

# The Complete Technology Book on Minerals & Mineral Processing

**Author:** NPCS Board of Consultants & Engineers

**Format:** Paperback

**ISBN:** 8178330164

**Code:** NI204

**Pages:** 712

**Price:** Rs. 2,200.00 US\$ 200.00

**Publisher:** Asia Pacific Business Press Inc.

Usually ships within **5** days

Mineral is defined as a naturally occurring solid chemical substance formed through biogeochemical processes, having characteristic chemical composition, highly ordered atomic structure, and specific physical properties. By comparison, a rock is an aggregate of minerals and/or mineraloids and does not have a specific chemical composition. Mineral resources of India are sufficiently rich and varied to provide the country with strong industrial base. The country is particularly rich in metallic minerals of the ferrous group such as iron ores, manganese etc. It has the world largest reserves in mica and bauxite. In the field of extractive metallurgy, mineral processing, also known as mineral dressing or ore dressing, is the process of separating commercially valuable minerals from their ores. Mining is the extraction of valuable minerals or other geological materials from the earth, from an ore body; the term also includes the removal of soil. Materials recovered by mining include base metals, precious metals, iron, uranium, limestone, etc. There are three methods of mining; conventional or manual mining, semi mechanised mining and mechanised mining. Geopolymerisation is the processes which can transfer large scale alumina silicate wastes into value added geopolymeric products with sound mechanical strength and high acid, fire and bacterial resistance. One of many useful applications of geopolymerisation is the immobilization of heavy metals and radioactive elements. The production of non ferrous metals from natural mineral ores is, in general, highly energy intensive. Some of the non ferrous mineral sources are bauxite, granite, magnesite, limonite etc. Limestone is a sedimentary rock composed largely of the minerals calcite and aragonite, which are different crystal forms of calcium carbonate ( $\text{CaCO}_3$ ). Limestone processing includes several steps; primary crushing (jaw crusher, gyratory crusher, impact breaker), secondary crushing (cone crusher), fine grinding and pulverization, conveying, screening, washing, heavy media separation, optical mineral sorters, drying and storage. The non metallic mineral mining and quarrying industry segment covers a wide range of mineral extraction. Most of these minerals are found in abundance close to the surface, so underground mining is uncommon in this industry segment. Mineral resources of India are sufficiently rich and varied to provide the country with strong industrial base. The country is particularly rich in metallic minerals of the ferrous group such as iron ores, manganese etc. It has the world largest reserves in mica and bauxite.

This book basically deals with methods of mining, mining machineries, geopolymerisation of mineral products and waste, industrial and scientific aspects of non ferrous metals production, processing of alumina rich Indian iron ore slimes, limestone processing, limestone exploration and extraction, the mineralogy of asbestos, the use of asbestos and asbestos free substitutes in buildings, flotation column ;a novel technique in mineral processing, applications of thermal plasma in the synthesis of covalent carbides, nitrogenous fertilizers, manufacture of ammonium bicarbonate etc.

This book is designed to describe the details of mining and processing of different minerals like alumina rich iron ore slimes, conversion of waste to a high valued product, lime stone, asbestos, coal beneficiation, gravity concentration processes to recover values from coal and ore fines and many more. The book is meant for

everyone who wants to study about the subject or wants to venture into the field of mineral processing.

## Contents

### 1. MINING

General Consideration

Mining Machineries

Methods of Mining

1. Conventional or Manual Method

2. Semi-mechanised Method

3. Mechanised Method

Mining of Other Decorative Stones

Conservation and Safety

Problems of Granite Mining

Geological Problems

Operational Problems

Environmental Problems

Status of Granite Mining in India

### 2. PROCESSING

General Consideration

Manual Methods

Mechanical Methods

1. Sawing

2. Polishing

3. Cutting and Polishing of Edges

4. Status of Granite Processing Industries in India

### 3. GEOPOLYMERISATION OF MINERAL PRODUCTS AND WASTE

Principles of Geopolymerisation

Reaction Mechanisms and Material Properties

Immobilisation of Heavy Metals and Radioactive Elements

Encapsulation of Organic Residue

Stabilisation of Mine Tailings

Concluding Remarks

### 4. INDUSTRIAL AND SCIENTIFIC ASPECTS OF NON-FERROUS METALS PRODUCTION

Introduction

Resources in India

The Developed Metals Industry

Environmental Aspects: Life Cycle Assessment (LCA)

Metals for Secondary Sources : The Energy Aspect

Extraction as a Separation Process

Application of Thermodynamics and Kinetics - Some Examples

R & D for the Future

Nonferrous Metallurgy at Regional Research Laboratory, Bhubaneswar

Processing of Ocean Nodules

Processing of Chromite Overburden

Concluding Remarks

### 5. THE IMPORTANCE OF USING A MULTIDISCIPLINARY APPROACH IN THE EVALUATION OF

## AMMONIA LEACHING BEHAVIOUR OF MULTIMINERAL SULPHIDES

Introduction

Research Practice/Methodology

1. Overall Aim of Leaching Studies
2. Raw Materials
3. Analysis of Feed Material, Leach Solution and Residues
4. Leaching as a process involving Parallel Reactions
5. Experimental Options and Limitations during Laboratory Studies
6. Analysis of Kinetic Data in Terms of Models
7. Selection of Experimental Conditions for Oxidative Ammonia Leaching of Multimetal Sulphides

Use of Multi-disciplinary Approach

1. Microscopic Studies
2. X-ray Diffraction (XRD) Studies
3. Thermal Analysis (TA)
4. Chemical Phase Analysis
5. Surface Area Measurements
6. Galvanic Interactions

Concluding Remarks

## 6. PROCESSING OF ALUMINA-RICH INDIAN IRON ORE SLIMES

Introduction

Motivation for the Beneficiation of Indian Iron Ores

Beneficiation Strategies for Indian Iron Ore Slimes

Selective Dispersion-flocculation Studies on Iron Ore Slimes

Concluding Remarks

## 7. CONVERSION OF A WASTE TO A HIGH VALUED PRODUCT

Introduction

Experimental

Results and Discussions

Concluding Remarks

## 8. DEFINITIONS AND PROPERTIES OF LIMES

Nomenclature

Physical Properties of Quicklimes

Physical Properties of Hydrated Limes

Chemical Properties of Quick and Hydrated Lime

## 9. ANALYTICAL TESTING OF LIMESTONE AND LIME

Physical Testing of Limestone

Limestone: Use Specifications

Limestone: Chemical Analyses

Physical Tests of Lime

Lime Materials Specifications

Lime: Chemical Analysis

## 10. LIMESTONE PROCESSING

Primary Crushing

Secondary Crushing

Fine Grinding and Pulverization

Conveying

Screening

Washing

Heavy-Media Separation  
Optical Mineral Sorters  
Drying  
Storage  
Portable Plants  
Environmental Controls  
Model of Ultramodern, High-Capacity Limestone Producer  
Costs  
Safety Record

## 11. LIME MANUFACTURE

Development of Kilns  
Vertical Kilns  
Rotary Kilns  
Coolers  
Internals  
Miscellaneous Kilns  
Chemical Analysis  
Refractory Linings  
Flexibility  
Fuels and Combustion  
Rotary Kilns  
Vertical Kilns  
Heat Balance  
Instrumentation  
Temperature  
Air  
Fuel  
Equipment  
Classification of Quicklime  
Control of Kiln Particulate Emissions  
Dead-Burned Dolomite Production  
Oystershell Lime  
Precipitated Calcium Carbonate  
Hydraulic Lime  
Selective Calcination  
Manufacturing Costs  
Lime Plant Safety

## 12. LIMESTONE EXPLORATION AND EXTRACTION

Exploration Criteria  
Land Use  
Zoning  
Coring  
Extraction of Limestone  
Stripping  
Disposal of Overburden  
Quarry Layout  
Mining Layout  
Drilling  
Blasting  
Loading  
Haulage

Pumping  
Extraction without Blasting  
Environmental Controls

### 13. THE MINERALOGY OF ASBESTOS

Introduction  
Definitions  
Chemical Composition  
Crystal Structures  
Serpentine Minerals  
Amphibole Minerals  
Occurrences  
Synthesis  
Optical Properties  
X-ray Diffraction Data  
Electron Optical Characteristics  
Non-asbestiform Amphibole and Serpentine Minerals

### 14. CHEMISTRY AND PHYSICS OF ASBESTOS

Asbestos : The Raw Material  
Occurrence and Formation  
World Production  
Applications  
Structure  
Composition  
Chemical Reactions  
Synthesis of the Asbestos Minerals  
Physical Properties of Asbestos Fibres  
Tensile Strength  
Surface Area  
Other Physical Properties  
Optical Properties  
Thermal Decomposition of Asbestos  
Amphibole Asbestos  
Chrysotile Asbestos  
Surface Properties of Asbestos  
Infrared Spectroscopic Data for Asbestos

### 15. THE IDENTIFICATION OF ASBESTOS IN SOLID MATERIALS

Synopsis  
Introduction  
Sampling and Pre-treatment of Samples  
Analysis of Samples for Asbestos  
(1) Observation by Stereo-bionocular Microscope  
(2) The Action of Heat on Fibres  
(3) Optical Microscope Methods  
(4) Infrared Spectrophotometry  
(5) X-ray Diffraction Analysis  
(6) Electron-optical Methods  
(7) Miscellaneous Methods of Analysis

### 16. THE USE OF ASBESTOS AND ASBESTOS-FREE SUBSTITUTES IN BUILDINGS

Synopsis

Introduction

Asbestos in Buildings

- (1) Higher Density Hard-surfaced Materials
- (2) Lower Density Soft-surfaced Materials
- (3) Sprayed Asbestos
- (4) Other Asbestos-based Building Materials and Components

The Risks to Health in the Use of Asbestos in Buildings

Sampling of Installed Building Materials

General Considerations of Health and Safety

Labelling Schemes for Asbestos-based Building Materials

Other Safety Precautions for Building Operatives and Users

Remedial Construction and Maintenance Work

The Substitution of Asbestos in Buildings

- (1) Higher Density Hard-surfaced Materials
- (2) Lower Density Soft-surfaced Materials
- (3) Sprayed or Floated Materials
- (4) Other Building Materials and Components

The Asbestos Hazard in Perspective

The Future for Asbestos in Building

## 17. PROCESS MODELLING AND SIMULATION OF COAL BENEFICIATION FLOWSHEET

Introduction

Software Components

1. Coaldata.com
2. Flowdata.com
3. Coalben.com

Case Study

Discussion

1. Effect of Media Density

Concluding Remarks

Appendix : Specifications and Parameters of Different Units of Sudamdih Washery

## 18. ENHANCED GRAVITY CONCENTRATION PROCESSES TO RECOVER VALUES FROM COAL AND ORE FINES

Introduction

Why Fines are a Problem?

Enhanced Gravity Separation Process

Treating Chromite Ore Fines Rejects

1. Multi-Gravity Separator

Results and Discussion

Concluding Remarks

## 19. MAGNETIC SEPARATION OF HEAVY MINERALS FROM BEACH SAND PLACER DEPOSITS

Introduction

Magnetic Separation Principle

Types of Magnetic Separators

1. Dry Type Magnetic Separators
2. Wet Type Magnetic Separators

Separation of Heavy Minerals

1. Factors of Layout Study

Test Work on Various Options

1. WHIMS in the Up-Front of Feed
2. RED in the Up-Front

- 3. HTS and RED Combination
- 4. Use of HTS and IRMS Combination
- Concluding Remarks

## 20. FLOTATION COLUMN – A NOVEL TECHNIQUE IN MINERAL PROCESSING

Introduction

Column Parameters and their Effect on Metallurgical Performance

- 1. Effect of Various Column Operating Parameters
- 2. Effect of Various Column Design Parameters on Metallurgical Performance

Mixing Effect in the Flotation Column

- 1. Reduction of Mixing Effect in Column

Flotation Studies at Regional Research Laboratory, Bhubaneswar

Concluding Remarks

## 21. PREPARATION OF OXIDES AND HYDROXIDES OF ALUMINIUM THROUGH AQUEOUS ROUTES

Introduction

Preparation of Alumina and Alumina Precursors through Aqueous Route

The Aqueous Species of  $Al^{3+}$

The Sol-Gel Synthesis Route

Homogenous Precipitation Route

Hydrothermal Precipitation Route

Boehmite Synthesis

Concluding Remarks

## 22. DISSOLUTION BEHAVIOUR OF CARBONACEOUS MATERIALS INTO IRON MELTS DURING DIRECT IRON SMELTING

Introduction

Characterisation of Various Carbonaceous Materials

Experimental

Experimental Results

Discussion

Concluding Remarks

## 23. APPLICATIONS OF THERMAL PLASMA IN THE SYNTHESIS OF COVALENT CARBIDES

Introduction

Experimental

Results and Discussion

Concluding Remarks

## 24. LIQUID FERTILIZERS

Liquid Nitrogenous Fertilizers

Compound Liquid Fertilizers

## 25. MANUFACTURE OF ORDINARY SUPERPHOSPHATE

Production Technology of Simple Superphosphate

Sulphuric Acid as a Raw Material in the Manufacture of Superphosphate

Reactions Occurring in Superphosphate Manufacture

Stoichiometric Amount of Sulphuric Acid and Peculiarities of the Decomposition Reaction

Main Technical-analytical Indices of Superphosphate Manufacture

Manufacturing Indices of Ordinary Superphosphate from Vietnam Phosphorite

Fast Curing of Superphosphate

Apparatus Used in Superphosphate Manufacture

Storage and Conditioning of Superphosphate

## 26. NITROGENOUS FERTILIZERS

Nitrogenous Fertilizers and the Cyclic Process of Plant Nutrition

Significance of Inorganic Nitrogenous Fertilizers

World Production of Nitrogenous Inorganic Fertilizers

## 27. CHEMISTRY OF NITROGEN AND ITS INORGANIC COMPOUNDS

### 28. AMMONIUM SALTS

Physicochemical and Agrochemical Properties

Manufacturing Processes

Ammonium Chloride

Physicochemical and Agrochemical Properties

Manufacturing Processes

Ammonium Bicarbonate

Physicochemical and Agrochemical Properties

Manufacture of Ammonium Bicarbonate

## About NIIR

**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, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

---

**NIIR PROJECT CONSULTANCY SERVICES** , 106-E, Kamla Nagar, New Delhi-110007, India. Email: [npcs.india@gmail.com](mailto:npcs.india@gmail.com) Website: [NIIR.org](http://NIIR.org)

Sun, 22 Sep 2019 08:13:15 +0530