

The Complete Technology Book on Asbestos, Cement, Ceramics and Limestone

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Asbestos is the generic term for a group of naturally occurring fibrous minerals with high tensile strength, flexibility, and resistance to thermal, chemical and electrical conditions. Asbestos fibers are of high-tensile strength, flexible, heat and chemical resistance, and good frictional properties. Cement is the most essential raw material in any kind of construction activity. Ceramics also known as fire clay is an inorganic, non-metallic solid article, which is produced by the art or technique of heat and subsequent cooling. Limestone is a sedimentary rock, mainly composed of calcium carbonate (CaCO₃). It is the principal source of crushed stone for construction, transportation, agriculture, and industrial uses.

Emerging applications in commercial sectors such as asbestos, cement and ceramic are poised to fuel demand in the coming years. Growing demand for limestone in the production of cement as well as in several other chemicals that are used in the production of high-value every-day products offers significant opportunities for growth. Global Limestone consumption is projected to reach 5.7 billion tons and expected to grow at an average annual rate of 4–5% in coming years. Presently, cement production is 330 million tonnes and expected to double to reach almost 550 million tonnes in future.

The major contents of the book are asbestos, monitoring and identification of air-borne asbestos, asbestos in industrial applications, asbestos – cement products, non – occupational asbestos emissions and exposures, cements, mortars and concrete, raw materials, additives and fuels for cement, processes of manufacturing of cement, cement based on natural and artificial pozzolanas, fast-setting cements, special portland cements, packing of cement, storages of cement, ceramics, lime & limestone, glass & glass ceramics etc. It describes the manufacturing processes and photographs of plant & machinery with supplier's contact details.

It will be a standard reference book for professionals, entrepreneurs, those studying and researching in this important area and others interested in the field of these industries. Chapter I

Asbestos

Commercial Uses

Properties and Composition

Method of Analysis

Chrysotile

Procedure

Crocidolite and Amosite

Procedure

Chapter II

Monitoring and Identification of Air-borne Asbestos

Synopsis

Introduction

Membrane Filter Method

I. Outline Technique

II. Definitions of Fibre which are evaluated

III. Membrane Filter

IV. Sampling

V. Transportation of Filters

VI. Mounting of the Filters

VII. Microscopical Evolution

VIII. Accuracy of the Membrane Filter Method

IX. Recent Developments in Fibre Evaluation

Determination of Very Low Asbestos Concentrations

Direct - Reading Dust Monitoring Equipment

Miscellaneous Instruments

I. Introduction

II. The Thermal Precipitation

III. The Konimeter

IV. Owens Jet Counter

V. The Impinger

Identification of Air-borne Asbestos Fibres

I. Introduction

II. Optical Techniques

III. Electron Microscopical Techniques

IV. Physical and Chemical Analysis

Summary

Chapter III

Alternatives to Asbestos in Industrial Applications

I. Thermal Properties

II. Mechanical Properties

III. Other Properties

IV. Price and Availability

V. Applications

Industrial Applications of Asbestos Products

I. Asbestos Textiles

1. Fire and Heat Protection Clothes

2. Fire Blankets, Curtains and Aprons

3. Electrical Insulators

4. Filters

5. Ropes, Yarns, Tapes etc

6. Other Applications

II. Thermal Insulations and High Temperature Applications

1. Dry Asbestos Packings

2. Asbestos Jointings

3. Gaskets

4. Lining and Insulating Blocks

5. Ceramic and Mineral Fibres

6 Vermiculite and Perlite

7 Solid Ceramics

8 Further information

III. Asbestos millboard

- 1. Substitutes
- IV. Industrial applications of asbestos-cement
 - 1. Substitutes
- VI. Friction materials
 - 1. Substitutes for asbestos in friction materials
- V. Dry-rubbing bearings
 - 1 Substitutes for asbestos-reinforced thermosets in bearing applications
- 2 Conclusion
- 3 Acknowledgments
- VI Electrical insulation
 - 1 Substitutes for asbestos products in electrical insulation
 - 2 Substitute electrical insulants at high temperatures
- VII Asbestos composites (not including frictional, bearing, and electrical applications)
 - 1 Alternatives to asbestos composites
- VIII Miscellaneous applications
 - 1 Substitutes
- Health hazards of substitute materials
- Conclusions

Chapter IV

Asbestos-Cement Products

Methods of Manufacture

Methods of Analysis

Procedure

Procedure

Chapter V

Non-Occupational Asbestos Emissions and Exposures

Asbestos emissions from natural sources

Asbestos emissions from human-created sources

Redistribution and fate of asbestos in the environment

(i) Redistribution by air

(ii) Redistribution by water

(iii) Ultimate fate of asbestos fibres

Exposure to airborne asbestos

(i) Exposure from ambient air

(ii) Exposure from air near asbestos industrial facilities

1 Asbestos mining, milling, and product manufacture

2 Transportation of materials containing asbestos

3 Estimated atmospheric concentration and exposures

(iii) Exposure from asbestos manufactured products

1 Automotive friction materials

2 Spray asbestos

(iv) Exposures from disposal of asbestos products and wastes

(v) Exposures of asbestos workers' families

Exposure to asbestos in drinking water

(i) Asbestos content of drinking water supplies

(ii) Elevated asbestos levels

(iii) Estimated asbestos consumption from water

Exposure to asbestos in foods and drugs

Appendix, calculation of atmospheric asbestos concentrations in the vicinity of major U.S. Asbestos industrial facilities

Chapter VI

Cements, Mortars and Concrete

Hydraulic Cements

Cement Specifications

Methods of Analysis

Determination of Compound Composition

Determination of major components

Rapid Procedures for Major Components

Chapter VII

Raw Materials, Additives and Fuels for Cement

1. Raw Materials for Making Cement
2. Constituents of Raw Mix and their proportioning
 - 2.1 Limestone
 - 2.2 Silica and Alumina
 - 2.3 Iron Oxide
3. Proportioning Constituents
 - 3.1 Correcting Materials
4. Composition of Clinker
5. Quality Control
 - 5.1 Commonly Found Proportions
6. Blended Cements
7. Fuels
8. Fuel in Shaft Kilns
9. Fuels for Rotary Kilns
10. Coals as Fuel
 - 10.1 Preparation of Coal for Firing
 - 10.2 Preparation of Oil for Firing
11. Costs of Fuels
12. Coals
 - 12.1 Typical Compositions of Coal and Coke are
 - 12.2 Typical Composition of Coal Ash is
 - 12.3 Volatiles
13. Calorific Value of Fuels
14. Oils
15. Gas as Fuel
16. Specific Fuel Consumption Obtainable using Different Fuels
17. Requirements of Raw Materials and Fuel

Chapter VIII

Processes of Manufacturing of Cement

1. Process of Making Cement
2. Predominance of Wet Process
3. Marginal grade Limestone and Froth Flotation
3. Dry and Semi Dry Processes
 - 3.1 Semi Dry Process
5. Dry Grinding and Blending
6. Semi Wet Process
7. Preheaters

- 7.1 Lepol Grate Preheater
- 7.2 Suspension Preheater
- 8. Clinker Coolers
- 8.1 Rotary and Planetary Coolers
- 8.2 Grate Coolers
- 9. Increase in Size of the Cement Plant – Large Kilns
- 10. Calciners
- 11. Technical Collaborations
- 12. Various Processes, Machinery and Size of Cement Plant

Chapter IX

Cements based on Natural and Artificial Pozzolanas

- 1 Fly Ash based Cements
- 1.1 Composition and properties of fly ashes
- 1.2 Lime-activated fly ash binder
- 1.3 Portland-fly ash cement and fly ash concrete
- 1.4 High-volume fly ash concrete
- 1.5 Alkali-activated fly binder
- 2. Cements made with fluidized bed ashes
- 3. Binders containing natural pozzolanas and related products
- 4. Microsilica-modified Portland cement
- 5. Rice Husk ash based cement

Chapter X

Fast-Setting Cements

- 1. Control of Portland Cement setting by the use of chemical admixtures
- 2. Fast-setting gypsum-free portland cement
- 3. Fast-setting cements containing the phases C11A7.CAF2 or C12A7
- 4. Fast-setting cements containing the phase tetracalcium trialuminate sulfate.
- 5. Fast-setting blends of portland cement and calcium aluminate cement
- 6. Fast-setting magnesium phosphate cement
- 7 Fast-setting glass cement
- 8 Miscellaneous fast-setting cements

Chapter XI

Special Portland Cements

- 1. Constituents and Composition of Portland Cements
- 1.1 Tricalcium silicate ($3\text{CaO}\cdot\text{SiO}_2$, abbreviation C3S)
- 1.2 Dicalcium silicate ($2\text{CaO}\cdot\text{SiO}_2$, abbreviating C2S)
- 1.3 Tricalcium Aluminate ($3\text{CaO}\cdot\text{Al}_2\text{O}_3$, abbreviation C3A)
- 1.4 The ferrite phase [calcium alumiante ferrite, $2\text{CaO}(\text{Al}_2\text{O}_3, \text{Fe}_2\text{O}_3)$] [abbreviation C2(A,F)]
- 1.5 Calcium sulfate
- 1.6 Free Calcium oxide (free lime, Cao)
- 1.7 Free Mangness oxide (periclase, MgO)
- 1.8 Alkali sufates
- 1.9 Composition of Portland clinker and Portland cement
- 2. The Hydration of Portland Cement
- 3. High-C3S Portland Cement

4. Portland Cement with Elevated C2S content
5. High-C3A Portland Cement
6. C3A Portland Cement
7. Low-Iron (White) Portland Cement
8. High-Iron Portland Cement
9. High-Mgo Portland Cement
10. Low-Alkali Portland Cement
11. Mineralized Portland Cement
12. High Specific Surface Area Portland Cement
13. Low Specific Surface Area Portland Cement
13. Limestone-Modified Portland Cement
15. Portland Cement Modified with Chemical Agents
16. Gypsum-Free Portland Cements
- 16.1 Low-porosity cement
17. Special Approaches in Portland Cement Manuacture
18. Special Approaches in Cement Processing

Chapter XII

Packing of Cement

1. Packing Cement for Despatches
2. Packing Machines
- 2.1 Rotary Packing Machines
3. Paper and HDPE/Jute Bags

Chapter XIII

Storages of Cement

1. Storages
2. Daily requirements of Various Materials
3. Conventions in Storing various materials
4. Factors Governing Storages
5. Storages of Semi Finished and Finished products
- 6.1 Quarry
- 6.2 Crusher
- 6.3 Stack Reclaimer
- 6.4 Raw Mill and Blending
- Kiln feed
- 6.5 Preheater – Calciner – Kiln and cooler
- 6.6 Cement
7. Storage After Expansion
8. Storage of Coal
10. Space for storages

Chapter XIV

Ceramics

Clay Products, Whitewares, and Porcelains

Enamels and Glazes

Glass and Glass Ceramics

Refractories

Newer Ceramics

Methods of Analysis

Determination of the Chemical Composition

Sampling

Anaysis

Emission Spectrometry
X-Ray Diffraction

Chapter XV

Lime and Limestone
Properties
Uses
Methods of Analysis
Sampling and Handling Precautions
Composition Analysis
Basicity Tests
Physical Tests

Chapter XVI

Glass and Glass Ceramics
Constitution of Glasses
Method of Analysis
Composition Analysis
Chemical Methods for Individual Constituents
Redox State Determinations
Chelometry
Flame Spectroscopy
Emission Spectroscopy
Spectrophotometry
X-Ray Diffraction
Microscopy
Electron Microprobe Analysis

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