

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

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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

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2. Invert Glasses

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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

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 - 2. Polymorphic Transformations and Melting
 - 3. Viscosity and Melt Allotropy
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 - 2. The Structure of Phosphate Glasses
 - 3. Paper Chromatography of Phosphate Glasses
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 - 2. The Structure of TeO_2 and Tellurite Glasses
 - 3. Viscosity of Tellurite Melts: Liquidus Temperatures
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 - 2. Liquidus Temperature in Vanadate Systems
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- Miscellaneous Oxide Glasses
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 - 2. Liquidus Temperatures; Structure
 - B. Glasses Base Ga_2O_3
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- D. Titanate Glasses
- E. Glasses Based on As_2O_3 , Sb_2O_3 AND Bi_2O_3
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 - 2. Binary Systems
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- G. Sulphate and Selenite Glasses

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- B. The System KNO_3 - $Ca(NO_3)_2$
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 - 2. Kinetic Considerations
- D. The Mechanism of Melting

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- B. The System H_2O - H_2O

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

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- F. Halogen-Containing Glasses
- G. Viscosity of Binary Glasses
- H. Phase Diagrams of Binary Chalcogenide Systems
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General Considerations and Equipment

Physical Properties of Glass

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The Compressed Air

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- (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.

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- (b) In the middle of the Tube.

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Blowing

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Physical Properties

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Procedures
Procedures
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Procedures
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