

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

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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.

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

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- 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 B₂O₃ and Al₂O₃ in Phosphate Glasses

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- A. Germanium Dioxide
- 1. Structure and Allotropy
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- B. Glass Formation in GeO₂ systems
- 1. Experimental Results
- 2. Phase Diagrams
- 3. The Structure of Alkali Germanate Glasses and Melts

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- A. Tellurite Glasses
- 1. Glass Formation
- 2. The Structure of TeO₂ 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 V₂O₅ and Vanadate Melts

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- A. Aluminate Glasses
- 1. Glass-forming Compositions
- 2. Liquidus Temperatures; Structure
- B. Glasses Base Ga₂O₃
- C. Carbonate Glasses

- D. Titanate Glasses
- E. Glasses Based on As₂O₃, Sb₂O₃ AND Bi₂O₃
- 1. Glass-Forming Behaviour of the Oxides
- 2. Binary Systems
- F. Glasses Based on MoO₃ AND WO₃
- G. Sulphate and Selenite Glasses

7. NITRATE GLASSES

- A. Glass-Forming Systems
- B. The System KNO₃-Ca(NO₃)₂
- C. Theories of Glass Formation
- 1. Structural Considerations
- 2. Kinetic Considerations
- D. The Mechanism of Melting

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- A. Vitreous Water
- B. The System H₂O-H₂O

- C. Other Aqueous Solutions
- D. Structure of Water
- E. Hydrogen Bonding in KHSO_4

9. HALIDE GLASSES

- A. BeF_2 Glasses
- 1. BeF_2
- 2. Model Relationships between Fluorides and Oxides
- 3. Binary Fluoroberyllate Systems
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- 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
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- E. Ternary Glasses
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 - 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
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 - 1. Chalcogenides of Group IV Elements
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- Physical Properties of Glass
- General Considerations and Equipment
- Physical Properties of Glass
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- Storing and Cleaning Glass

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- 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

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Bending Wide Tubing

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Sealing a Tube

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

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To Blow a Hole in the Side of a Tube

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Joining Two Tubes of Unequal Diameters

Blowing Larger Bulbs

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Physical Properties

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Procedure

Procedures

Procedure

Procedures

Procedures

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Procedures

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Procedures

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About NIIR

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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.

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