## Handbook on Gypsum and Gypsum Based Products (Mining, Processing, Transportation, Handling & Storage, Gypsum Board, Plaster of Paris with Machinery & Equipment Details)

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Gypsum is chemically known as calcium sulfate dihydrate and it contains calcium and sulfur, which is bound to oxygen and water. Gypsum is an abundant mineral and takes various forms including alabaster, which is a material, used in decoration and construction. This is a non-toxic mineral and it can be helpful to humans, animals, plant life, and the environment. The majority of gypsum produced is used to manufacture gypsum board or building plasters and it is used in many other ways.

Gypsum products are used in dentistry, medicine, homes, and industry. In homes, gypsum plaster is used to make walls; in industry, it is used to make molds. Three types of gypsum products are plaster, stone, and high-strength or improved stone. The Gypsum and the Gypsum products are used for construction purposes. It is also used in industry for making pottery, moulds etc. It is used by orthopedics to make plaster casts and helps the dentist for the cast preparation, models and dies, impression material, investment material, mounting of Casts, as a mold material for processing of complete dentures etc.

The global gypsum board market size is anticipated to exhibit a CAGR of 11.9% in terms of revenue. Increasing utilization of gypsum boards in decorative and partitioning applications in residential constructions is anticipated to drive the market. The demand for gypsum boards is driven by the residential sector, where the product is widely used in multi-family constructions for room partitioning. Durability and lightweight coupled with easy handling of the product are some of the factors anticipated to propel the demand.

The major contents of the book are Mining, Processing, Transportation, Handling & Storage, Gypsum Board, Plaster of Paris for gypsum, Plant Layout, Process Flow Chart and Diagram, Plant & Machinery Suppliers and Photographs of Machineries.

This book is one-stop guide to one of the fastest growing sector of the Gypsum and Gypsum based Products, where opportunities abound for manufacturers, retailers, and entrepreneurs. This is the only complete handbook on gypsum and gypsum based Products. It serves up a feast of how-to information, from concept to purchasing equipment.

**1. INTRODUCTION Chemical Identification and Analysis** Gypsum Plaster of Paris **Calcium Sulfate Physical-Chemical Properties** History of Gypsum **Gypsum Moulds Gypsum Credentials** 1. Unequalled as a Material for Interiors 2. Gypsum Products' Unique Properties **Fire Properties Fire Resistant** Non-Combustible Effective in Fire **Acoustic Properties Thermal Properties** Aesthetics and Design Ease of Installation From Products to Solutions 2. MANUFACTURING PROCESS Raw Material Dehvdration: Rock into Plaster **Production Processes Gypsum Unique Properties in Buildings** Gypsum is Fire Protective Gypsum Regulates Sound Gypsum equilibrates Humidity and Heat Peaks Gypsum is Easy to Install and to Dismantle Gypsum Acts as a Thermal Insulator when **Combined with Insulation Materials** Gypsum is Impact Resistant Gypsum is Multifaceted, Multipurpose, Supple and Aesthetic Plaster Board

Gypsum Fibre Boards **Gypsum-Based Self-Levelling Screeds** Plaster Blocks **Decorative Plaster Building Plaster** Uses of Gypsum Chemistry of Gypsum Products Chemistry of Gypsum Product Formation Setting Mechanism **Manipulation Stages** Manufacture of Gypsum Precursors "Plaster of Paris" "Hydrocal" "Densite" Properties Variables influencing Properties Manufacturing Variables User's Variables

Effects of Increases in Variables on Final Properties

Occurrence of Gypsum Gypsum Physical Properties Agricultural Gypsum Uses

1. Gypsum Improves Soil Texture and Compacted Soils

2. Gypsum Decreases Bulk Density of Soil

3. Gypsum Stops Water Runoff, Erosion and Soil Crusting

- 4. Gypsum Improves Swelling Clays
- 5. Gypsum Increases Value of Organics
- 6. Gypsum Counteracts Subsoil Acidity
- 7. Gypsum Helps Reclaim Sodic Soils
- 8. Gypsum Decreased ph of Sodic Soils
- 9. Gypsum Enhances Water Use Efficiency

10. Gypsum Makes it Possible to Use Low Quality Irrigation Water

11. Gypsum Replaces Harmful Salts

12. An Excellent Fertilizer Source for Calcium and Sulfur

13. Gypsum Helps with High Bicarbonate Irrigation Water

- 14. Gypsum Makes Slightly Wet Soils Easier to Till
- 15. Gypsum Prevents Water Logging of Soil

16. Gypsum Helps Earthworms to Flourish

3. TYPES OF GYPSUM PRODUCTS

Setting of Gypsum Products

Theories of Setting of Gypsum Products

Hydration Theory

**Dissolution Precipitation Theory** 

Setting Process

Stages

W:P Ratio

Recommended Ranges

Properties

Setting Time

Mixing Time

1. Loss of Gloss Test for Initial Set

2. Initial Gillmore Test for Initial Set

3. Gillmore Test for Final Setting Time

Vicat Test for Setting Time

Ready for Use Criterion

Control of Setting Time (S.T.)

4. PLASTER OF PARIS

Preparation of Plaster of Paris

Step 1 - Plaster of Paris Manufacture

Step 2 - Rehydration

Common Plaster Additives

Step 3 - Setting

Properties

Application of Plaster of Paris

Uses of Plaster of Paris

Architecture

Art

Uses in Medicinal and Fireproof Fields Medicinal Fireproof 5. GYPSUM BOARD The Chemistry of Gypsum Board **Gypsum Board Manufacturing Process** Step-1 Step-2 Step-3 Step-4 Advantages of Gypsum Board Areas of Applications Gypsum Board for Acoustic Applications Gypsum Board for Ceiling Application Drywall Manufacturing Process **Blending of Additives** Making the Sandwich Finishing the Edges **Cutting the Panels** The Drying Process The Finished Product Types of Gypsum Board Regular and Type X Gypsum Board Types of Gypsum Board Based on Edges Common Types of Gypsum Board (a) Regular/Standard Gypsum Board (b) Fire Resistance Gypsum Board (c) Moisture Resistance Gypsum Board (d) Fire & Moisture Resistance Gypsum Board (e) Abuse-Resistant Gypsum Panels (f) Exterior Gypsum Soffit Board (g) Foil-Backed Gypsum Board Gypsum Fiber Board **Glass Mat Gypsum Board** Sheathing **Backing Board** 6. TYPES AND SOURCES OF GYPSUM Mined Gypsum Flue Gas Desulphurization (FGD) gypsum and Spray-Dry Absorption materials (SDA) Phosphogypsum Pickle Gypsum Drywall Gypsum Landfill Versus Recycling Green Building Common Uses of Gypsum Markets for Gypsum Products General Benefits of Gypsum for Soils Soil Crusting Acid Subsoil Sodic or Salt Contaminated Soils Nutrient Availability

Runoff and Water Absorption Animal Bedding Poultry Bedding Manure Treatment Crops Known to Benefit From Gypsum Plants that can Benefit from Gypsum Include Animals Application 7. DIFFERENT TYPES OF DRYWALL 1. Dry Lining Systems 2. Interior Partition Systems 3. Performance partition Systems How to build a drywall Installation **Drywall Tools Fixing Tools Cutting Tools** Marking Tools **Finishing Tools** Lifting Tools Basic Principles to Design a Drywall Key Design Criteria Height **Maximum Partition Heights** Thermal Insulation Different Types of Drywall Benefits of Effective Thermal Insulation make Building 8. GYPSUM PRODUCTS IN DENTISTRY: TYPES, **USES. PROPERTIES Desirable Properties** Types of Gypsum Products A. Plaster B. Stone C. High-Strength or Improved Stone D. Other Types of Gypsum **Setting Reaction** Water/Powder Ratio Setting Time Definitions 1. Working Time or Initial Setting Time 2. Final Setting Time Measurement Variation in Setting Times 1. Increased Setting Time (A Slower-Setting Product) 2. Decreased Setting Time (A Faster-Setting Product) Setting Expansion Strength 9. GYPSUM AS AN AGRICULTURAL PRODUCT Benefits of Gypsum as a Soil Amendment Processing Gypsum into a Soil Amendment

Agricultural and Land Application uses of Gypsum Gypsum as a Source of Plant Nutrients for Crops Gypsum to Improve Soil Physical Properties Gypsum to Improve Soil Chemical Properties Gypsum for Nursery, Greenhouse, Landscape, and Sports Field Use Gypsum for Landscape and Sports Field Use Other Uses of Gypsum in Agriculture Use of Gypsum as a Soil Conditioner **Causes of Poor Soil Structure Recognition of Gypsum Responsive Soils** Exchangeable Sodium Percentage (ESP) Exchangeable Magnesium Percentage (EMgP) Calcium: Magnesium Ratio (Ca:Mg) **Clay Dispersion Index 10. MINING TECHNOLOGY Exploration Techniques** Stratigraphy Topography Vegetation Hydrology **Deposit Evaluation Drilling and Sampling Testing Procedures 11. PREPARATION OF OTHER GYPSUM AND** ANHYDRITE Phosphogypsum Titanogypsum Insoluble Anhydrite **Calcination Methods** Batch Kettle **Continuous Kettles** Submerged Combustion Kettles Conical Kettle **Rotary Kilns** Impact Mill Calciner **Ring Ball and Roller Mills** Calcidyne Unit Anhydrous and Multiphase Plaster Hemihydrate Plasters **12. ROLE OF GYPSUM IN CEMENT** The Effect of Gypsum on Setting of Cement The Effect of Gypsum Solubility **Optimum Gypsum Content** Strength and Volume Stability Effects of Gypsum on Cement 13. TECHNOLOGY OF GYPSUM AND GYPSUM **PLASTERS** 

14. GYPSUM TRANSPORTATION Power Station to Plaster Board Factory Packaging Transportation Truck Rail Barge Ship **15. GYPSUM HANDLING AND STORAGE** Handling and Transportation **Gypsum Storage Gypsum Panel Products** Safety Tips for Handling Handling and Storage of Gypsum Panel Products: A guide for distributors, Retailers, and Contractors Storage Support Risers Preventing Sagging Gypsum Panel Products Preventing Sagging Gypsum Panel Products, cont. Manual Handling Mechanical Handling Use of Wedges Stocking Gypsum Panel Products on Job Sites Loading Gypsum Panel Products **Open Top Rail Flatcars** Flatbed Trucks Guidelines for Carriers, Drivers and Trailer Loading Personnel **16. GYPSUM BOARD WASTE MANAGEMENT** Gypsum and Gypsum Board Sustainability Imperative Gypsum Board Waste and the Management **Recycling Process and Technology** Policy Instruments for Promoting Recycling Action on Gypsum Board Waste **CRD** Waste Management in Europe **17. GRINDING AND CALCINING OF GYPSUM 18. CRYSTALLISTAION AND DISSOLUTION OF** GYPSUM Introduction **Background Information** Mineralogy **Crystal Nucleation: The Classical Nucleation** Theory The Induction Period and the Surface Free Energy Crystallization of Gypsum **Gypsum Nucleation Kinetics** Gypsum Nucleation Induction Period and the Surface Free Energy Inhibition of Gypsum Crystallization **Dissolution of Gypsum** 

**Gypsum Dissolution Kinetics** 

Surface Behavior of Gypsum during Dissolution

**19. GYPSUM PELLETIZING** 

Gypsum Waste

**Recycled Gypsum Products Agricultural Products** New Drywall Cement **Paper Products** Composting Flow Diagram of Typical Gypsum Pelletizing Process **Gypsum Pelletizing** Pelletizing Gypsum for Use as a Soil Conditioner Benefits of Pelletizing Gypsum The Basics of Pelletizing Gypsum Disc Pelletizer Rotary Dryer Important Gypsum Pelletizing Elements Binder Equipment Drying Gypsum **Drying Mined Gypsum Beneficiation** Drying Gypsum for Use in Wallboard Benefits to Drying Pelletized Gypsum Improved Product Handling **Product Consistency** The Benefits of Adding a Pin Mixer to a Gypsum Pelletizing System How it Works Improved Blending **De-Dusting** Improved Productivity **Reduced Binder Usage** 20. BIS SPECIFICATIONS

## 21. PROCESS FLOW SHEET

22. PLANT LAYOUT

23. PHOTOGRAPHS OF MACHINERY WITH SUPPLIER'S CONTACT DETAILS **Gypsum Board Making Machine** Plaster of Paris Making Machine Rotary Kiln **Gypsum Cutting Machine** Storage Tank Conveyors Gypsum Rotary Dryer Blower Crusher Scrubber Hammer Mill **Coarse Grain Silos** Mixer Gypsum Plaster Spraying Machine

Pulveriser Automatic Corrugated Board Making Machine **Corrugated Board Making Machine Rotary Calciner Rotary Die Cutting Machine Die Cutting Creasing Conveyor Belt** Blower **VSI** Crusher Scrubber Making Machine Semi-Automatic Hammer Mill **Gypsum Plaster Spraying Machine Plaster Spray Machine** Semi-automatic Bandage Machine **Gypsum Powder Production Line Gypsum Board Production Line Machine** 

## About NIIR

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