

Properties of Glass as Related to Applications with Silicon

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A. Introduction

In this paper some very general properties for silicon and several types of Corning glass are given. Many silicon wafer-users bond silicon to glass, or use glass materials in coordination with silicon. The glass data reported here has been taken from the Corning web site [1] and assumed to be accurate. Most the data on silicon can be located by reviewing a variety of textbooks, or the primary source given in reference 2.

This Tech-note is intended to assist general silicon users with a quick reference to very basic glass properties and suppliers, and the reader should carefully review the Corning web site and other references as needed and appropriate.

B. Basic Data on Glass and Silicon

A basic listing of glass properties for Corning 7740 and 7070 glass is given below.

Corning 7740 Glass substrates

Diameter and Shape: 76.2mm \pm 0.5mm, 100mm \pm 0.5mm, 150mm \pm 0.5mm

Material Type: Borosilicate Glass

Primary Flat Length: SEMI Specification

Secondary Flat Length: SEMI Specification

Secondary Flat Orientation and Location: SEMI Specification

Center Thickness: 1000um \pm 25um, 500um \pm 25um standard

Total Thickness Variation (5 point measurement): <20um

Surface Polishing and Properties: Single Side or Double Side Polished

Density: 2.23 g/cm³

Youngs Modulus: 6.4e3 Kg/mm²

Poisson's ratio: 0.2

Coefficient Thermal Expansion (0-300C): 3.25 e-6 1/C

Thermal conductivity: 0.0027 sec-cm²-C

Working Point: 1252 C

Softening Point: 820 C

Annealing Point: 560 C

Dielectric Constant: 4.6 @ 1MHz

Loss Tangent: 0.4% @ 1MHz

Index of refraction: 1.474

Light Transmission: 90% at 300nm to 2700nm

Corning 7070 Glass Substrates

Diameter and Shape: 76.2mm ± 0.5mm, 100mm ± 0.5mm, 150mm± 0.5mm

Material Type: Lithia Potash Borosilicate Glass

Primary Flat Length: SEMI Specification

Secondary Flat Length: SEMI Specification

Secondary Flat Orientation and Location: SEMI Specification

Center Thickness: 1000um +/- 25um, 500um +/- 25um standard

Total Thickness Variation (5 point measurement): <20um

Surface Polishing and Properties: Single Side or Double Side Polished

Density: 2.13 g/cm³

Youngs Modulus: 5.2e3 Kg/mm²

Poisson's ratio: 0.22

Coefficient Thermal Expansion: 3.2 e-6 1/C

Working Point: 1068 C

Annealing Point: 496 C

Dielectric Constant: 4.1 @ 1MHz

Loss Tangent: 0.06% @ 1MHz

Index of refraction: 1.47

A basic listing of the properties of silicon is given below. The reader should further review the VSI Technology Library (www.virginiasemi.com) for extensive details regarding silicon parameters, specifications, and characteristics.

CZ and FZ Silicon Substrates

The basic specifications for VSI CZ and FZ silicon wafers are given below.

Diameter and Shape: 25.4mm ± 0.3mm, 50.8mm ± 0.3mm, 76.2mm ± 0.3mm, 100mm ± 0.3mm, 150mm± 0.3mm

Material Type: Single Crystal CZ and FZ silicon

Primary Flat Length: SEMI Specification

Secondary Flat Length: SEMI Specification

Secondary Flat Orientation and Location: SEMI Specification

Center Thickness: SEMI Specification, or any thickness greater, or as thin as 10um

Total Thickness Variation (5 point measurement): SEMI Specification, or <1um

Surface Polishing and Properties: Single Side or Double Side Polished

Density: 2.33 g/cm³

Coefficient Thermal Expansion: 2.6e-6 1/C

Thermal conductivity: 1.5 W/cm-C

Melting Point: 1415 C

Annealing Point: 1250 C

Dielectric Constant: 11.9

Resistivity: .0006 to 5000 Ohm cm (engineered)

Light Transmission: Opaque in the visible

C. Summary

The basic properties of glass and silicon commonly used in the semiconductor industry have been presented.

D. References

[1] As of December 2003 see www.corning.com/lightingmaterials/images/wafersheet.pdf

[2] R. Hull [*Properties of Crystalline Silicon* (INSPEC, London, 1999), EMIS Data Review Series, No. 20]