presents papers from the first collaborative global

metallurgy conference focused exclusively on extractive topics, including business and economic issues. Contributions examine new developments in foundational extractive metallurgy topics and techniques, and present the latest research and insights on emerging technologies and issues that are shaping the global extractive metallurgy industry. The book is organized around the following main themes: hydrometallurgy, pyrometallurgy, sulfide flotation, and extractive metallurgy markets and economics.

Evolutionary and Revolutionary Technologies for Mining

This book presents the applications of ion-exchange materials in the area of environmental analysis and treatment. It includes chapters on applications of organic, inorganic and composite ion exchange materials and hexacyanoferrates in various fields such as chemical and biochemical separations, water purification, removal of harmful impurities, dyes and cationic and anionic complexes. This title is a highly valuable source of knowledge on ion-exchange materials and their applications suitable for postgraduate students and researchers but also to industrial R&D specialists in chemistry, chemical, and biochemical technology. Additionally, this book will provide an in-depth knowledge of ion-exchange column and operations suitable for engineers and industrialists.

Cerium Oxide

Ionic liquids, including the newer subcategory of deep eutectic solvents, continue to attract a great deal of research attention in an even increasing number of areas, including traditional areas such as synthesis (organic and materials), electrochemistry, and physical property studies and predictions, as well as less obvious areas such as lubrication and enzymatic transformations. In this volume, recent advances in a number of these different areas are reported and reviewed, thus granting some appreciation for the future that ionic liquid research holds and affording inspiration for those who have not previously considered the application of ionic liquids in their area of interest.

Rare Metal Technology 2020

Topics covered in this collection include the following: •Enabling & Understanding Sustainability - Ferrous & Non-ferrous Metals Processing •Understanding & Enabling Sustainability - (Rechargeable) Batteries •Enabling & Understanding Sustainability - Rare Earth Element Applications •Enabling & Understanding Sustainability - Building Materials & Slag Valorisation •Designing Materials and Systems for Sustainability •Understanding & Enabling Sustainability - Light Metals Recycling & Waste Valorisation •Understanding & Enabling Sustainability - Education Research Innovation I •Understanding & Enabling Sustainability - Education Research Innovation II + Electronic Equipment

Mechanochemistry in Nanoscience and Minerals Engineering

This is the first book of its kind to focus on the geochemistry of the lanthanide series elements in groundwater/aquifer environments. The contributors are leading

researchers in the study of low-temperature geochemistry of rare earth elements. Individual chapters address analytical techniques, water-rock interactions, aqueous complexation, and the reactions and processes that influence these heavy metals along groundwater flow paths.

Hydrometallurgy of Rare Earths

Rare earth elements have significant physical and chemical properties, which have been made indispensable in many magnetic, electronic, and optical applications. For instance, rare earth magnets have high magnetic intensity that can be retained at high temperatures, making them ideal for aerospace applications. Moreover, rare earth elements allow to fabricate faster, smaller, and lighter devices such as cell phones and hard drives. They are also important for in-ear headphones, microphones, loudspeakers, optical fibers, smartphones, and tablet computers. All these technological possibilities have made sure that the rare earth elements are part of the daily life. Therefore, this book has a main objective to let the readers know useful information about the rare earth elements that possibly allow development of the researches in different fields of science where the rare earth elements are used.

Uranium in the Environment

Contents: (1) Intro.; (2) What are Rare Earth Elements (REE)?; (3) Major End Uses and Applications: Demand for REE; The Application of REE in National Defense; (4) Rare Earth Resources and Production Potential; Supply Chain Issues; Role of China; (5) Rare Earth Legislation in the 111th Congress: H.R. 4866, and S. 3521, the Rare Earths Supply-Chain Technology and Resources Transformation Act of 2010; H.R. 5136, the FY 2011 Nat. Defense Authorization Act; P.L. 111-84, the FY 2010 Nat. Defense Authorization Act; (6) Possible Policy Options: Authorize and Appropriate Funding for a USGS Assessment; Support and Encourage Greater Exploration for REE; Challenge China on Its Export Policy; Establish a Stockpile. Illustrations.

Rare

The use of copper, silver, gold and platinum in jewelry as a measure of wealth is well known. This book contains 19 chapters written by international authors on other uses and applications of noble and precious metals (copper, silver, gold, platinum, palladium, iridium, osmium, rhodium, ruthenium, and rhenium). The topics covered include surface-enhanced Raman scattering, quantum dots, synthesis and properties of nanostructures, and its applications in the diverse fields such as high-tech engineering, nanotechnology, catalysis, and biomedical applications. The basis for these applications is their high-free electron concentrations combined with high-temperature stability and corrosion resistance and methods developed for synthesizing nanostructures. Recent developments in all these areas with up-to-date references are emphasized.

Chemical Process Engineering

How will your life change when the supply of tantalum dries up? You may have

never heard of this unusual metal, but without it smartphones would be instantly less omniscient, video game systems would falter, and laptops fail. Tantalum is not alone. Rhodium. Osmium. Niobium. Such refugees from the bottom of the periodic table are key components of many consumer products like cell phones, hybrid car batteries, and flat screen televisions, as well as sophisticated medical devices and even weapon systems. Their versatile properties have led manufacturers to seek these elements out to maximize longevity, value, and efficiency, but not without a human price. In addition to explaining the chemistry behind rare earth metals, *Rare* delves into the economic and geopolitical issues surrounding these “conflict minerals,” blending tales of financial and political struggles with glimpses into the human lives that are shattered by the race to secure them. In the past decade, the Congo has been ravaged by tribal wars fought to obtain control of tantalum, tungsten, and tin supplies in the region, with over five million people dying at the crossroads of supply and demand. A burgeoning black market in China, Africa, and India is propped up by school-age children retrieving and purifying these metals while risking their lives and health in the process. Fears of future political struggles inside China, the world’s largest supplier of these metals, have already sent the United States, Great Britain, and Japan racing to find alternative sources. Will scientists be able to create lab substitutes for some or all of these metals? Will Afghanistan be the next big supplier of rare metals? What happens when the limited supply runs out? Whatever the answers, it is clear that our modern lifestyle, dependent on technology, is far from stable.

Rare Earth Elements

High-technology and environmental applications of the rare-earth elements (REE) have grown dramatically in diversity and importance over the past four decades. This book provides a scientific understanding of rare earth properties and uses, present and future. It also points the way to efficient recycle of the rare earths in end-of-use products and efficient use of rare earths in new products. Scientists and students will appreciate the book's approach to the availability, structure and properties of rare earths and how they have led to myriad critical uses, present and future. Experts should buy this book to get an integrated picture of production and use (present and future) of rare earths and the science behind this picture. This book will prove valuable to non-scientists as well in order to get an integrated picture of production and use of rare earths in the 21st Century, and the science behind this picture. Defines the chemical, physical and structural properties of rare earths. Gives the reader a basic understanding of what rare earths can do for us. Describes uses of each rare earth with chemical, physics, and structural explanations for the properties that underlie those uses. Allows the reader to understand how rare earths behave and why they are used in present applications and will be used in future applications. Explains to the reader where and how rare earths are found and produced and how they are best recycled to minimize environmental impact and energy and water consumption.

Agromining: Farming for Metals

The Office of Industrial Technologies (OIT) of the U. S. Department of Energy commissioned the National Research Council (NRC) to undertake a study on required technologies for the Mining Industries of the Future Program to

complement information provided to the program by the National Mining Association. Subsequently, the National Institute for Occupational Safety and Health also became a sponsor of this study, and the Statement of Task was expanded to include health and safety. The overall objectives of this study are: (a) to review available information on the U.S. mining industry; (b) to identify critical research and development needs related to the exploration, mining, and processing of coal, minerals, and metals; and (c) to examine the federal contribution to research and development in mining processes.

Hydrogeology of Crystalline Rocks

This thesis deals with Rare Earth Elements (REE), especially with neodymium used in permanent magnets, from a very scientific basis by providing basic research data. Despite the fact that REE are newsworthy and very important elements for a considerable bandwidth of today's technologies, accompanied by the monopolistic supply-situation and Chinese politics, there are inexplicable data discrepancies about REE which have been recognized frequently but usually have not been addressed accordingly. So this analysis started with the hypothesis that the four application areas, namely computer hard disk drives (HDD), mobile phones, wind turbines and e-mobility (automotive traction), account for about 80% of the global annual neodymium-demand. The research methodology was a laboratory analysis of the composition of used magnets for HDDs and mobile phones and a literature and official report analysis of wind turbine and automotive neodymium use. The result was amazing and the hypothesis had to be withdrawn as these four areas only account for about 20% of neodymium use. This result raises some questions concerning actual use and thus potential recycling options.

Separation Hydrometallurgy of Rare Earth Elements

Weathered crust elution - deposited rare earth ore (original name is the ion-adsorbed rare earth ore) was first discovered as a novel exogenous ore in Jiangxi province of China in 1969. There are many advantages for the ore which has a widespread distribution, rich reserves, low radioactivity, complete RE partitioning and is rich in middle and heavy rare earth. Especially, the middle and heavy rare earth which occupies 80% over the world is the unique mineral resource in China, distributing only in southern China such as Jiangxi, Fujian, Hunan, Guangdong and Guangxi et al.

Rate Processes of Extractive Metallurgy

Developments in Geochemistry, Volume 2: Rare Earth Element Geochemistry presents the remarkable developments in the chemistry and geochemistry of the rare earth elements. This book discusses the analytical techniques and the recognition that rare earth fractionation occurs naturally in different ways. Organized into 13 chapters, this volume begins with an overview of the wide array of types and sizes of the cation coordination polyhedral in rock-forming minerals. This text then examines the application of rare earth element abundances to petrogenetic problems that has centered on the evolution of igneous rocks. Other chapters consider the matching of observed rare earth element abundances with

those provided by the theoretical modeling of petrogenetic processes. This book discusses as well the hypotheses on the genesis of a rock or mineral suite. The final chapter deals with the principal analytical methods. This book is a valuable resource for undergraduates, lecturers, and researchers who study petrology and geochemistry.

Critical and Rare Earth Elements

This is the first book on global agromining/phytomining technology. It presents the complete metal farming or agromining chain; an emerging technology expected to be transformative in the extraction of resources of those elements not accessible by traditional mining techniques. Meeting the demand for critical minerals (rare earth elements, platinum group elements, nickel cobalt) is increasingly difficult in the 21st century due to resource depletion and geopolitical factors. Agromining uses hyperaccumulator plants as “metal crops” farmed on sub-economic soils or mineral waste to obtain valuable elements. This book, which follows the metal farming chain, starts with the latest information on the global distribution and ecology of hyperaccumulator plants, biogeochemical pathways, the influence of rhizosphere microbes, as well as aspects of propagation and conservation of these unusual plants. It then presents the state of the art in new tools for identifying hyperaccumulator plants and for understanding their physiology and molecular biology. It goes on to describe the agronomy of “metal crops,” and opportunities for incorporating agromining into rehabilitation and mine closure, including test-cases of nickel, cobalt, selenium, thallium, rare earth elements and PGEs. Finally, it concludes with an overview of the latest developments in the processing of bio-ores and associated products. This book is edited and authored by the pioneers in the field who have been at the foreground of the development of agromining over the past three decades. It is timely as agromining is now at a pivotal point in its development with rapid expansion of activities in the field around the globe. As such it is of interest to environmental professionals in the minerals industry, government regulators and academics.

Extractive Metallurgy of Rare Earths

This book describes in a comprehensive manner the technical aspects of separation of rare earth elements into individual elements for industrial and commercial use. The authors include details on and differentiate among the effective separation of rare earth elements for various parts of the world. They introduce new applications of separation of rare earth elements from concentrates of diverse ore types.

Hydrometallurgy in Extraction Processes

This collection presents papers from a symposium on extraction of rare metals as well as rare extraction processing techniques used in metal production. Rare metals include strategic metals that are in increasing demand and subject to supply risks. Metals represented include neodymium, dysprosium, scandium and others; platinum group metals including platinum, palladium, iridium, and others; battery related metals including lithium, cobalt, nickel, and aluminum; electronics-

related materials including copper and gold; and refractory metals including titanium, niobium, zirconium, and hafnium. Other critical materials such as gallium, germanium, indium and silicon are also included. Papers cover various processing techniques, including but not limited to hydrometallurgy (solvent extraction, ion exchange, precipitation, and crystallization), electrometallurgy (electrorefining and electrowinning), pyrometallurgy, and aerometallurgy (supercritical fluid extraction). Contributions are focused on primary production as well as secondary production through urban mining and recycling to enable a circular economy. A useful resource for all involved in commodity metal production, irrespective of the major metal Provides knowledge of cross-application among industries Extraction and processing of rare metals that are the main building block of many emerging critical technologies have been receiving significant attention in recent years. The technologies that rely on critical metals are prominent worldwide, and finding a way to extract and supply them effectively is highly desirable and beneficial.

Rare Earth Elements

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Weathered Crust Elution-deposited Rare Earth Ores

This book presents the multifaceted aspects of rare earth elements (REEs), focusing on both their potential benefits and adverse health effects. The adverse impacts of REEs on human and environmental health raise a growing concern not only in the scientific community but also among a number of stakeholders, potentially including students, media workers, and decision makers. The recognized and potential benefits arising from REE-related technological applications may envisage their further advantages. A limited number of books have been devoted so far to REEs, and they mainly focus on REE-related chemistry, mineralogy, economy, and developing technologies for these elements. This book presents recent research achievements in REE-associated health effects, which have been mostly confined to journal reports on individual laboratory studies so far. It is an updated and balanced approach to REE research and technology. It provides novel yet established information as stated in the title "At the Crossroads between Toxicity and Safety," with particular emphasis on the hormesis

phenomenon.

Rare Metal Technology 2019

This book examines the development, use, extraction, and recovery of rare earth metals. Rare earth elements (REEs) occupy a key role in daily life in industrial applications. They are one of the critical elements for energy and sustainable growth. REEs are utilized in many modern electrical and electronic devices such as smart phones, computers, LED lights etc. Recovery of the REEs from secondary resources represents a way to meet the growing demand for electronic devices. Because of their rarity, utility, and importance, the recovery, utilization and recycling of rare earth metals is of utmost importance. This book presents both current methods of processing rare earths from primary and secondary sources and new, green routes for their isolation and purification. The book also addresses their utilization, re-use, reduction, and recycling policies that exist globally. Applications in metallurgy, magnets, ceramics, electronics, and chemical, optical, and nuclear technologies are discussed.

Critical Mineral Resources of the United States

This collection presents the papers presented in the symposium on extraction of rare metals as well as rare extraction processing techniques used in metal production. Paper topics include the extraction and processing of elements like antimony, arsenic, gold, indium, palladium, platinum, rare earth metals including yttrium and neodymium, titanium, tungsten, and vanadium. The rare processing techniques covered include direct extraction process for rare earth element recovery; biosorption of precious metals; fluorination behavior of uranium and zirconium mixture of fuel debris treatment; and recovery of valuable components of commodity metals such as zinc, nickel, and metals from slag.

Rare Earth Element Geochemistry

As the importance and dependence of specific mineral commodities increase, so does concern about their supply. The United States is currently 100 percent reliant on foreign sources for 20 mineral commodities and imports the majority of its supply of more than 50 mineral commodities. Mineral commodities that have important uses and face potential supply disruption are critical to American economic and national security. However, a mineral commodity's importance and the nature of its supply chain can change with time; a mineral commodity that may not have been considered critical 25 years ago may be critical today, and one considered critical today may not be so in the future. The U.S. Geological Survey has produced this volume to describe a select group of mineral commodities currently critical to our economy and security. For each mineral commodity covered, the authors provide a comprehensive look at (1) the commodity's use; (2) the geology and global distribution of the mineral deposit types that account for the present and possible future supply of the commodity; (3) the current status of production, reserves, and resources in the United States and globally; and (4) environmental considerations related to the commodity's production from different types of mineral deposits. The volume describes U.S. critical mineral resources in a

global context, for no country can be self-sufficient for all its mineral commodity needs, and the United States will always rely on global mineral commodity supply chains. This volume provides the scientific understanding of critical mineral resources required for informed decisionmaking by those responsible for ensuring that the United States has a secure and sustainable supply of mineral commodities.

Rare Earth Elements in Human and Environmental Health

This book is aimed to compile the distribution of rare earth elements in various resources with their processing from secondary resources. It includes details of various processes developed for extraction of rare earth elements from varied raw materials ranging from e-wastes, tailings, process wastes and residues. It emphasizes importance of processing of the secondary resources to assist environmental remediation of such untreated wastes and get finished products. It covers all aspects of rare metals and rare earth metals in one volume covering extraction, separation and recycling of secondary resources for extraction of these metals along with relevant case studies.

Rare Earth Element

Waste electrical and electronic equipment (WEEE) generation is a global problem. Despite the growing awareness and deterring legislation, most of the WEEE is disposed improperly, i.e. landfilled or otherwise shipped overseas, and treated in sub-standard conditions. Informal recycling of WEEE has catastrophic effects on humans and the environment. WEEE contains considerable quantities of valuable metals such as base metals, precious metals and rare earth elements (REE). Metal recovery from WEEE is conventionally carried out by pyrometallurgical and hydrometallurgical methods. In this PhD research, novel metal recovery technologies from WEEE are investigated. Using acidophilic and cyanide-generating bacteria, copper and gold were removed from crushed electronic waste with removal efficiencies of 98.4 and 44.0%, respectively. The leached metals in solution were recovered using sulfidic precipitation and electrowinning separation techniques. Finally, a techno-economic assessment of the technology was studied. This research addresses the knowledge gap on two metal extraction approaches, namely chemical and biological, from a secondary source of metals. The essential parameters of the selective metal recovery processes, scale-up potential, techno-economic and sustainability assessment have been studied.

Rare-Earth Metal Recovery for Green Technologies

Hydrogeology of Crystalline Rocks deals with deep groundwater in the granite and gneiss basement of the continents. It has become evident during the past years that highly mineralized water is present in an interconnected fracture network of the basement. Thus, the upper part of the crust of the continents can be viewed as an aquifer and investigated with tools common in hydrogeology. This book presents accounts on water-conducting features of crystalline rocks and summarizes the hydraulic properties of the basement. The volume includes reviews, new data and research on the often remarkable chemical composition of

deep groundwater. Microbial processes in the deep basement aquifer are probably more important than previously thought. Two contributions focus on this recent extension of research of the biosphere to greater depth in the Earth. This book represents the first multidisciplinary and integrated account of deep groundwater hydrology in crystalline basement. It is of interest to hydrologists and hydrogeologists working with water in crystalline rocks, but also to solid earth geophysicists, geochemists and petrologists with an interest in fluids in the crust. Scientists involved in nuclear waste disposal programs and geothermal energy development will find a wealth of stimulating ideas in this volume.

Ionic Liquids

This collection presents the papers from a symposium on extraction of rare metals as well as rare extraction processing techniques used in metal production. Paper topics include the extraction and processing of elements like antimony, arsenic, calcium, chromium, hafnium, gold, indium, lithium, molybdenum, niobium, rare earth metals, rhenium, scandium, selenium, silver, strontium, tantalum, tellurium, tin, tungsten, vanadium, and zirconium. Rare processing techniques presented include bio leaching, molecular recognition technology, recovery of valuable components of commodity metals such as magnesium from laterite process wastes, titanium from ilmenites, and rare metals from wastes such as phosphors and LCD monitors.

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