

The Complete Book on Glass and Ceramics Technology (2nd Revised Edition)

Author: NIIR Board of Consultants & Engineers

Format: Paperback

ISBN: 9788178331751

Code: NI163

Pages: 624

Price: Rs. 1,495.00 **US\$** 150.00

Publisher: Asia Pacific Business Press Inc.

Usually ships within **5** days

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. The ceramics industry in India came into existence about a century ago and has matured over time to form an industrial base. From traditional pottery making, the industry has evolved to find its place in the market for sophisticated insulators, electronic and electrical items. The ceramic industry has been modernizing continuously, by newer innovations in product design, quality etc. Glass is an inorganic product typically produced by melting a mixture of silica, soda and calcium compound with desired metallic oxides that serves as coloring agents. Indian glass industry will increase on the sidelines of real estate growth across retail, residential and office estate. Glass production involves the fusion of several inorganic substances. These various substances include products such as silica sand, soda ash, dolomite and limestone, representing together 99% of all the raw materials, excluding recycled glass. Glass-ceramics are mostly produced in two steps: First, a glass is formed by a glass-manufacturing process. The glass is cooled down and is then reheated in a second step. In this heat treatment the glass partly crystallizes. In most cases nucleation agents are added to the base composition of the glass-ceramic. These nucleation agents aid and control the crystallization process. Glass-ceramics are fine-grained polycrystalline materials formed when glasses of suitable compositions are heat treated and thus undergo controlled crystallization to the lower energy, crystalline state. It is important to emphasize a number of points in this statement on glass ceramics. Glass ceramics has helped the electronics industry build much smaller and highly efficient transistors, leading to advances in all types of devices.

The book covers almost all important aspects of Glass and Ceramic Industry: Properties, Applications, Manufacturing, Processing and Photographs of Plant & Machinery with Supplier's Contact Details. The major contents of the book are types of glasses, silicate glasses, boric oxide and borate glasses, phosphorus pentoxide and phosphate glasses, germanium dioxide and germanate glasses, titanate glasses, nitrate glasses, glasses based on water, halide glasses, modern glass working, monax and pyrex glass, electric welding, photo electric cells, glassy metals, analysis of glass, glass ceramics, ceramics as electrical materials, analysis of ceramics etc.

The book will be useful to the consultants, technocrats, research scholars, libraries and existing units and new entrepreneurs who will find a good base to work further in this field.

Contents

1. GLASS Structure

Composition
Single-Phase Glasses
Glass-Ceramics and Phase-Separated Glasses
Properties
Manufacture and Processing

2. TYPES OF GLASSES

A. Chemical Composition

B. Devitrification of Fused Silica

1. The Phases of Silica

2. Crystalline Phases Produced by the Devitrification of Fused Silica

3. Effect of Impurities on the Rate of Devitrification of Vitreous Silica

4. Effect of Atmosphere on the Rate of Devitrification

5. Detailed Studies of Devitrification Kinetics

6. Comparison of Calculated and Measured Growth Rates

C. The Kinetics Of Melting Of Quartz And Cristobalite

1. Superheating of Quartz and Cristobalite Melting

2. Evidence for Residual Crystalline Structures in Fused Silica

D. Viscosity of Fused Silica

3. SILICATE GLASSES

A. Binary Systems

1. Alkali Silicate Systems

a. Structural considerations

b. Glass formation in the alkali silicate systems

c. Phase diagrams of the alkali silicate systems

d. The kinetics of devitrification

2. Binary Systems Containing Alkaline Earth Oxides

B. THE Na_2O - CaO - SiO_2 SYSTEM

1. Structural Considerations

2. The Glass-forming Region

3. The Phase Diagram

4. Devitrification Kinetics

C. SOME SPECIAL SILICATE GLASSES

1. Alkali Aluminosilicates

2. Invert Glasses

4. BORIC OXIDE AND BORATE GLASSES

A. The Preparation and Properties of Boric Oxide Glass

B. Glass Formation in Binary Borate Systems

1. Ranges of Glass Formation

2. Phase Diagrams

3. Chemical Bonding in Systems Containing Highly Polarizable Cations

C. Ternary Systems

1. The Na_2O - B_2O_3 - SiO_2 System

2. Aluminoborate Systems

D. The Structure of Vitreous Boric Oxide and Borate Glasses

1. Vitreous Boric Oxide

2. Alkali Borate Glasses

5. PHOSPHORUS PENTOXIDE AND PHOSPHATE GLASSES`

A. Phosphorus Pentoxide

1. Structure and Polymorphism

2. Polymorphic Transformations and Melting
3. Viscosity and Melt Allotropy
- B. Glass Formation in Binary Phosphate Systems
 1. Regions of Glass Formation
 2. The Structure of Phosphate Glasses
 3. Paper Chromatography of Phosphate Glasses
 4. Devitrification Kinetics of Sodium Metaphosphate Glass
 5. The Role of B_2O_3 and Al_2O_3 in Phosphate Glasses

6. GERMANIUM DIOXIDE AND GERMANATE GLASSES
 - A. Germanium Dioxide
 1. Structure and Allotropy
 2. GeO_2 Glass : Viscosity
 - B. Glass Formation in GeO_2 systems
 1. Experimental Results
 2. Phase Diagrams
 3. The Structure of Alkali Germanate Glasses and Mels
- Tellurite and Vanadate Glasses
 - A. Tellurite Glasses
 1. Glass Formation
 2. The Structure of TeO_2 and Tellurite Glasses
 3. Viscosity of Tellurite Melts: Liquidus Temperatures
 - B. Vanadate Glasses
 1. Glass Formation
 2. Liquidus Temperature in Vanadate Systems
 3. The Structure of V_2O_5 and Vanadate Melts
- Miscellaneous Oxide Glasses
 - A. Aluminate Glasses
 1. Glass-forming Compositions
 2. Liquidus Temperatures; Structure
 - B. Glasses Base Ga_2O_3
 - C. Carbonate Glasses
 - D. Titanate Glasses
 - E. Glasses Based on As_2O_3 , Sb_2O_3 AND Bi_2O_3
 1. Glass-Forming Behaviour of the Oxides
 2. Binary Systems
 - F. Glasses Based on MoO_3 AND WO_3
 - G. Sulphate and Selenite Glasses

7. NITRATE GLASSES
 - A. Glass-Forming Systems
 - B. The System KNO_3 - $Ca(NO_3)_2$
 - C. Theories of Glass Formation
 1. Structural Considerations
 2. Kinetic Considerations
 - D. The Mechanism of Melting

8. GLASSES BASED ON WATER
 - A. Vitreous Water
 - B. The System H_2O - H_2O
 - C. Other Aqueous Solutions
 - D. Structure of Water

E. Hydrogen Bonding in KHSO₄

9. HALIDE GLASSES

A. BeF₂ Glasses

1. BeF₂
 2. Model Relationships between Fluorides and Oxides
 3. Binary Fluoroberyllate Systems
 4. Microphase Separation
- ### B. Other Fluoride Glasses
- ### C. ZnCl₂ Glasses

10. CHALCOGENIDE GLASSES

A. COMPARISON WITH OTHER SYSTEMS

- #### A. Comparison with Other Systems
- #### B. Structure and Melting Behaviour of Elements in Groups IV, V and VI
- #### C. Sulphur, Selenium and Tellurium
1. Sulphur
 2. Selenium
 3. Tellurium
- #### D. Binary Glasses
1. Chalcogenides with Group V Elements
 2. Chalcogenides with Group IV Elements
- #### E. Ternary Glasses
1. Glasses Based on Arsenic Chalcogenides
 2. Glasses Containing Both Group IV and Group V elements
- #### F. Halogen-Containing Glasses
- #### G. Viscosity of Binary Glasses
- #### H. Phase Diagrams of Binary Chalcogenide Systems
- #### I. Structures of Chalcogenide Compounds and Glasses
1. Chalcogenides of Group IV Elements
 2. Chalcogenides of Group V Elements
 3. Structures of the Chalcogenide Glasses

11. MODERN GLASS WORKING

General Considerations and Equipment

Physical Properties of Glass

General Considerations and Equipment

Physical Properties of Glass

Kinds of Laboratory Glass

Soda-Glass

The Glass Working Flame. The Blowpipe

Other Types of Blowpipe

The Hand Blowpipe

The Compressed Air

The Glass Working Bench

Bloom and Devitrification

Annealing

Storing and Cleaning Glass

12. FUNDAMENTAL OPERATIONS.

Skill

Cutting Glass Tubing

Instruments in use for Starting the Crack

- (1) The Glass Knife.
- (2) Steel Files.
- (3) Specially hardened Steel Wheels.
- (4) Diamond.

Methods of Propagating the Crack

(a) Mechanical.

- (1) Manual Pressure.
- (2) Impact.

(b) The Application of Heat.

- (1) The Electrically Heated Hot Wire.
- (2) Hot Glass Rod.
- (3) The Blowpipe Flame.
- (4) Hot Iron Wires.

The Importance of good Glass Cutting

Rotating the Tube in the Flame

Bending Glass Tubing

Bending Wide Tubing

Drawing Out and Constructing A Tube

Bordering

Sealing a Tube

Blowing Bulbs

- (a) At the end of a Tube.
- (b) In the middle of the Tube.

Joining Two Tubes of the Same Diameter

Method I.

Method II.

To Blow a Hole in the Side of a Tube

Composite Operations

Joining Two Tubes of Unequal Diameters

Blowing Larger Bulbs

- (a) From a Bulb in the Middle of a Tube.
- (b) From a Larger Tube Sealed On.

T-Joints

Internal Seals

- (a) Inner tube unsupported.
- (b) Inner tube supported.

Closed Circuits of Tubing

13. MONAX AND PYREX GLASS

General

Monax Glass

Physical Properties

Cutting

Bending

Blowing

Small Joints

Large Joints

Annealing

Pyrex Glass

Physical Properties

Cutting

Bending

Blowing

Joints
Annealing

14. SEALING METALS INTO GLASS

Platinum
Copper-Clad Wire
Tungsten
Copper to Glass

15. ELECTRIC WELDING

General
Resistance Welding
Strength of Welded Wires
ARC Welding

16. VACCUM TUBES

The Conduction of Gases
The Electrodes
Positive Rays
X-ray Fluorescence
The Fleming Valve
The De Forest Valve

17. PHOTO-ELECTRIC CELLS

General
Photo-Emissive Cells
Cell Construction
Working the Cell
Photo-Voltaic Cells
Cuprous-oxide-copper
Other Semi-Conductors

18. VACUUM TECHNIQUE

Diffusion Pumps
Theory
Jet Design
Working Substance
Jets in Series
Cleaning
Insulation
Heating
Joints
The Importance of Wide Tubing
Use of a Reservoir
Connections and Taps
Precautions

19. LEAKS, OUT-GASSING AND SEALING OFF

Leaks
Out-Gassing
The Electric Furnace
Sealing Off
'Clean-up' and 'Getters'

20. MEASUREMENT OF LOW PRESSURES

The McLEOD Gauge

Construction

Other Indications of Pressure

21. GLASSY METALS

Structure

Properties

Thermal Behaviour

Formation

Preparation

Applications

22. ANALYSIS OF GLASS

Methods of Anylysis

Composition Analysis

Chemical Methods for Individual Constituents

Procedure

Procedure

Procedures

Procedure

Procedures

Procedures

Calculate the zirconium content as zirconium dioxide, ZrO_2 .

Procedures

Calculate the antimony as antimony trioxide, Sb_2O_3 .

Calculate the antimony content of the sample as antimonous oxide, Sb_2O_3 .

Procedures

Procedures

Redox State Determinations

Chelometry

Procedures

Flame Spectroscopy

Method for Alkali Metals in Glass by Flame Emission Spectrometry.

Procedure

Emission Spectroscopy

X-Ray Emission Spectroscopy

Spark Source Spectrometry

Electroanalytical Methods

Coulometry.

Determination of Properties

Spectrophotometry

Procedure

Procedure

Microscopy

Electron Microprobe Analysis

23. GLASS-CERAMICS

The Glass-Ceramic Process

Properties

Commercial Applications

24. Ceramics

SCOPE

25. RAW MATERIALS

Clays

Nonclay Minerals

Special Materials

26. FORMING PROCESS

Material Preparation

Forming Process

Thermal Treatment

Methods of Thermal Treatment

Physical and Chemical Changes During Thermal Treatment

27. CERAMICS POTTERY

The Indian Industry

Raw Materials

Manufacture

Production and Trade

28. PROPERTIES AND APPLICATIONS

Composition and Microstructure

Chemical Properties of Ceramic Materials

Optical Properties

Thermal Properties

Elastic Properties

Strength

Electrical and Magnetic Properties

Composites and Cermets

Uses of Ceramics

29. CERAMICS AS ELECTRICAL MATERIALS

Electrical Conduction Phenomena

Ionic Conduction in Ceramics

Electronic conduction in Ceramics

Nonstoichiometric and Solute-Controlled Electronic Ceramics.

Ceramics With High Electronic Conductivity or With Nonlinear Behaviour

Mixed Conduction in Ceramics

30. ANALYSIS OF CERAMICS

Abrasives

Cements, Lime, and Gypsum

Clay Products, Whitewares, and Porcelains

Enamels and Glazes

Glass and Glass Ceramics

Refractories

Newer Ceramics

Methods of Analysis

Determination of The Chemical Composition

Sampling

Sample Dissolution

Procedure
Analysis
Emission Spectroscopy
X-Ray Diffraction
Microscopy

31. PHOTOGRAPHS OF MACHINERY WITH SUPPLIERS CONTACT DETAILS

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.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

NIIR PROJECT CONSULTANCY SERVICES , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** npcs.india@gmail.com **Website:** NIIR.org

Fri, 19 Apr 2024 15:15:04 +0530