AN ISO 9001 : 2015 CERTIFIED COMPANY

Handbook on Rare Earth Metals and Alloys (Properties, Extraction, Preparation and Applications)

FREE SAMPLE: contents and introduction of the 688-page book

Price: Rs 1,875 | US$ 50.67

Order the full book >

AN ISO 9001 : 2015 CERTIFIED COMPANY

Author: NPCS Board of Consultants & Engineers
Format: paperback
Code: NI218
Pages: 688
Price: Rs 1,875 | US$ 50.67
Publisher: NIIR PROJECT CONSULTANCY SERVICES
Shipping: 5 days

About the Book

Rare earths are essential constituents of more than 100 mineral species and present in many more through substitution. They have a marked geochemical affinity for calcium, titanium, niobium, zirconium, fluoride, phosphate and carbonate ions. Industrially important minerals, which are utilized at present for rare earths production, are essentially three, namely monazite, bastnasite and xenotime. In modern time techniques for exploration of rare earths and yttrium minerals include geologic identification of environments of deposition and surface as well as airborne reconnaissance with magnetometric and radiometric equipment. There are numerous applications of rare earths such as in glass making industry, cracking catalysts, electronic and optoelectronic devices, medical technology, nuclear technology, agriculture, plastic industry etc. Lot of metals and alloys called rare earth are lying in the earth which required to be processed. Some of the important elements extracted from rare earths are uranium, lithium, beryllium, selenium, platinum metals, tantalum, silicon, molybdenum, manganese, chromium, cadmium, titanium, tungsten, zirconium etc. There are different methods involved in production of metals and non metals from rare earths for example; separation, primary crushing, secondary crushing, wet grinding, dry grinding etc. The rare earths are silver, silverymwhite, or gray metals; they have a high luster, but tarnish readily in air, have high electrical conductivity. The rare earths share many common properties this makes them difficult to separate or even distinguish from each other. There are very small differences in solubility and complex formation between the rare earths. The rare earth metals naturally occur together in minerals. Rare earths are found with non metals, usually in the 3+ oxidation state. At present all the rare earth resources in India are in the form of placer monazite deposits, which also carry other industrially important minerals like ilmenite, rutile, zircon, sillimanite and garnet.

Some of the fundamentals of the book are commercially important rare earth minerals, exploration for rare earth resources, rare earth resources of the world, some rare earth minerals and their approximate compositions, rare earths in cracking catalysts, rare earth based phosphors, interdependence of applications and production of rare earths, uranium alloys, conversion of ores to lithium chemicals, characterization and analysis of very pure silicon, derivation of molybdenum metal, electoplating and chromizing, electrolytic production of titanium, heat treatment of titanium alloys, tensile properties of alloys etc.

The book covers occurrence of rare earth, resources of the world, production of lithium metals, compounds derived from the metals, chemical properties of beryllium, uses of selenium, derivation of molybdenum metals, ore concentration and treatment and many more. This is a unique book of its kind, which will be a great asset for scientists, researchers, technocrats and entrepreneurs.

Contents

Natural Abundance
Occurrence of Rare Earths
1. Placer Deposits
2. Vein Type Deposits
3. Bastnasite Deposits
4. Ion Adsorption Type Ores
5. Other Rare Earth Sources
Commercially important Rare Earth Minerals
1. Monazite
2. Bastnasite
3. Xenotime
Exploration for Rare Earth Resources
Rare Earth Resources of the world
1. China
2. United States of America
3. India
1. Beach Placers and Dunes
2. Inland Placers
3. Reserves of Monazite
4. Occurrence of Xenotime
4. Australia
1. Placer Deposits
2. Hard rock Deposits
1. Mount Weld Deposit
2. Mary Kathleen
3. Port Pirie
4. Olympic Dam
5. Brazil
Other countries
Table 1.
The Content of Rare Earths and Some Common Elements in the Igneous Rocks of the Earth's CrustTable 2.
Some Rare Earth Minerals and their Approximate Compositions
Table 3.
Typical Placer Minerals and their Specific Gravity
Table 4.
Mineralogial Composition of Typical Placer Samples, as mined in India and Australia
Table 5.
Rare Earth Distribution in Various Rock Forming and Accessory Mineral of Host Rock
Table 6.
The Rrare Earth Pattern in Different Layers of an Ion Adsorption Type Desposit
Table 7.
Composition of REO recovered from major Ion-Adsorption Type Deposits in China
Table 8.
The REO Centent of Different Types of Ores in China
Table 9.
Analysis of the Typical Loparite Sample
Table 10.

Rare Earths Distribution in Monazite from Different Sources (wt %)
Table 11.
Rere Earth Distribution in REO from Bastnasite from different
Sources (wt. %)
Table 12.
Rare Earth Distribution in Xenotime Samples (wt.%)
Table 13.
Ore Types In Baiyunebo Deposit
Table 14.
Chemical Analysis of Ore Samples from Deposit no. 801, China
Table 15
Some Important Rare Earth Resources of Australia and their Rare Earth and Thorium content
Table 16
Countrywise Distribution of Rare Earth Resources
1. Arc Carbons
Glass Making Industry
1. Decolourization of glass
2. Colouring of glass
3. Special Glasses
1. Spectacle Glass
2. Television and Cathode Ray Tubes
3. Glass for Eye protection
4. Infrared Transmitting Glass
5. Radiation Protection Windows
6. Optical Glass
Laser Glass
Fibre
Glass Polishing Powders
1. Glass Polishing Technology
2. Different Types of Abrasives
3. Manufacturing Methods
4. Producers of Polishing Powders
4. Enamels and Glazes
Catalysts
1. Rare Earths in Cracking Catalysts .
1. Cracking Process
2. Evolution of the catalyst
3. Rare Earth, Exchange of the Zeolite
4. Composition of the catalyst
5. Role of Rare Earths in the Catalyst
Use of Rare Earth Zeolites
6. Rare Earth Consumption
7. Impact of Lead Additive Phase down
8. Scope for using cerium in FCC unit
2. Application of Cerium and Lanthanum in Auto-exhaust Catalysts
1. Catalyst Converter System
2. Role of Rare Earths
3. Other Catalyst Applications of Rare Earths
1. Methanation
2. Ammonia Synthesis
3. Homogenous Catalysis

4. Methane Conversion
Fine Ceramics
1. HighTemperature Structural Ceramics
1. Stabilization of Zirconia
2. Sintering of Silicon Nitride (Si3N4)
3. Sintering of Silicon Carbide (SiC)
2. Functional Ceramics
1. Piezoelectric Materials
1. Role of REO in Piezoelectric Ceramics
2. Applications of Piezoelectric Ceramics
2. Optoelectronic Materials
1. Applications
2. Preparation of PLZT Materials
3. Thermistor, Varistor and Capacitor Materials
1. PTC Thermistor
2. Varistor Materials
3. Grain Boundary Barrier Layer (GBBL) Capacitors
4. Solid Oxide Fuel Cells
1. Electrolyte
2. Electrodes
3. Interconnecting Material
5. Oxygen Sensors
6. Heating Elements
7. High Temperature Super-conducting Materials
Rare Earth Based Phosphors
1. General
1. Laser Action
2. Antistoke Emission
2. Rare Earths as Phosphor Materials
1. Fluorescence due to 4f Transitions
2. Fluorescence due to Transitions from 5d to 4f Orbital
3. Rare Earths as Phosphor Matrices
3. Major Applications of Rare Earth Phosphors
1. Low Pressure Mercury Lamps
1. Desirable Phosphor Properties for Fluorescent Tubes
2. Phosphors used in Tube Lights
3. Rare Earth Phosphors in Fluorescent Tubes
2. Rare Earths in High Pressure Mercury Vapour Lamps
3. Trichromatic Compact Lamps
1. Matching of Lamp Light to the Visual System
2. Red Phosphor
3. Green Phosphor
4. Blue Phosphor
5. Performance of the Trichromatic Lamp
4. R&D in phosphor Development in India
5. Preparation of Light Phosphors
6. Application of Cathodoluminescence of Rare Earth
1. Colour Television Phosphors
2. Preparation of Phosphors
7. Phosphors for Non-illumination Purposes
8. Electroluminescent Phosphors

9. Thermoluminescent Phosphors
10. Rare Earth X-ray phosphors
1. X-ray screens and scanners
2. Advantage of Rare Earth Phosphors
3. Rare Earth Compounds used in X-ray phosphors
11. Rare Earths in other Medical Imagery
Rare Earths in Nuclear Technology
9. Miscellaneous Applications
1. Application in Agriculture
1. Techniques of Application
2. Nong-le and N.P.K. Fertilizers
3. Areas of Application
2. Dyeing and Currying
3. Colouring of Plastics
Interdependence of Applications and Production of Rare Earths
Introductory
Particle Characteristics
Middlings
Table 1.
Types of Middling
Staged Concentration
Panning
Gravity Separation
Chemical Methods
Flotation
Magnetic and Electric Methods
Amalgamation
Exploitable Factors
Concentration Formulae
Preliminary
Crushing
Crushing Theory
Physical Aspects of Comminution
The Crushing Sequence
Jaw Crushers
Variations on the Blake
The Dodge Crusher
Gyratory Crushers
Comparison of Jaw and Gyratory Crushers
Mobile Crushing Units
By-passing the Undersize
Feeding Arrangements
Protective Devices
The Duty of the Section
Lay-out and Equipment
The Symons Cone Crusher
Gearless Gyratories
ROLLS
Hammer Mills
Gravity Stamps
Dry Crushers, Summarised

Optimum Grind
Applied Power
Useful or Net Power
Grinding and the Particle
Grinding Objectives
Comminution of Particles
Effect of Peripheral Speed
The Return Load
The Solid-Liquid Ratio
Control
Preliminary
Fixed-path Mills
The Vibrating Mill
Tumbling Mills
Operation
Application
Mill Capacity
General Conclusions
Preliminary
Milling Action
Types of Mill
The Hardinge Mill
The Low-discharge Cylindrical Mill
Tube, or High-discharge Mills
The Cascade Mill
Mill Liners
Feeding
Crushing Bodies
Capacity
Introduction
Isotopes and Nuclear Reactions
OCCURRENCE AND SOURCES
PRODUCTION AND ECONOMIC STATISTICS
CONCENTRATION FROM ORES
REFINING
PREPARATION OF METAL
PHYSICAL PROPERTIES
MECHANICAL AND METALLURGICAL BEHAVIOUR
Hardness
Elastic Properties
Tensile Properties
Creep
Fatigue
Deformation and Textures
Recovery, Recrystallization, and Grain Growth
RADIATION DAMAGE
CHEMICAL BEHAVIOuR: REACTIONS AND COMPOUNDS
Reactions with Nonmetallic Elements; Binary Compounds
Reactions with Simple Compounds of Nonmetallic Elements
Reactions with Aqueous Solutions
Uranium Alloys

Nonmetals: Carbon, Boron, and Silicon
Metals
Liquid Metals
Phase Diagrams
Table 13. Alloying Behavior of Uranium
Metallography
Melting and Casting
Forging
Rolling
Extrusion
Swaging and Drawing
Machining
Welding
Powder Metallurgy
USE OF URANIUM
In Nuclear Reactors
Other Uses
INTRODUCTION
OCCURRENCE
Cost Considerations
CONVERSION OF ORES TO LITHIUM CHEMICALS
Production of Lithium Metal by Fused Salt Electrolysis
PHYSICAL PROPERTIES AND HANDLING OF THE METAL
Lithium Cartridges
Lithium Wire or Ribbon
Lithium Shot
Sodium-Free Lithium Metal
Molten Lithium
COMPOUNDS DERIVED FROM THE METAL
Lithium and Hydrogen
Lithium and Nitrogen
Lithium and Oxygen
Lithium and Silicon
OTHER LITHIUM COMPOUNDS
Lithium Hydroxide
Lithium Halides
Various Other Lithium Compounds
ELECTROCHEMISTRY OF LITHIUM
Alloys
Lithium-Magnesium Alloys
Lithium-Aluminium Alloys
Lithium-Zinc Alloys
Lithium-Lead Alloys
USES OF LITHIUM METAL
Lithium in Alloys
Lithium as a Degasifier and Refining Agent
Lithium in Cast Iron
Lithium in Steels
Lithium in Organic Chemistry
Lithium in Atomic-Energy Developments
Lithium in High-Energy Fuels

USES OF LITHIUM COMPOUNDS
INTRODUCTION
OCCURRENCE
PRODUCTION AND ECONOMIC STATISTICS
DERIVATION
Copeaux-Kawecki Process
Sawyer-Kjellgren Process
PRODUCTION
Pure Beryllium Oxide
Beryllium Metal
Beryllium-Copper Master Alloy
PHYSICAL PROPERTIES
Beryllium
Beryllium Oxide
CHEMICAL PROPERTIES OF BERYLLIUM
TOXICITY
MECHANICAL PROPERTIES
Beryllium
Beryllium Alloys
FABRICATION
Beryllium
Beryllium-Copper Alloys
APPLICATIONS
Beryllium
Beryllium Oxide
Beryllium-Copper Alloys
Beryllium-Nickel Alloys
Beryllium-Iron Alloys
Miscellaneous Beryllium Alloys
INTRODUCTION
OCCURRENCE
DERIVATION
PHYSICAL PROPERTIES
The Solid State
The Liquid State
The Vapour State
Electrical Conductivity
Effect of Light on Electrical Properties of Selenium
CHEMICAL PROPERTIES
Oxygen
Hydrogen
Halogens
TOXICITY
USES OF SELENIUM
Electronics Industry
Glass and Ceramics Industry
Pigment Industry
Steel Industry
Miscellaneous Uses
INTRODUCTION
OCCURRENCE

PRODUCTION AND ECONOMIC STATISTICS
DERIVATION
Extraction of Platinum Metals from
Canadian Nickel Ores
Extraction of Platinum from South African Ores
Refining of Platinum Metal Concentrates
Treatment of Native Platinum
Refining of Scrap
FABRICATION TECHNIQUES
Melting
Working
Electrodeposition
Vapour Deposition
Available Forms
PHYSICAL PROPERTIES
Platinum
Palladium
Rhodium and Iridium
Ruthenium and Osmium
Alloys of the Platinum Metals
CHEMICAL PROPERTIES
Compact Metals
Sponge and Powdered Metals
â€œBlacksâ€• and Colloidal Metals
APPLICATIONS
Platinum
Palladium
Rhodium
Iridium
Osmium
Ruthenium
History
Occurrence and Sources
Production and Price Statistics
Extraction
Production of Tantalum Metal
Consolidation and Purification
Physical Properties
Mechanical Properties
Chemical Properties
Alloys
Tantalum-Tungsten Alloys
Fabrication
Applications
Surgical
Nuclear Energy Systems
Miscellaneous
CALCIUM
Derivation
Physical Properties
Mechanical Properties

Applications
Calcium Hydride
Calcium Alloys
BARIUM
STRONTIUM
INTRODUCTION
OCCURRENCE
PRODUCTION AND ECONOMIC STATISTICS
DERIVATION
PHYSICAL PROPERTIES
CHEMICAL PROPERTIES
APPLICATIONS
SINGLE CRYSTALS
CHARACTERIZATION AND ANALYSIS OF VERY PURE SILICON
INTRODUCTION
OCCURRENCE
PRODUCTION AND STATISTICS
Prices
ORE PROCESSING
DERIVATION OF MOLYBDENUM METAL
Powder Metallurgy Process
Arc-Casting Process
WORKING OF MOLYBDENUM
PHYSICAL PROPERTIES
MECHANICAL PROPERTIES
Corrosion Resistance of Metallic Molybdenum
PROTECTION FROM OXIDATION
MOLYBDENUM COMPOUNDS
FABRICATION
JOINING
APPLICATIONS
Molybdenum as an Alloying Element
OCCURRENCE
PRODUCTION AND ECONOMIC STATISTICS
DERIVATION
PHYSICAL PROPERTIES
CHEMICAL PROPERTIES
FABRICATION
ALLOYS
APPLICATIONS
OCCURRENCE AND CHARACTERISTICS
USES OF CHROMIUM ORE
CHROMIUM METAL
Alumino- and Silicothermic Chromium
Carbon-Reduced Chromium
Electrolytic Chromium
PHYSICAL PROPERTIES OF CHROMIUM
Electronic Structure
Thermal Properties
CHEMICAL PROPERTIES
ANALYSIS OF CHROMIUM

CHROMIUM TOXICOLOGY
MELTING AND FABRICATION
MECHANICAL PROPERTIES
TENSILE PROPERTIES
TRANSITION TEMPERATURE
Electoplating and Chromizing
CHROMIUM ALLOY SYSTEMS
APPLICATIONS
INTRODUCTION
OCCURRENCE
PRODUCTION AND STATISTICS
DERIVATION
Initial Recovery
Purification
Recovery
Purification
PHYSICAL PROPERTIES
CHEMICAL PROPERTIES
Toxicity
ALLOYS
Binary Systems
Ternary Systems
FABRICATION TECHNIQUES
APPLICATIONS
INTRODUCTION
OCCURRENCE
HISTORICAL REVIEW
PROCESSES FOR MAKING BORON
PRODUCTION OF BORON 10
PHYSICAL PROPERTIES
CHEMICAL PROPERTIES
METHODS OF ANALYSIS
FABRICATION TECHNIQUES
APPLICATIONS
OCCURRENCE
PRODUCTION
EXTRACTIVE METALLURGY
Oxide Reduction
Magnesium Reduction of Titanium Tetrachloride
Sodium Reduction Titanium Terachloride
The Iodide Process
Electrolytic Production of Titanium
PHYSICAL AND MECHANICAL PROPERTIES
CHEMICAL PROPERTIES
Corrosion
Oxidation
Chemical Compounds
PHYSICAL METALLURGY
Alloying Principles
Heat Treatment of Titanium Alloys
Metallography

PROCESSING AND FABRICATION
Melting
Fabrication
APPLICATIONS OF TITANIUM
INTRODUCTION
OCCURRENCE
PRODUCTION AND ECONOMIC STATISTICS
METALLURGY
Ferrotungsten
Tungsten Compounds
Tungsten Metal
Reduction
Tungsten Carbide
PHYSICAL PROPERTIES
MECHANICAL PROPERTIES
CHEMICAL PROPERTIES
ALLOYS
Tungsten-Molybdenum, Columbium, Tantalum, Chromium
Tungsten-Rhenium
Tungsten-Iron
Tungsten-Cobalt
Tungsten-Nickel
Tungsten-Nickel-Copper
Tungsten Steels
Miscellaneous
ANALYSIS AND METALLOGRAPHY
FABRICATION
Ductile Rod and Wire
Tungsten Sheet
Slip Casting
Arc Casting
Electron Beam Melting
Hydrostatic Compacting
Flame Spraying
Sintered Carbide
APPLICATIONS
Present Applications
Potential Applications
INTRODUCTION
Sources of zirconium
ORE CONCENTRATION AND TREATMENT
Separation of Zirconium and Hafnium
PRODUCTION OF DUCTILE ZIRCONIUM METAL
Reduction of ZrO2
Reduction of Zirconium Halides
Reduction of Other Compounds
Reduction of ZrCI1 with Mgâ€”the Kroll Process
Iodide Decomposition Process
Electrodeposition of Zirconium
Physical and mechanical properties
CHEMICAL PROPERTIES

Reaction with Gases
Reaction with Halogens
Miscellaneous
CORROSION RESISTANCE
Corrosion in Various Media
Corrosion in Gases
Corrosion in Liquid Metals
Corrosion in Other Media
MELTING ZIRCONIUM
FABRICATION
Rolling and Forging
Extrusion
Cold Working
Machining
Power Brake Forming
Surface Finishing
Welding
ZIRCONIUM-ALLOY SYSTEMS
Tensile Properties of Alloys
Zircaloy
APPLICATIONS

Get the full book

This sample shows only the contents and introduction. The full book has every chapter.
Price: Rs 1,875 | US$ 50.67
Delivery: Shipped within 5 working days of payment
Order online: niir.org/books/rare-earth-metals-alloys-handbook/ **WhatsApp:** +91 9097-075-054

Planning a unit? NPCS project reports:

- Carbon Fibre project report
- Zeolite 4A project report

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Market Research, Manufacturing Process, Machinery, Raw Materials, Project Feasibility, Investment Opportunities, Technical Consultancy and Startup Help.

NPCS also publishes process technology books, technical books, startup books, directory, business database, detailed project reports and market research reports.

Our Detailed Project Report aims at providing all the critical data required by entrepreneurs for starting new business ventures.

NIIR PROJECT CONSULTANCY SERVICES
106-E, Kamla Nagar, New Delhi-110007, India

Email: npcs.india@gmail.com **Website:** https://www.niir.org/



Scan to order the full book on niir.org