U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NBS Technical Note 1212

A Computerized Fracture Mechanics Database for Oxide Glasses

S.W. Freiman, T.L. Baker, and J.B. Wachtman, Jr.

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[1] Headquarters and Laboratories at Gaithersburg, MD, unless otherwise noted; mailing address Gaithersburg, MD 20899.
[2] Some divisions within the center are located at Boulder, CO 80303.
[3] Located at Boulder, CO, with some elements at Gaithersburg, MD.

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Issued June 1985

U.S. Department of Commerce
Malcolm Baldrige, Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards
Technical Note 1212
Natl. Bur. Stand. (U.S.)
Tech. Note 1212,
91 pages (June 1985)
CODEN: NBTNAE

U.S. Government Printing Office
Washington: 1985

For sale by the Superintendent
of Documents,
U.S. Government Printing Office,
Washington, DC 20402

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Values of critical fracture toughness (K_{IC}), fracture energy (γ), subcritical crack growth exponents (n) and Young's modulus (E), are compiled and tabulated for a wide variety of oxide glasses. A computerized data retrieval system has been formulated to allow for selection of data by either glass composition, investigator, or experimental technique, and year. Plotting routines allow K_{IC} or γ to be plotted versus either the mole % of a particular component or the Young's modulus of the glass. A few illustrations are given to demonstrate trends in K_{IC} and γ as a function of composition and elastic modulus.

Key words: crack growth exponents; elastic modulus; fracture database; fracture mechanics; fracture toughness; oxide glasses.

1. Introduction

The strength of glass and other brittle materials has long been known to depend on the size and character of flaws. The strength of a particular specimen of glass depends on both the severity of the most serious flaw (an extrinsic property of the glass) and the resistance of the glass to flaw propagation (thought to be an intrinsic property of the glass). The theory of linear elastic fracture mechanics predicts that for a simple crack of length C the strength S will be given by

$$S = K_{IC}/(YC^{1/2}) \tag{1}$$

where Y is a numerical constant that depends on flaw location and geometry and K_{IC} is the critical stress intensity factor, usually taken to be an intrinsic property of the material.

An entire theory and methodology of design has been developed for brittle materials based on linear elastic fracture mechanics. It is recognized that K_{IC}, will change with glass composition. However, all of the aspects of composition which affect the critical stress intensity factor are not sufficiently well understood to achieve the goal of being able to predict those glasses which have optimum fracture toughness as well as possess the other properties required by the application. Accordingly, there is both scientific and technological interest in examining the whole body of fracture mechanics data for glasses to see how well critical stress intensity values can be understood in terms of the character of the glasses.

The foregoing discussion relates to cases in which no environmentally enhanced slow crack propagation occurs prior to sudden failure, i.e. in inert environments, or to rapid-fracture measurements in which any slow crack propagation has a minimal effect on the strength. The phenomenon of moisture-assisted slow crack growth occurs to some extent in every oxide glass of which we are aware, and so must be accounted for in structural design. The rate of crack propagation is a strong function of the stress intensity factor, K_I, at the flaw. The external factors of crack size and shape can be taken into account through eq (1). An equation widely used to fit crack growth data over large ranges of crack propagation rates is:

$$V = A\,K_I^n \tag{2}$$

where V is the crack velocity and A and n are empirical constants that depend on glass composition as well as the external environment. A methodology for safe-life design with materials that undergo slow crack propaga-

tion has been developed based on eqs (1) and (2). Again it is recognized that the constants A and n may vary if the composition varies within a family of glasses. As before, it is hoped that the factors affecting the above constants can be sufficiently understood, specified, and controlled to permit reliable engineering use.

The time is ripe for the development of a comprehensive compilation of the available fracture mechanics data on glasses. On one level, it is appropriate to inquire if the accumulated data are sufficiently consistent to form a useful guide in the choice of glass compositions for load-bearing applications. On another level, one can ask if the existing data show trends, such as dependence on composition, useful in developing new glasses or in further understanding fracture behavior. In addition, such a compilation is the first step in evaluating the quality of this data. The present paper describes a computerized fracture mechanics data base and associated computer programs which permit extension and modification of the data base as well as selection, plotting and curve fitting. Some preliminary results of correlations of fracture energy, γ, and critical stress intensity factor K_{IC} with composition and elastic modulus are presented.

2. Design of the Fracture Mechanics Data Base

The form of the fracture mechanics data base was designed with several ideas in mind. The following information was included:

1. Primary parameters such as K_{IC}, n, etc., required for engineering design for glass structure.
2. Secondary parameters, e.g. elastic modulus.
3. Test methods and environmental factors.
4. Manufacturers and engineering designations for commercial glasses.
5. References.

The design is intended to be as open-ended as possible and the data base should be capable of expansion in the number of records it contains.[1] The data base should be computer searchable in detail; i.e., for each record, each type of information is formatted to be available for analysis without further personal judgment being required. The data base is in a form generally accessible for computer research by other users; i.e., it is in a format and language generally available and likely to remain in use.

For this data base, fracture energy and the related quantity, critical fracture toughness, were chosen as the primary variables. The slow crack-propagation constant, n, and Young's modulus, E, were also compiled when available. A survey of published literature as well as private sources, i.e., government reports and corporate data, suggested that about 300 measurements are available on reasonably well-characterized glasses. For each measurement, the number of associated items making up a record can be as large as 25. An expansion of a factor of 2 in the number of records in the next few years seems possible, and was taken as a data base design goal. The resulting size, though substantial in terms of data bases to be manually developed and analyzed, is not very large by computer standards. Flexibility rather than efficiency in use of computer memory or speed was therefore taken as the primary goal.

3. Design of the Computer Programs and Files

In anticipation of possible future use by a variety of persons with minimal programming knowledge, all programs were written in menu-driven style and in a simple language (Basic). In anticipation of possible use in small organizations which might lack large center computers, the programs and files were subdivided into units which can be run on the current generation of stand-alone laboratory microcomputers. That is, the computer only needs Basic, a minimum of 128 kilobytes of memory, and floppy disk storage of at least 160 kilobytes per diskette. To keep within these limits, the file-creating program was kept separate from the file-analysis program.

The file creating program has been designed to ask the keyboard operation for the following information for each record:

1. The record number
2. The first previous record number for the same glass
3. A generic description of the glass (e.g., aluminosilicate)
4. A specific description of the glass (e.g., a commercial specification)

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[1]The term record is taken to mean the complete set of information associated with each independent measurement of a fracture mechanics parameter.

5. Manufacturers name when appropriate
6. Indication of whether composition will be input in mole percent (M) or weight percent (W).[2]
7. The percentage of each of the following in mole or weight percent:
   a. Al_2O_3
   b. B_2O_3
   c. CaO
   d. MgO
   e. Na_2O
   f. K_2O
   g. PbO_2
   h. SiO_2
8. The percentage of any two other oxides specified by the user
9. Young's modulus in units of MPa
10. The fracture mechanics data itself:
    a. the test method (see table 1 for abbreviations used for the test methods).
    b. the critical stress intensity in units of MPa $m^{1/2}$. [3]
    c. the fracture energy in units of J/m^2. [3]
11. Same as 10 but for a second measurement method when appropriate.
12. The crack growth exponent, n.
13. The test environment.[4]
14. The reference.
15. Comments.

Table 1. *Abbreviations used in the computerized data base for the test methods used.*

Abbreviation	*Test method*
NB	Notched Beam
DCB	Double Cantilever Beam
AMDCB	Applied Moment Double Cantilever Beam
DT	Double Torsion
Ind. Crk. Len.	Indentation Crack Length
Controlled Flaw	Controlled Flaw
Static Fat.	Static Fatigue
Dynamic Fat.	Dynamic Fatigue
Short bar	Short Bar

Table 2. *List of environments used by various authors*

air
air, x % RH (i.e. air with x % relative humidity)
H_2O
D.I. H_2O (i.e. deionized water)
N_2 (l) at −196°C (i.e. liquid nitrogen at −196°C)
Heptane
N_2 (l) (i.e. liquid nitrogen)
N_2 (g) (i.e. nitrogen gas)
Vacuum
Toluene
Mineral oil
1 M Cs in D.I. H_2O (i.e. 1 Molar Cs in deionized water)
1 M Li in D.I. H_2O (i.e. 1 Molar Li in deionized water)
6 N NaOH (i.e. 6 Normal NaOH)
6 N HCl (i.e. 6 Normal HCl)

[2]When the input is in weight percent, a subroutine in the program enables the user to convert these values to mole percent, and a C is placed in Item 6 to indicate the calculation has been done.

[3]When either b or c alone is given and a value for Young's modulus is present, the program calculates the other from the identity ($K_{IC} = 2E\gamma)^{1/2}$ where E is Young's modulus.

[4]Both the relative humidity of air, the chemical activity of water in solutions and the pH value in solutions are known to affect the slow crack propagation parameters and may affect other fracture mechanics parameters unless the test is conducted very rapidly. The various environments that have been used are listed in table 2.

To reduce effort in keyboarding, the program allows duplication of earlier data (such as the reference) by a single keystroke when appropriate. Each record is written to permanent storage on a diskette before entry of the next record.

The file-analysis program as currently written provides for a search of the file for any combination of the following keys:

1. Generic material
2. Specific material designation
3. Presence of a first specified oxide
4. Presence of a second specified oxide
5. Presence of a third specified oxide
6. Test techniques
7. Principal author
8. Year

Following the search and selection of the appropriate data, this program provides the option of plotting with the critical stress intensity factor, the fracture energy, or the crack velocity parameter as the independent variable. Any of these parameters may be plotted as a function of Young's modulus, or the mole percentage of one of the specified oxides. Provision for fitting and plotting a straight line or a quadratic least squares fit to the data is also provided. Also, Young's modulus may be plotted as a function of composition.

4. Results

The current data base consists of 291 separate records, some of which contain measurements of γ or K_{IC} obtained by more than one technique. In some instances, a record will contain a value of the crack growth exponent, n, instead of γ or K_{IC}. The entire list of records is given in table 3. Because table 3 is not ordered with respect to composition, author etc., finding a specific set of data could be difficult. Therefore, we have constructed additional tables 4–7 which contain the four major compositional categories of these glasses, i.e. silicate (SiO_2), borate (B_2O_3), phosphate (P_2O_3), and germanate (GeO_2). Within each table the data is listed in order of decreasing amounts of the primary constituent of the glass. At the end of each different glass composition is the reference indicating the source of the data. Each reference, which is included in its entirety in table 3, has been abbreviated and is broken down in the following manner: "WIE74/1" refers to a paper which has Wiederhorn as the primary author and is the first of two papers written by him in 1974. If there is only one paper by a particular author in one year, no /# will be suffixed to the reference.

Table 3. *Fracture mechanics parameters for oxide glasses*

ASH82

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 50 % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 50
Other Formula = Other % =
Young's Modulus = 5.85 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .7 Gamma = 4.19
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = SrO Other % = 50
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 5.0 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .61 Gamma = 3.72
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 50
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.32 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .49 Gamma = 2.78
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO = 50
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 50
Other Formula = Other % =
Young's Modulus = 5.4 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .95 Gamma = 8.36
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No., 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 50
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.24 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .6 Gamma = 4.25
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 50 % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 50
Other Formula = Other % =
Young's Modulus = 3.45 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .35 Gamma = 1.78
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = Li_2O Other % = 50
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.9 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .57 Gamma = 3.32
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = ASHIZUKA,M.,BRADT,R., JACTAW, Vol. 65, No. 5, 1982
Comments =

BRU77

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DT K_{IC} = .77 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = Toluene
Reference = BRUCE,J.,KOEPKE,B., JACTAW, Vol. 60, No. 5-6, 1977
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DT K_{IC} = .77 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = Mineral oil
Reference = BRUCE,J.,KOEPKE,B., JACTAW, Vol. 60, No. 5-6, 1977
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DT K_{IC} = .76 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = BRUCE,J.,KOEPKE,B., JACTAW, Vol. 60, No. 5-6, 1977
Comments =

CHA58

Specific Material = 0080
Manufacturer = Corning Glass
% Al_2O_3 = 1.76 % B_2O_3 = % CaO = 5.35 % MgO = 4.46
% Na_2O = 16.4 % K_2O = % PbO = % SiO_2 = 71.9
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 16
Environment = air, 50% RH
Reference = CHARLES,R.J., Jour. of Appl. Phys., 29, 1657-62, 1958
Comments = Surface condition-abraded

EAG78

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 40 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 $E4$
1st Technique = NB K_{IC} = .62 Gamma = 3.15
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 8 % B_2O_3 = % CaO = % MgO =
% Na_2O = 32 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.9 *E*4
1st Technique = NB K_{IC} = .64 Gamma = 2.97
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 16.2 % B_2O_3 = % CaO = % MgO =
% Na_2O = 23.8 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.25 *E*4
1st Technique = NB K_{IC} = .62 Gamma = 2.61
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 20 % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.3 *E*4
1st Technique = NB K_{IC} = .67 Gamma = 3.10
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 22.8 % B_2O_3 = % CaO = % MgO =
% Na_2O = 17.2 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.8 *E*4
1st Technique = NB K_{IC} = .70 Gamma = 3.10
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 80
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.1 $E4$
1st Technique = NB K_{IC} = .58 Gamma = 2.76
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 5 % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.4 $E4$
1st Technique = NB K_{IC} = .63 Gamma = 3.10
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 10 % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 70
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.9 $E4$
1st Technique = NB K_{IC} = .67 Gamma = 3.25
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 20 % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.25 $E4$
1st Technique = NB K_{IC} = .67 Gamma = 3.10
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 24 % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 56
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.75 *E*4
1st Technique = NB K_{IC} = .67 Gamma = 2.85
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 32 % B_2O_3 = % CaO = 8 % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.3 *E*4
1st Technique = NB K_{IC} = .6 Gamma = 1.94
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 13.3 % B_2O_3 = % CaO = 26.7 % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.2 *E*4
1st Technique = NB K_{IC} = .65 Gamma = 2.26
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 20 % B_2O_3 = % CaO = 20 % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.35 *E*4
1st Technique = NB K_{IC} = .66 Gamma = 2.29
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 22.8 % B_2O_3 = % CaO = 17.2 % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.8 *E*4
1st Technique = NB K_{IC} = .66 Gamma = 2.19
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 40 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.1 *E*4
1st Technique = NB K_{IC} = .63 Gamma = 3.20
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 8 % CaO = % MgO =
% Na_2O = 32 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.5 *E*4
1st Technique = NB K_{IC} = .75 Gamma = 4.33
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 16.2 % CaO = % MgO =
% Na_2O = 23.8 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.4 *E*4
1st Technique = NB K_{IC} = .94 Gamma = 5.26
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 20 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.2 *E*4
1st Technique = NB K_{IC} = .88 Gamma = 4.72
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 22.8 % CaO = % MgO =
% Na_2O = 17.2 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.6 *E*4
1st Technique = NB K_{IC} = .92 Gamma = 4.89
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = EAGAN,R.,SWEARENGEN,J.,JACTAW, Vol 61, No 1-2, 27-30, 1978
Comments =

FRE83

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 67
Other Formula = Li_2O Other % = 33
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 11
Environment = H_2O
Reference = FREIMAN,S.W., Private Communications, 1983
Comments =

Specific Material = Low Iron Float
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19.3
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments =

Specific Material = Low Iron Float
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 15.2
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments =

Specific Material = 7809
Manufacturer = Corning Glass
% Al_2O_3 = 5.72 % B_2O_3 = 7.45 % CaO = 2.31 % MgO = 9.41
% Na_2O = 9.41 % K_2O = 3.44 % PbO = % SiO_2 = 71.2
Other Formula = TiO_2 Other % = .405
Other Formula = Fe_2O_3 Other % = < .1W%
% Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 25.3
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments =

Specific Material = 7809
Manufacturer = Corning Glass
% Al_2O_3 = 5.72 % B_2O_3 = 7.45 % CaO = 2.31 % MgO = 9.41
% Na_2O = 9.41 % K_2O = 3.44 % PbO = % SiO_2 = 71.2
Other Formula = TiO_2 Other % = .405
Other Formula = Fe_2O_3 Other % = < .1W%
Young's Modulus =
1st Technique = Dynamic Fat K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 31.4
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments =

Specific Material = 0317
Manufacturer = Corning Glass
% Al_2O_3 = 18.8 % B_2O_3 = 8.08 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 73.0
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 25.1
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments = % composition - 9.5% modifiers

Specific Material = 0317
Manufacturer = Corning Glass
% Al_2O_3 = 18.8 % B_2O_3 = 8.08 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 73.0
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 32.6
Environment = H_2O
Reference = FREIMAN, S.W., et al, Submitted to JACTAW, 1983
Comments = % composition - 9.5% modifier

FRE84

Specific Material = 8244
Manufacturer = NBS
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 74.6
Other Formula = La_2O_3 Other % = 25
Young's Modulus = 6.05 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .58 Gamma = 2.78
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = 3rd Other Oxide- 0.5% Nd_2O_3, & Young's Modulus is estimated

Specific Material = 8245
Manufacturer = NBS
% Al_2O_3 = 25 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 74.6
Other Formula = Nd_2O_3 Other % = 0.5
Young's Modulus = 8.7 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .58 Gamma = 1.93
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Young's Modulus is estimated

Specific Material = 9023
Manufacturer = GTE
% Al_2O_3 = 25 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 74.6
Other Formula = Nd_2O_3 Other % = 0.4
Young's Modulus = 8.7 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .72 Gamma = 2.98
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Young's Modulus is estimated

Specific Material = UP63-6771
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO = 20
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 70
Other Formula = Other % =
Young's Modulus = 4.67 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .33 Gamma = 1.17
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- + 10% (La_2O_3 + Nd_2O_3)

Specific Material = UP37-6830
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO = 12
% Na_2O = % K_2O = 12 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 65
Other Formula = Other % =
Young's Modulus = 5.39 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .35 Gamma = 1.14
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- + 12% (La_2O_3 + Nd_2O_3)

Specific Material = UP16-6766
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 25 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 62
Other Formula = Other % =
Young's Modulus = 4.42 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .33 Gamma = 1.23
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- + 13% (La_2O_3 + Nd_2O_3)

Specific Material = MJ-4-5288
Manufacturer =
% Al_2O_3 = 15 % B_2O_3 = % CaO = % MgO = 15
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 69
Other Formula = Other % =
Young's Modulus = 6.72 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .55 Gamma = 2.25
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- + 2% (La_2O_3 + Nd_2O_3)

Specific Material = UP86-6961
Manufacturer =
% Al_2O_3 = 9.4 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 9.4 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 75.3
Other Formula = La_2O_3 Other % = 1.6
Young's Modulus = 6.37 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .37 Gamma = 1.08
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.3% Nd_2O_3

Specific Material = UP77-6945
Manufacturer =
% Al_2O_3 = 16.5 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 12.5 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 65.1
Other Formula = La_2O_3 Other % = 1.7
Young's Modulus = 6.55 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .45 Gamma = 1.55
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.2% Nd_2O_3

Specific Material = UP69-6897
Manufacturer =
% Al_2O_3 = 11.8 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 23.6 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 59
Other Formula = La_2O_3 Other % = 1.5
Young's Modulus = 5.37 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .33 Gamma = 1.01
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.1% Nd_2O_3

Specific Material = UP70-6937
Manufacturer =
% Al_2O_3 = 15.9 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 15.9 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 62.7
Other Formula = La_2O_3 Other % = 1.4
Young's Modulus = 6.21 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .41 Gamma = 1.35
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.1% Nd_2O_3

Specific Material = UP68-6893
Manufacturer =
% Al_2O_3 = 9.4 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 28.3 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 56.7
Other Formula = La_2O_3 Other % = 1.5
Young's Modulus = 4.94 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .31 Gamma = .97
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.0% Nd_2O_3

Specific Material = UP84-6957
Manufacturer =
% Al_2O_3 = 9.4 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 18.8 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 65.9
Other Formula = La_2O_3 Other % = 1.7
Young's Modulus = 5.38 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .37 Gamma = 1.27
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.2% Nd_2O_3

Specific Material = UP85-6959
Manufacturer =
% Al_2O_3 = 9.4 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 14.1 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 70.6
Other Formula = La_2O_3 Other % = 1.6
Young's Modulus = 5.68 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .38 Gamma = 1.27
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.2% Nd_2O_3

Specific Material = UP83-6955
Manufacturer =
% Al_2O_3 = 18.8 % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 9.4 % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 65.9
Other Formula = La_2O_3 Other % = 1.7
Young's Modulus = 6.48 *E*4
1st Technique = Ind. Crk. Len. K_{IC} = .55 Gamma = 2.33
2nd Technique = K_{IC} = Gamma =
n =
Environment = Heptane
Reference = FREIMAN,S.W., Private Communications, 1984
Comments = Compo.- 3rd Other Oxide- 4.2% Nd_2O_3

GUP83

Specific Material = E-Glass
Manufacturer =
% Al_2O_3 = 13.8 % B_2O_3 = 8.07 % CaO = 17.4 % MgO = 6.66
% Na_2O = 5.44 % K_2O = % PbO = % SiO_2 = 53.8
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 24.8
Environment = air
Reference = GUPTA, P., Frac. Mech. of Ceram., Vol. 5, 291-303, 1983
Comments = Material is an E-Glass Fiber

KEN74

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 33 % K_2O = % PbO = % SiO_2 = 67
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.9 $E4$
1st Technique = DCB K_{IC} = 1.12 Gamma = 7.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 29 % K_2O = % PbO = % SiO_2 = 71
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.93 $E4$
1st Technique = DCB K_{IC} = 1.04 Gamma = 6.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.1 $E4$
1st Technique = DCB K_{IC} = 1.04 Gamma = 5.95
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 80
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.25 $E4$
1st Technique = DCB K_{IC} = .98 Gamma = 5.2
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 17 % K_2O = % PbO = % SiO_2 = 83
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 9.35 $E4$
1st Technique = DCB K_{IC} = .96 Gamma = 4.95
2nd Technique = K_{IC} = Gamma
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 10.1 $E4$
1st Technique = DCB K_{IC} = .87 Gamma = 3.7
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l)
Reference = KENNEDY,C.,BRADT,R.,Frac. Mech. of Cer.,883-93,Vol. 2,1974
Comments =

MEC74

Specific Material = 7940
Manufacturer = Corning Glass
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.21 $E4$
1st Technique = AMDCB K_{IC} = .73 Gamma = 3.7
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,RICE,R., JACTAW, Vol. 57, No. 10, 1974
Comments =

Specific Material = 1723
Manufacturer = Corning Glass
% Al_2O_3 = 9.43 % B_2O_3 = 4.60 % CaO = 11.4 % MgO = 11.1
% Na_2O = % K_2O = % PbO = % SiO_2 = 60.8
Other Formula = BaO Other % = 2.51
Other Formula = Other % =
Young's Modulus = 8.91 *E*4
1st Technique = AMDCB K_{IC} = .81 Gamma = 3.7
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,RICE,R., JACTAW, Vol. 57, No. 10, 1974
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 3.36 % B_2O_3 = 11.3 % CaO = % MgO =
% Na_2O = 3.26 % K_2O = % PbO = % SiO_2 = 82.0
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.37 *E*4
1st Technique = AMDCB K_{IC} = .71 Gamma = 4.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,RICE,R., JACTAW, Vol. 57, No. 10, 1974
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = .581 % B_2O_3 = % CaO = 5.28 % MgO = 5.88
% Na_2O = 16.2 % K_2O = % PbO = % SiO_2 = 71.9
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.34 *E*4
1st Technique = AMDCB K_{IC} = .72 Gamma = 3.5
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,RICE,R., JACTAW, Vol. 57, No. 10, 1974
Comments =

MEC77
Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 67
Other Formula = Li_2O Other % = 33
Other Formula = Other % =
Young's Modulus = 5.2 *E*4
1st Technique = DCB K_{IC} = .7 Gamma = 5.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,FREIMAN,Proc. of Int. Glass Cong.,479-83,1977
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 62.5
Other Formula = BaO Other % = 37.5
Other Formula = Other % =
Young's Modulus = 6.4 *E*4
1st Technique = DCB K_{IC} = .5 Gamma = 2.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MECHOLSKY,J.,FREIMAN,Proc. of Int. Glass Cong.,479-83,1977
Comments =

MET72

Specific Material = ENK5
Manufacturer = Owens-Corning
% Al_2O_3 = 8.55 % B_2O_3 = 8.17 % CaO = 17.6 % MgO = 6.74
% Na_2O = 2.14 % K_2O = 2.21 % PbO = % SiO_2 = 54.4
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 11
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = EF5
Manufacturer = Owens-Corning
% Al_2O_3 = 8.94 % B_2O_3 = 8.54 % CaO = 18.4 % MgO = 7.04
% Na_2O = % K_2O = % PbO = % SiO_2 = 56.9
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = EBN0
Manufacturer = Owens-Corning
% Al_2O_3 = 9.83 % B_2O_3 = % CaO = 21.3 % MgO = 7.37
% Na_2O = % K_2O = % PbO = % SiO_2 = 61.4
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 30
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol.13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = ES
Manufacturer = Owens-Corning
% Al_2O_3 = 8.89 % B_2O_3 = 8.53 % CaO = 18.3 % MgO = 6.97
% Na_2O = .504 % K_2O = % PbO = % SiO_2 = 56.7
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 22
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = EN0
Manufacturer = Owens-Corning
% Al_2O_3 = 8.88 % B_2O_3 = 8.52 % CaO = 18.3 % MgO = 6.97
% Na_2O = % K_2O = % PbO = % SiO_2 = 57.2
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 22
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = EN5
Manufacturer = Owens-Corning
% Al_2O_3 = 8.45 % B_2O_3 = 8.07 % CaO = 17.4 % MgO = 6.66
% Na_2O = 5.44 % K_2O = % PbO = % SiO_2 = 53.8
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 20
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

Specific Material = EK5
Manufacturer = Owens-Corning
% Al_2O_3 = 8.61 % B_2O_3 = 8.23 % CaO = 17.8 % MgO = 6.79
% Na_2O = % K_2O = 3.64 % PbO = % SiO_2 = 54.8
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 17
Environment = H_2O
Reference = METCALFE,A.G.,SCHMITZ,G.K.,Glass Tech.,5-16,Vol. 13,No. 1,1972
Comments = Material is an E-Glass Fiber

MIY80

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 100 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = .89 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 98.4 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 1.5 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len K_{IC} = .87 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 96.8 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 3.13 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = .8 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 95.8 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 4.16 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = .77 Gamma =
2nd Technique = NB K_{IC} = .82 Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 94.3 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 5.62 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = .78 Gamma =
2nd Technique = NB K_{IC} = .84 Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 87.9 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 12.0 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = 1.63 Gamma =
2nd Technique = NB K_{IC} = 1.59 Gamma
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 85.9 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 14.0 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = 1.39 Gamma =
2nd Technique = NB K_{IC} = 1.38 Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 83.7 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 16.2 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = 1.29 Gamma =
2nd Technique = NB K_{IC} = 1.33 Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 80.7 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 19.2 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Ind. Crk. Len. K_{IC} = .95 Gamma =
2nd Technique = NB K_{IC} = .91 Gamma =
n =
Environment = air
Reference = MIYATA,N.,JINNO,H.,J. of Non-Cryst. Sol. 38 & 39,391-96,1980
Comments =

MIY81

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 100 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 1.73 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .96 Gamma = 26.64
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 98.4 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 1.50 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 1.87 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .96 Gamma = 24.64
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 96.8 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 3.13 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.02 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .88 Gamma = 19.17
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 95.8 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 4.16 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.1 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .87 Gamma = 18.02
2nd Technique = NB K_{IC} = .82 Gamma = 16.01
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 94.3 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 5.62 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.23 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = .88 Gamma = 17.36
2nd Technique = NB K_{IC} = .85 Gamma = 16.20
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 87.9 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 12 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.12 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = 1.75 Gamma = 49.08
2nd Technique = NB K_{IC} = 1.6 Gamma = 41.03
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 85.9 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 14.0 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.62 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = 1.52 Gamma = 31.91
2nd Technique = NB K_{IC} = 1.37 Gamma = 25.92
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 83.7 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 16.2 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.45 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = 1.4 Gamma = 22.02
2nd Technique = NB K_{IC} = 1.35 Gamma = 20.48
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 80.7 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 19.2 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.04 $E4$
1st Technique = Ind. Crk. Len. K_{IC} = 1.05 Gamma = 9.13
2nd Technique = NB K_{IC} = .93 Gamma = 7.16
n =
Environment = air
Reference = MIYATA,H.,JINNO,N.,Journ. of Mat. Sci. 16,2205-17,1981
Comments =

MIY83

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 5.36 % MgO =
% Na_2O = 14.5 % K_2O = % PbO = % SiO_2 = 80.0
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.19 $E4$
1st Technique = NB K_{IC} = .8 Gamma = 5.17
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,TANIGAWA,K.,Frac. Mech. of Cer.,Vol. 5,609-23,1983
Comments = Test Tech.- introduced a sharp crack at the notch

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 5.37 % MgO =
% Na_2O = 19.4 % K_2O = % PbO = % SiO_2 = 75.1
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.28 $E4$
1st Technique = NB K_{IC} = .8 Gamma = 5.10
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,TANIGAWA,K.,Frac. Mech. of Cer.,Vol. 5,609-23,1983
Comments = Test Tech.- introduced a sharp crack at the notch

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 5.37 % MgO =
% Na_2O = 24.3 % K_2O = % PbO = % SiO_2 = 70.2
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.37 *E*4
1st Technique = NB K_{IC} = .8 Gamma = 5.02
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,TANIGAWA,K.,Frac. Mech. of Cer., Vol. 5,609-23,1983
Comments = Test Tech.- introduced a sharp crack at the notch

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 5.38 % MgO =
% Na_2O = 29.2 % K_2O = % PbO = % SiO_2 = 65.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.42 *E*4
1st Technique = NB K_{IC} = .8 Gamma = 4.98
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = MIYATA,N.,TANIGAWA,K.,Frac. Mech. of Cer.,Vol. 5,609-23,1983
Comments = Test Tech.- introduced a sharp crack at the notch

MOU59

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Static Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 13
Environment = H_2O
Reference = MOULD,R.E.,SOUTHWICK,R.D.,JACTAW,42,542-47,582-92,1959
Comments = Surface condition- abraded

PRO67

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Static Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19.2
Environment = air, 50% RH
Reference = PROCTER,B.A.,Proc. Roy. Soc. Lond.,Ser. A,297,534-57,1967
Comments = Surface condition- as-drawn fiber

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 27
Environment = air, 50% RH
Reference = PROCTER,B.A.,Proc. Roy. Soc. Lond.,Ser. A,297,534-57,1967
Comments = Surface condition- as-drawn fiber

RIT69

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 13
Environment = air, 50% RH
Reference = RITTER,J.E.,Jr., Jour. of Appl. Phys., 40, 340-44, 1969
Comments = Surface condition- acid etch and abraded

RIT71

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 27.4
Environment = air, 100% RH
Reference = RITTER,J.E.,Jr.,SHERBOURNE,C.L.,JACTAW,54,601-05,1971
Comments = Surface condition- abraded

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 37.8
Environment = air, 100% RH
Reference = RITTER,J.E.,Jr.,SHERBOURNE,C.L.,JACTAW,54,601-05,1971
Comments = Surface condition- abrade

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Static Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 32
Environment = air, 50% RH
Reference = RITTER,J.E.,Jr.,SHERBOURNE,C.L.,JACTAW,54,601-05,1971
Comments = Surface condition- acid etch

RIT73

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 16
Environment = air, 100% RH
Reference = RITTER,J.E.,Jr.,MANTHURUTHIL,J.,Glass Tech.,14,60-64,1973
Comments = Surface condition- abraded

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 22
Environment = air, 100% RH
Reference = RITTER,J.E.,Jr.,MANTHURUTHIL,J.,Glass Tech.,14,60-64,1973
Comments = Surface condition- acid polished

RIT75

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19.5
Environment = 6N NaOH
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 13
Environment = H_2O
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 25.1
Environment = 6N HCl
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19.3
Environment = 6N NaOH
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 16.9
Environment = H_2O
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = R6
Manufacturer = Owens-Illinois
% Al_2O_3 = 1.78 % B_2O_3 = 1.74 % CaO = 5.42 % MgO = 6.03
% Na_2O = 14.7 % K_2O = .645 % PbO = % SiO_2 = 68.8
Other Formula = BaO Other % = .793
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 17.8
Environment = 6N HCl
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 22.6
Environment = 6N NaOH
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 35.1
Environment = H_2O
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 26.9
Environment = 6N HCl
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- abraded

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 21.1
Environment = 6N NaOH
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 39.8
Environment = H_2O
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 64.9
Environment = 6N HCl
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments = Surface condition- acid polished

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 34.1
Environment = H_2O
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 22.7
Environment = 6N NaOH
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 57
Environment = 6N HCl
Reference = RITTER,J.E.,Jr.,LAPORTE,R.P., JACTAW, 58, 265-67, 1975
Comments =

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Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 70 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.33 $E4$
1st Technique = Controlled Flaw K_{IC} = .32 Gamma = 1.16
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 70 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.33 $E4$
1st Technique = Controlled Flaw K_{IC} = .24 Gamma = .65
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 52.5 % SiO_2 =
Other Formula = ZnO Other % = 17.5
Other Formula = Other % =
Young's Modulus = 5.27 *E*4
1st Technique = Controlled Flaw K_{IC} = .44 Gamma = 1.82
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 35 % SiO_2 =
Other Formula = ZnO Other % = 35
Other Formula = Other % =
Young's Modulus = 6.1 *E*4
1st Technique = Controlled Flaw K_{IC} = .61 Gamma = 3.05
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 35 % SiO_2 =
Other Formula = ZnO Other % = 35
Other Formula = Other % =
Young's Modulus = 6.1 *E*4
1st Technique = Controlled Flaw K_{IC} = .38 Gamma = 1.17
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 60 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.55 *E*4
1st Technique = Controlled Flaw K_{IC} = .37 Gamma = 1.26
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 60 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.55 $E4$
1st Technique = Controlled Flaw K_{IC} = .36 Gamma = 1.17
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 52.5 % SiO_2 =
Other Formula = ZnO Other % = 17.5
Other Formula = Other % =
Young's Modulus = 5.27 $E4$
1st Technique = Controlled Flaw K_{IC} = .29 Gamma = .78
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 45 % SiO_2 =
Other Formula = ZnO Other % = 15
Other Formula = Other % =
Young's Modulus = 6.98 $E4$
1st Technique = Controlled Flaw K_{IC} = .48 Gamma = 1.66
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 45 % SiO_2 =
Other Formula = ZnO Other % = 15
Other Formula = Other % =
Young's Modulus = 6.98 $E4$
1st Technique = Controlled Flaw K_{IC} = .43 Gamma = 1.30
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = ZnO Other % = 30
Other Formula = Other % =
Young's Modulus = 7.47 *E*4
1st Technique = Controlled Flaw K_{IC} = .61 Gamma = 2.47
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = ZnO Other % = 30
Other Formula = Other % =
Young's Modulus = 7.47 *E*4
1st Technique = Controlled Flaw K_{IC} = .56 Gamma = 2.11
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 15 % SiO_2 =
Other Formula = ZnO Other % = 45
Other Formula = Other % =
Young's Modulus = 7.9 *E*4
1st Technique = Controlled Flaw K_{IC} = .75 Gamma = 3.57
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 15 % SiO_2 =
Other Formula = ZnO Other % = 45
Other Formula = Other % =
Young's Modulus = 7.9 *E*4
1st Technique = Controlled Flaw K_{IC} = .61 Gamma = 2.32
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 60
Other Formula = Other % =
Young's Modulus = 8.88 *E*4
1st Technique = Controlled Flaw K_{IC} = .89 Gamma = 4.45
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 60
Other Formula = Other % =
Young's Modulus = 8.88 *E*4
1st Technique = Controlled Flaw K_{IC} = .80 Gamma = 3.64
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 50 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.12 *E*4
1st Technique = Controlled Flaw K_{IC} = .51 Gamma = 2.13
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 50 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.12 *E*4
1st Technique = Controlled Flaw K_{IC} = .40 Gamma = 1.33
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 37.5 % SiO_2 =
Other Formula = ZnO Other % = 12.5
Other Formula = Other % =
Young's Modulus = 7.13 *E*4
1st Technique = Controlled Flaw K_{IC} = .63 Gamma = 2.74
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 37.5 % SiO_2 =
Other Formula = ZnO Other % = 12.5
Other Formula = Other % =
Young's Modulus = 7.13 *E*4
1st Technique = Controlled Flaw K_{IC} = .46 Gamma = 1.48
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 25 % SiO_2 =
Other Formula = ZnO Other % = 25
Other Formula = Other % =
Young's Modulus = 8.08 *E4*
1st Technique = Controlled Flaw K_{IC} = .77 Gamma = 3.70
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 25 % SiO_2 =
Other Formula = ZnO Other % = 25
Other Formula = Other % =
Young's Modulus = 8.08 *E*4
1st Technique = Controlled Flaw K_{IC} = .64 Gamma = 2.54
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 12.5 % SiO_2 =
Other Formula = ZnO Other % = 37.5
Other Formula = Other % =
Young's Modulus = 8.26 *E*4
1st Technique = Controlled Flaw K_{IC} = .89 Gamma = 4.80
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 12.5 % SiO_2 =
Other Formula = ZnO Other % = 37.5
Other Formula = Other % =
Young's Modulus = 8.26 *E*4
1st Technique = Controlled Flaw K_{IC} = .71 Gamma = 3.09
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 50
Other Formula = Other % =
Young's Modulus = 9.73 *E*4
1st Technique = Controlled Flaw K_{IC} = .88 Gamma = 3.98
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 50
Other Formula = Other % =
Young's Modulus = 9.73 *E*4
1st Technique = Controlled Flaw K_{IC} = .83 Gamma = 3.57
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 40 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.37 *E*4
1st Technique = Controlled Flaw K_{IC} = .80 Gamma = 4.99
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 40 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.37 *E*4
1st Technique = Controlled Flaw K_{IC} = .50 Gamma = 1.92
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = ZnO Other % = 10
Other Formula = Other % =
Young's Modulus = 8.35 *E*4
1st Technique = Controlled Flaw K_{IC} = .90 Gamma = 4.89
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = ZnO Other % = 10
Other Formula = Other % =
Young's Modulus = 8.35 *E*4
1st Technique = Controlled Flaw K_{IC} = .55 Gamma = 1.79
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 20 % SiO_2 =
Other Formula = ZnO Other % = 20
Other Formula = Other % =
Young's Modulus = 8.75 *E*4
1st Technique = Controlled Flaw K_{IC} = .96 Gamma = 5.26
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 20 % SiO_2 =
Other Formula = ZnO Other % = 20
Other Formula = Other % =
Young's Modulus = 8.75 *E*4
1st Technique = Controlled Flaw K_{IC} = .79 Gamma = 3.55
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 10 % SiO_2 =
Other Formula = ZnO Other % = 30
Other Formula = Other % =
Young's Modulus = 8.91 *E*4
1st Technique = Controlled Flaw K_{IC} = 1.0 Gamma = 5.61
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 10 % SiO_2 =
Other Formula = ZnO Other % = 30
Other Formula = Other % =
Young's Modulus = 8.91 *E*4
1st Technique = Controlled Flaw K_{IC} = .81 Gamma = 3.72
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.47 *E*4
1st Technique = Controlled Flaw K_{IC} = 1.36 Gamma = 16.91
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 30 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.47 *E*4
1st Technique = Controlled Flaw K_{IC} = .63 Gamma = 3.66
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 22.5 % SiO_2 =
Other Formula = ZnO Other % = 7.5
Other Formula = Other % =
Young's Modulus = 6.4 *E*4
1st Technique = Controlled Flaw K_{IC} = 1.23 Gamma = 11.82
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 22.5 % SiO_2 =
Other Formula = ZnO Other % = 7.5
Other Formula = Other % =
Young's Modulus = 6.4 *E*4
1st Technique = Controlled Flaw K_{IC} = .77 Gamma = 4.61
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 15 % SiO_2 =
Other Formula = ZnO Other % = 15
Other Formula = Other % =
Young's Modulus = 6.97 *E*4
1st Technique = Controlled Flaw K_{IC} = 1.24 Gamma = 11.03
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(l) at -196C
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 15 % SiO_2 =
Other Formula = ZnO Other % = 15
Other Formula = Other % =
Young's Modulus = 6.97 *E*4
1st Technique = Controlled Flaw K_{IC} = .85 Gamma = 5.20
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SHINKAI,N.,Thesis by author at Penn. State Univ., 1979
Comments =

SIM81

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 33 % K_2O = % PbO = % SiO_2 = 67
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 21
Environment = D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 33 % K_2O = % PbO = % SiO_2 = 67
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 21
Environment = 1M Cs in D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 33 % K_2O = % PbO = % SiO_2 = 67
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 30
Environment = 1 M Li in D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 33 % K_2O = % PbO = % SiO_2 = 67
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 93
Environment = air, 30% RH
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19
Environment = D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19
Environment = 1 M Cs in D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 27
Environment = 1 M Li in D.I. H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 27
Environment = air, 30% RH
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 1.75 % B_2O_3 = % CaO = 7.44 % MgO = 5.91
% Na_2O = 13.4 % K_2O = % PbO = % SiO_2 = 71.4
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 18.1
Environment = H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 23 % CaO = % MgO =
% Na_2O = 7 % K_2O = % PbO = % SiO_2 = 70
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 28.3
Environment = H_2O
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 23 % CaO = % MgO =
% Na_2O = 7 % K_2O = % PbO = % SiO_2 = 70
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 31.1
Environment = air, 50% RH
Reference = SIMMONS,C.J., FREIMAN,S.W., JACTAW, 64, 683-86, 1981
Comments

SME83

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 100
Other Formula = Other % =
Young's Modulus = 4.65 $E4$
1st Technique = NB K_{IC} = .61 Gamma = 3.8
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 2.5 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 97.5
Other Formula = Other % =
Young's Modulus = 5.258 $E4$
1st Technique = NB K_{IC} = .69 Gamma = 4.3
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 5 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 95
Other Formula = Other % =
Young's Modulus = 5.84 $E4$
1st Technique = NB K_{IC} = .83 Gamma = 5.6
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 7.5 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 92.5
Other Formula = Other % =
Young's Modulus = 6.196 $E4$
1st Technique = NB K_{IC} = .82 Gamma = 5.1
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 10 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 90
Other Formula = Other % =
Young's Modulus = 6.12 $E4$
1st Technique = NB K_{IC} = .93 Gamma = 6.6
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 9.9 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 90.1
Other Formula = Other % =
Young's Modulus = 6.903 $E4$
1st Technique = NB K_{IC} = .84 Gamma = 4.8
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 12.5 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 87.5
Other Formula = Other % =
Young's Modulus = 6.752 $E4$
1st Technique = NB K_{IC} = .87 Gamma = 5.2
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 14 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 86
Other Formula = Other % =
Young's Modulus = 7.275 *E*4
1st Technique = NB K_{IC} = .78 Gamma = 3.9
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 2.5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 97.5
Other Formula = Other % =
Young's Modulus = 5.238 *E*4
1st Technique = NB K_{IC} = .71 Gamma = 4.6
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 95
Other Formula = Other % =
Young's Modulus = 5.593 *E*4
1st Technique = NB K_{IC} = .86 Gamma = 6.2
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 7.5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 92.5
Other Formula = Other % =
Young's Modulus = 5.8 *E*4
1st Technique = NB K_{IC} = .79 Gamma = 5.1
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 10 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 90
Other Formula = Other % =
Young's Modulus = 6.031 *E*4
1st Technique = NB K_{IC} = .75 Gamma = 4.4
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 12.5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 87.5
Other Formula = Other % =
Young's Modulus = 6.13 *E*4
1st Technique = NB K_{IC} = .72 Gamma = 3.9
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 15 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 85
Other Formula = Other % =
Young's Modulus = 6.184 *E*4
1st Technique = NB K_{IC} = .67 Gamma = 3.4
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 16.5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 83.5
Other Formula = Other % =
Young's Modulus = 6.157 *E*4
1st Technique = NB K_{IC} = .62 Gamma = 2.9
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 17.5 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 82.5
Other Formula = Other % =
Young's Modulus = 6.054 *E*4
1st Technique = NB K_{IC} = .62 Gamma = 3.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = 20 % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 80
Other Formula = Other % =
Young's Modulus = 5.781 *E*4
1st Technique = NB K_{IC} = .65 Gamma = 3.4
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 5 % SiO_2 =
Other Formula = GeO_2 Other % = 95
Other Formula = Other % =
Young's Modulus = 4.866 *E*4
1st Technique = NB K_{IC} = .6 Gamma = 3.5
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 15 % SiO_2 =
Other Formula = GeO_2 Other % = 85
Other Formula = Other % =
Young's Modulus = 5.414 *E*4
1st Technique = NB K_{IC} = .6 Gamma = 3.5
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = SMETS,B.M.J., Private Communications, 1983
Comments = Precracked samples, crosshead speed 4.3 10-6 m/s, dew point 50C

SWE78

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 4.2 % CaO = % MgO =
% Na_2O = 20.8 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.8 *E*4
1st Technique = NB K_{IC} = .84 Gamma = 5.19
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SWEARENGEN,J.,Fracture Mechanics of Cer.,Vol 4,973-87,1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 10 % CaO = % MgO =
% Na_2O = 15 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.735 *E*4
1st Technique = NB K_{IC} = .88 Gamma = 5.01
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SWEARENGEN,J.,Fracture Mechanics of Cer.,Vol 4,973-87,1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 14.2 % CaO = % MgO =
% Na_2O = 10.8 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.02 *E*4
1st Technique = NB K_{IC} = .83 Gamma = 4.30
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SWEARENGEN,J.,Fracture Mechanics of Cer.,Vol 4,973-87,1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 18.8 % CaO = % MgO =
% Na_2O = 6.2 % K_2O = % PbO = % SiO_2 = 75
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.89 *E*4
1st Technique = NB K_{IC} = .83 Gamma = 5.0
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = SWEARENGEN,J.,Fracture Mechanics of Cer.,Vol 4,973-87,1978
Comments =

TAR78

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 29.2
Environment = air, 2% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber (EVA-single coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 21.8
Environment = air, 45% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber (EVA-single coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 16.2
Environment = air, 71% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber (EVA-single coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 15.3
Environment = air, 97% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber (EVA-single coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 29.9
Environment = air, 45% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978,
Comments = Surface cond.-plastic-clad fiber(silane and EVA-dual coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 16.8
Environment = air, 97% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface cond.-plastic-clad fiber(silane and EVA-dual coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 27.6
Environment = air, 45% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber (single coating)

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Dynamic Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 25.3
Environment = air, 97% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = Static Fat. K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 14.7
Environment = air, 97% RH
Reference = TARIYAL,B.K., KALISH,D., Frac. Mech. of Cer. 3,161-75,1978
Comments = Surface condition-plastic-clad fiber

VER80

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 100 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.7 $E4$
1st Technique = NB K_{IC} = 1.45 Gamma = 18.44
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 99 % CaO = % MgO =
% Na_2O = 1 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.6 $E4$
1st Technique = NB K_{IC} = 1.4 Gamma = 17.5
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 98 % CaO = % MgO =
% Na_2O = 2 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.9 $E4$
1st Technique = NB K_{IC} = 1.25 Gamma = 15.94
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 95 % CaO = % MgO =
% Na_2O = 5 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.8 $E4$
1st Technique = NB K_{IC} = 1.2 Gamma = 15
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 90 % CaO = % MgO =
% Na_2O = 10 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.2 $E4$
1st Technique = NB K_{IC} = 1.05 Gamma = 13.13
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 80 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.6 $E4$
1st Technique = NB K_{IC} = .95 Gamma = 12.54
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 66 % CaO = % MgO =
% Na_2O = 34 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.8 $E4$
1st Technique = NB K_{IC} = .65 Gamma = 7.55
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 90 % CaO = % MgO =
% Na_2O = 10 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.9 *E*4
1st Technique = DT K_{IC} = 1.0 Gamma = 12.82
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 80 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.3 *E*4
1st Technique = DT K_{IC} = .85 Gamma = 10.95
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 75 % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.0 *E*4
1st Technique = DT K_{IC} = .77 Gamma = 9.88
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 66 % CaO = % MgO =
% Na_2O = 34 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.6 *E*4
1st Technique = DT K_{IC} = .7 Gamma = 9.42
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 65 % CaO = % MgO =
% Na_2O = 35 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 2.2 $E4$
1st Technique = DT K_{IC} = .57 Gamma = 7.38
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 7.5 % K_2O = % PbO = % SiO_2 = 92.5
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.225 $E4$
1st Technique = NB K_{IC} = 1.1 Gamma = 9.72
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 12.5 % K_2O = % PbO = % SiO_2 = 87.5
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.2 $E4$
1st Technique = NB K_{IC} = 1.09 Gamma = 9.58
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 80
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.7 $E4$
1st Technique = NB K_{IC} = .87 Gamma = 6.64
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 = 70
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.8 $E4$
1st Technique = NB K_{IC} = .9 Gamma = 6.98
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 38 % K_2O = % PbO = % SiO_2 = 62
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 $E4$
1st Technique = NB K_{IC} = 1.03 Gamma = 8.84
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 45 % K_2O = % PbO = % SiO_2 = 55
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.775 $E4$
1st Technique = NB K_{IC} = .9 Gamma = 7.01
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 24 % SiO_2 = 76
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 13.8 $E4$
1st Technique = NB K_{IC} = 1.1 Gamma = 4.38
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 27 % SiO_2 = 73
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 12.8 $E4$
1st Technique = NB K_{IC} = 1.0 Gamma = 3.91
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 40 % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 11.7 $E4$
1st Technique = NB K_{IC} = .9 Gamma = 3.46
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 60 % SiO_2 = 40
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.7 $E4$
1st Technique = NB K_{IC} = .5 Gamma = 1.62
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 82 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 18 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 5.1 $E4$
1st Technique = NB K_{IC} = 1.15 Gamma = 12.97
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 72 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 28 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 4.4 $E4$
1st Technique = NB K_{IC} = .85 Gamma = 8.21
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 65.5 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 34.5 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.9 $E4$
1st Technique = NB K_{IC} = .65 Gamma = 5.42
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 50 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.15 $E4$
1st Technique = NB K_{IC} = .38 Gamma = 2.29
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = 60 % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 3.7 $E4$
1st Technique = NB K_{IC} = .58 Gamma = 4.55
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 50
Other Formula = Other % =
Young's Modulus = 4.0 $E4$
1st Technique = NB K_{IC} = .7 Gamma = 6.13
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 45 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 55
Other Formula = Other % =
Young's Modulus = 4.2 $E4$
1st Technique = NB K_{IC} = .78 Gamma = 7.24
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 60
Other Formula = Other % =
Young's Modulus = 4.25 $E4$
1st Technique = NB K_{IC} = .80 Gamma = 7.44
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 100
Other Formula = Other % =
Young's Modulus = 2.65 $E4$
1st Technique = NB K_{IC} = .67 Gamma = 8.47
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 4 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 96
Other Formula = Other % =
Young's Modulus = 4.2 $E4$
1st Technique = NB K_{IC} = 1.06 Gamma = 13.38
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 9 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 91
Other Formula = Other % =
Young's Modulus = 4.9 $E4$
1st Technique = NB K_{IC} = 1.27 Gamma = 16.46
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 10 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 90
Other Formula = Other % =
Young's Modulus = 5.2 $E4$
1st Technique = NB K_{IC} = 1.34 Gamma = 17.27
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 12 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 88
Other Formula = Other % =
Young's Modulus = 4.7 $E4$
1st Technique = NB K_{IC} = 1.2 Gamma = 15.32
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 37 % K_2O = % PbO = % SiO_2 =
Other Formula = GeO_2 Other % = 63
Other Formula = Other % =
Young's Modulus = 2.45 *E*4
1st Technique = NB K_{IC} = .58 Gamma = 6.87
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 80 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 =
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = .93 Gamma = 7.21
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 70 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 10
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = .84 Gamma = 5.88
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 60 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 20
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = .83 Gamma = 5.74
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 50 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 30
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = 1.0 Gamma = 8.33
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 40 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 40
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = 1.0 Gamma = 8.33
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 30 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 50
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = 1.1 Gamma = 10.08
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 20 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 60
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = 1.08 Gamma = 9.72
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = 10 % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 70
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = .91 Gamma = 6.90
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

Specific Material =
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 = 80
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.0 *E*4
1st Technique = NB K_{IC} = .86 Gamma = 6.16
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = VERNAZ,E., Journal of Non-Crystal. Solids 37, 359-65,1980
Comments = Young's Modulus is extrapolated

WIE69

Specific Material = 7944
Manufacturer = Corning Glass
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 99.9
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.21 *E*4
1st Technique = DCB K_{IC} = .79 Gamma = 4.37
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

Specific Material = 7900
Manufacturer = Corning Glass
% Al_2O_3 = .594 % B_2O_3 = 2.61 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 96.7
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.59 *E*4
1st Technique = DCB K_{IC} = .72 Gamma = 3.96
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

Specific Material = 1720
Manufacturer = Corning Glass
% Al_2O_3 = 12.0 % B_2O_3 = 3.54 % CaO = 6.59 % MgO = 18.3
% Na_2O = .994 % K_2O = % PbO = % SiO_2 = 58.4
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 8.91 *E*4
1st Technique = DCB K_{IC} = .91 Gamma = 4.66
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.37 *E*4
1st Technique = DCB K_{IC} = .77 Gamma = 4.63
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

Specific Material =
Manufacturer = Corning Glass
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 7.34 *E*4
1st Technique = DCB K_{IC} = .75 Gamma = 3.86
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

Specific Material = 0041
Manufacturer = Corning Glass
% Al_2O_3 = 2.97 % B_2O_3 = % CaO = % MgO =
% Na_2O = 12.2 % K_2O = 1.6 % PbO = 7.59 % SiO_2 = 75.6
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus = 6.53 *E*4
1st Technique = DCB K_{IC} = .68 Gamma = 3.52
2nd Technique = K_{IC} = Gamma =
n =
Environment = N_2(g)
Reference = WIEDERHORN,S., JACTAW, Vol. 52, No. 2, 99-105, 1969
Comments =

WIE70

Specific Material = 7944
Manufacturer = Corning Glass
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 99.9
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 40.8
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No. 10,543-48,1970
Comments =

Specific Material = 1720
Manufacturer = Corning Glass
% Al_2O_3 = 12.0 % B_2O_3 = 3.54 % CaO = 6.59 % MgO = 18.3
% Na_2O = .994 % K_2O = % PbO = % SiO_2 = 58.4
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 26.5
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No. 10,543-48,1970
Comments =

Specific Material =
Manufacturer = Corning Glass
% Al_2O_3 = 10.8 % B_2O_3 = % CaO = .462 % MgO = 5.79
% Na_2O = 13.0 % K_2O = 2.33 % PbO = % SiO_2 = 66.6
Other Formula = TiO_2 Other % = .649
Other Formula = As_2O_3 Other % = < .1W%
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 28.7
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No. 10,543-48,1970
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 12.4 % CaO = % MgO =
% Na_2O = 3.99 % K_2O = % PbO = % SiO_2 = 82.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 35.5
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No. 10,543-548,1970
Comments =

Specific Material = 0041
Manufacturer = Corning Glass
% Al_2O_3 = 2.97 % B_2O_3 = % CaO = % MgO =
% Na_2O = 12.2 % K_2O = 1.60 % PbO = 7.59 % SiO_2 = 75.6
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 25.2
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No. 10,543-548,1970
Comments =

Specific Material =
Manufacturer = Corning Glass
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 18.5
Environment = H_2O
Reference = WIEDERHORN,S.M.,BOLZ,L.,JACTAW,Vol. 53,No.10,543-548,1970
Comments =

WIE73

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 19.4
Environment = 6N NaOH
Reference = WIEDERHORN,S.M., JOHNSON,H., JACTAW, 56, 192-97, 1973
Comments =

Specific Material =
Manufacturer =
% Al_2O_3 = 1.16 % B_2O_3 = % CaO = 7.43 % MgO = 5.91
% Na_2O = 13.4 % K_2O = .632 % PbO = % SiO_2 = 71.3
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 32
Environment = 6N HCl
Reference = WIEDERHORN,S.M., JOHNSON,H., JACTAW, 56, 192-97, 1973
Comments =

WIE74

Specific Material = 7940
Manufacturer = Corning Glass
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 100
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .74 Gamma =
2nd Technique = NB K_{IC} = .75 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = 7900
Manufacturer = Corning Glass
% Al_2O_3 = .179 % B_2O_3 = 2.62 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 97.1
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .7 Gamma =
2nd Technique = NB K_{IC} = .71 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = 7913
Manufacturer = Corning Glass
% Al_2O_3 = .297 % B_2O_3 = 2.61 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 97.0
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .72 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = 1723
Manufacturer = Corning Glass
% Al_2O_3 = 9.43 % B_2O_3 = 4.60 % CaO = 11.4 % MgO = 11.1
% Na_2O = % K_2O = % PbO = % SiO_2 = 60.8
Other Formula = BaO Other % = 2.51
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .85 Gamma =
2nd Technique = NB K_{IC} = .84 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = 7740
Manufacturer = Corning Glass
% Al_2O_3 = 1.21 % B_2O_3 = 11.5 % CaO = % MgO =
% Na_2O = 3.98 % K_2O = % PbO = % SiO_2 = 83.2
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .76 Gamma =
2nd Technique = NB K_{IC} = .78 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = BK-7
Manufacturer = Schott
% Al_2O_3 = % B_2O_3 = 10.0 % CaO = .227 % MgO =
% Na_2O = 10.3 % K_2O = 4.74 % PbO = % SiO_2 = 73.3
Other Formula = BaO Other % = .833
Other Formula = CeO Other % = < .1W%
Young's Modulus =
1st Technique = DCB K_{IC} = .86 Gamma =
2nd Technique = NB K_{IC} = .84 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = UBK-7
Manufacturer = Schott
% Al_2O_3 = % B_2O_3 = 10.0 % CaO = .226 % MgO =
% Na_2O = 10.2 % K_2O = 4.71 % PbO = % SiO_2 = 73.9
Other Formula = BaO Other % = .828
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .89 Gamma =
2nd Technique = NB K_{IC} = .90 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40, 1974
Comments =

Specific Material = SF-1
Manufacturer = Schott
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 7.15 % K_2O = % PbO = 28.2 % SiO_2 = 64.5
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = .62 Gamma =
2nd Technique = NB K_{IC} = .64 Gamma =
n =
Environment = Vacuum
Reference = WIEDERHORN,S., Frac. Mech. of Cer., Vol. 2, 829-40,1974
Comments =

Specific Material = 7900
Manufacturer = Corning Glass
% Al_2O_3 = .179 % B_2O_3 = 2.62 % CaO = % MgO =
% Na_2O = % K_2O = % PbO = % SiO_2 = 97.1
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 50.5
Environment = air, 100% RH
Reference = WIEDERHORN,S.,EVANS,A.,Frac. Mech. of Cer. 2,829-41,1974
Comments =

Specific Material = 1723
Manufacturer = Corning Glass
% Al_2O_3 = 9.43 % B_2O_3 = 4.60 % CaO = 11.4 % MgO = 11.1
% Na_2O = % K_2O = % PbO = % SiO_2 = 60.8
Other Formula = BaO Other % = 2.51
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 46
Environment = air, 100% RH
Reference = WIEDERHORN,S.,EVANS,A.,Frac. Mech. of Cer. 2,829-41,1974
Comments =

Specific Material = SF-1
Manufacturer = Schott
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 7.15 % K_2O = % PbO = 28.2 % SiO_2 = 64.5
Other Formula = Other % =
Other Formula = Other % =
Young's Modulus =
1st Technique = DCB K_{IC} = Gamma =
2nd Technique = K_{IC} = Gamma =
n = 38
Environment = air, 100% RH
Reference = WIEDERHORN,S.,EVANS,A.,Frac. Mech. of Cer. 2,829-41,1974
Comments =

WIL83
Specific Material = NBP-3
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 20
Other Formula = P_2O_5 Other % = 50
Young's Modulus =
1st Technique = Short bar K_{IC} = .47 Gamma =
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments =

Specific Material = NBP-4
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 25 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 25
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.3 *E*4
1st Technique = Short bar K_{IC} = .52 Gamma = 3.14
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2929

Specific Material = NBP-5
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 20 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 30
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .50 Gamma = 2.80
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2930

Specific Material = NBP-6
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 15 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 35
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.5 *E*4
1st Technique = Short bar K_{IC} = .52 Gamma = 3.03
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2958

Specific Material = NBP-7
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 10 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 40
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.5 *E*4
1st Technique = Short bar K_{IC} = .51 Gamma = 2.89
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2975

Specific Material = NBP-10
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 16
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.3 *E*4
1st Technique = Short bar K_{IC} = .47 Gamma = 2.56
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = 3rd Other Oxide- 4% ZnO, Poisson's Ratio= .2890

Specific Material = NBP-11
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 12
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .47 Gamma = 2.48
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = 3rd Other Oxide- 8% ZnO, Poisson's Ratio= .2867

Specific Material = NBP-13
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 8
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .48 Gamma = 2.61
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = 3rd Other Oxide- 12% ZnO, Poisson's Ratio= .2839

Specific Material = NBP-14
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 4
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .47 Gamma = 2.48
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = 3rd Other Oxide- 16% ZnO, Poisson's Ratio= .2815

Specific Material = NZP-1
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 20
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .48 Gamma = 2.63
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2803

Specific Material = NBP-20
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 4 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 16
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.3 *E*4
1st Technique = Short bar K_{IC} = .52 Gamma = 3.18
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2886

Specific Material = NBP-21
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 8 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 12
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.4 *E*4
1st Technique = Short bar K_{IC} = .54 Gamma = 3.29
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2855

Specific Material = NBP-23
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 12 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 8
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.5 *E*4
1st Technique = Short bar K_{IC} = .52 Gamma = 3.04
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2829

Specific Material = NBP-24
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 16 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 4
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.6 *E*4
1st Technique = Short bar K_{IC} = .53 Gamma = 3.01
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2801

Specific Material = NCP-6
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 20 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = P_2O_5 Other % = 50
Other Formula = Other % =
Young's Modulus = 4.7 *E*4
1st Technique = Short bar K_{IC} = .46 Gamma = 2.23
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2757

Specific Material = NCP-9
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 16 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 4
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.6 *E*4
1st Technique = Short bar K_{IC} = .46 Gamma = 2.27
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2768

Specific Material = NCP-10
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 12 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 8
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.6 *E*4
1st Technique = Short bar K_{IC} = .45 Gamma = 2.18
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2768

Specific Material = NCP-12
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = 4 % MgO =
% Na_2O = 30 % K_2O = % PbO = % SiO_2 =
Other Formula = ZnO Other % = 16
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.5 *E*4
1st Technique = Short bar K_{IC} = .46 Gamma = 2.35
2nd Technique = K_{IC} =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio= .2788

Specific Material = NBP-1
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 40 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 10
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.0 *E*4
1st Technique = Short bar K_{IC} = .44 Gamma = 2.39
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio = .2909

Specific Material = NBP-2
Manufacturer =
% Al_2O_3 = % B_2O_3 = % CaO = % MgO =
% Na_2O = 35 % K_2O = % PbO = % SiO_2 =
Other Formula = BaO Other % = 15
Other Formula = P_2O_5 Other % = 50
Young's Modulus = 4.1 *E*4
1st Technique = Short bar K_{IC} = .46 Gamma = 2.60
2nd Technique = K_{IC} = Gamma =
n =
Environment = air
Reference = WILDER, J., Private Communications, 1983
Comments = Poisson's Ratio = .2916

Table 4. *Compositions of silicate base glasses*

SiO_2	Al_2O_3	B_2O_3	CaO	K_2O	MgO	Na_2O	PbO	Other	Ref.
100									MEC74
100									KEN74
100									WIE74/1
100									PRO67
100									TAR78
100									RIT71
99.9									WIE69
99.9									WIE70
97.1	.179	2.62							WIE74/2
97.1	.179	2.62							WIE74/1
97.0	.297	2.61							WIE74/1
96.7	.594	2.61							WIE69
92.5						7.5			VER80
87.5						12.5			VER80
83.2	1.21	11.5				3.98			WIE74/1
83						17			KEN74
82.3	1.21	12.4				3.99			WIE69
82.3	1.21	12.4				3.99			RIT75
82.3	1.21	12.4				3.99			RIT73
82.3	1.21	12.4				3.99			RIT71
82.3	1.21	12.4				3.99			WIE70
82.0	3.36	11.3				3.26			MEC74
80.0			5.36			14.5			MIY83
80						20			VER80
80						20			KEN74
80						20			EAG78
76							24		VER80
75.6	2.97			1.60		12.2	7.59		WIE69
75.6	2.97			1.60		12.2	7.59		WIE70
75.1			5.37			19.4			MIY83
75						25			KEN74
75		18.8				6.2			SWE78
75		14.2				10.8			SWE78
75		10				15			SWE78
75		4.2				20.8			SWE78
75						25			SIM81
75	5					20			EAG78
73.9		10.0	.226	4.71		10.2		.828	WIE74/1
73.3		10.0	.227	4.74		10.3		<1.0 W %	WIE74/1
73.0	18.8	8.08							FRE83/1
73							27		VER80
71.9	1.76		5.35		4.46	16.4			CHA58
71.9	.581		5.28		5.88	16.2			MEC74
71.4	1.75		7.44		5.91	13.4			SIM81
71.3	1.16		7.43	.632	5.91	13.4			WIE69
71.3	1.16		7.43	.632	5.91	13.4			BRU77
71.3	1.16		7.43	.632	5.91	13.4			MOU59
71.3	1.16		7.43	.632	5.91	13.4			RIT69
71.3	1.16		7.43	.632	5.91	13.4			WIE73
71.3	1.16		7.43	.632	5.91	13.4			WIE70
71.3	1.16		7.43	.632	5.91	13.4			FRE83/1
71.2	5.72	7.45	2.31	3.44		9.41		<1.0 W %	FRE83/1
71						29			KEN74
70.2			5.37			24.3			MIY83
70		23				7			SIM81
70		10				20			VER80
70						30			VER80
70	10					20			EAG78
68.8	1.78	1.74	5.42	.645	6.03	14.7		.793	RIT75
68.8	1.78	1.74	5.42	.645	6.03	14.7		.793	RIT71
67								33	MEC77
67						33			KEN74
67						33			SIM81
67								33	FRE83/2

Table 4. *Compositions of silicate base glasses*—Continued

SiO_2	Al_2O_3	B_2O_3	CaO	K_2O	MgO	Na_2O	PbO	Other	Ref.
66.6	10.8		.462	2.33	5.79	13.0		<1.0 W %	WIE70
65.3			5.38			29.2			MIY83
64.5						7.15	28.2		WIE74/1
64.5						7.15	28.2		WIE74/2
62.5								37.5	MEC77
62						38			VER80
61.4	9.83		21.3		7.37				MET72
60.8	9.43	4.60	11.4		11.1			2.51	MEC74
60.8	9.43	4.60	11.4		11.1			2.51	WIE74/1
60.8	9.43	4.60	11.4		11.1			2.51	WIE74/2
60		20				20			VER80
60							40		VER80
60		22.8				17.2			EAG78
60		20				20			EAG78
60		16.2				23.8			EAG78
60		8				32			EAG78
60						40			EAG78
60	22.8		17.2						EAG78
60	20		20						EAG78
60	13.3		26.7						EAG78
60	8		32						EAG78
60	20					20			EAG78
60	22.8					17.2			EAG78
60	20					20			EAG78
60	16.2					23.8			EAG78
60	8					32			EAG78
60						40			EAG78
58.4	12.0	3.54	6.59		18.3	.994			WIE69
58.4	12.0	3.54	6.59		18.3	.994			WIE70
57.2	8.88	8.52	18.3		6.97				MET72
56.9	8.94	8.54	18.4		7.04				MET72
56.7	8.89	8.53	18.3		6.97	.504			MET72
56	24					20			EAG78
55						45			VER80
54.8	8.61	8.23	17.8	3.64	6.79				MET72
54.4	8.55	8.17	17.6	2.21	6.74	2.14			MET72
53.8	8.45	8.07	17.4		6.66	5.44			MET72
50		30				20			VER80

Table 5. *Compositions of borate base glasses*

B_2O_3	Al_2O_3	CaO	K_2O	MgO	Na_2O	PbO	SiO_2	Other	Ref.
100									VER80
100									MIY80
100									MIY81
99					1				VER80
98.4						1.5			MIY80
98.4						1.5			MIY81
98					2				VER80
96.8						3.13			MIY80
96.8						3.13			MIY81
95.8						4.16			MIY80
95.8						4.16			MIY81
95					5				VER80
94.3						5.62			MIY80
94.3						5.62			MIY81
90					10				VER80
87.9						12.0			MIY80
87.9						12.0			MIY81
85.9						14.0			MIY80
85.9						14.0			MIY81
83.7						16.2			MIY80
83.7						16.2			MIY81
82						18			VER80
80.7						19.2			MIY80
80.7						19.2			MIY81
80					20				VER80
75					25				VER80
72						28			VER80
70					20		10		VER80
70						15		15	SHI79
70						22.5		7.5	SHI79
70						30			SHI79
66					34				VER80
65.5						34.5			VER80
65					35				VER80
60					20		20		VER80
60						10		30	SHI79
60						20		20	SHI79
60						30		10	SHI79
60						40			SHI79
50					20		30		VER80
50								50	VER80
50						50			VER80
50								50	SHI79
50						12.5		37.5	SHI79
50						25		25	SHI79
50						37.5		12.5	SHI79
50						50			SHI79
45								55	VER80
40					20		40		VER80
40								60	VER80
40						60			VER80
40								60	SHI79
40						15		45	SHI79
40						30		30	SHI79
40						45		15	SHI79
40						60			SHI79
30						35		35	SHI79
30						52.5		17.5	SHI79
30						70			SHI79

Table 6. *Compositions of phosphate base glasses*

P_2O_5	Al_2O_3	BaO	CaO	K_2O	La_2O_3	MgO	Na_2O	Other	Ref.
75.3	9.4			9.4	1.6			4.3	FRE84
74.6					25			0.5	FRE84
74.6	25							0.5	FRE84
74.6	25							0.4	FRE84
70.6	9.4			14.1	1.6			4.2	FRE84
70						20		10	FRE84
69	15					15		2	FRE84
65.9	18.8			9.4	1.7			4.2	FRE84
65.9	9.4			18.8	1.7			4.2	FRE84
65.1	16.5			12.5	1.7			4.2	FRE84
65				12		12		12	FRE84
62.7	15.9			15.9	1.4			4.1	FRE84
62				25				13	FRE84
59	11.8			23.6	1.5			4.1	FRE84
56.7	9.4			28.3	1.5			4.0	FRE84
50		8					30	12	WIL83
50		8	12				30		WIL83
50			12				30	8	WIL83
50			20				30		WIL83
50		10					40		WIL83
50		12					30	8	WIL83
50		12	8				30		WIL83
50		15					35		WIL83
50		16					30	4	WIL83
50		16	4				30		WIL83
50			4				30	16	WIL83
50		20					30		WIL83
50							30	20	WIL83
50		25					25		WIL83
50		30					20		WIL83
50		35					15		WIL83
50		4					30	16	WIL83
50		4	16				30		WIL83
50			16				30	4	WIL83
50		40					10		WIL83
50								50	ASH82
50		50							ASH82
50								50	ASH82
50								50	ASH82
50			50						ASH82
50						50			ASH82
50							50		ASH82

Table 7. *Compositions of germanate base glasses*

GeO_2	K_2O	Na_2O	PbO	Ref.
100				VER80
100				SME83
97.5	2.5			SME83
97.5		2.5		SME83
96		4		VER80
95	5			SME83
95			5	SME83
95		5		SME83
92.5	7.5			SME83
92.5		7.5		SME83
91		9		VER80
90.1		9.9		SME83
90	10			SME83
90		10		SME83
90		10		VER80
88		12		VER80
87.5	12.5			SME83
87.5		12.5		SME83
86		14		SME83
85			15	SME83
85	15			SME83
83.5	16.5			SME83
82.5	17.5			SME83
80	20			SME83
63		37		VER80

5. Discussion of Results

One of the primary decisions in collecting this data was what tests represented valid measurements of K_{IC} or γ. Generally almost all published data, regardless of the test procedure, was included. It must be noted, however, that the there will not necessarily be a correspondence in K_{IC} (or γ) values between different techniques. K_{IC} is at present an experimentally defined parameter, and historically has been taken as the stress intensity value at which a crack is moving at some rapid, though not precisely defined, rate. It can be expected that in all of these oxide glasses, cracks will grow at K_I's below K_{IC} because of the interaction of water with the crack tip bonds under stress in the test environment. K_{IC} is actually just one point on a V-K_I curve. For this reason, the measured value of K_{IC} will be sensitive to loading rate, test environments, and the crack length dependence of K_I in the test specimen. Given these considerations, it is understandable why there is a large scatter in the K_{IC} and γ data for similar glass compositions. In addition, data obtained by the notched beam technique in which the specimens were not precracked is questionable. Experience has shown that the fracture toughness data for glasses obtained in this way will lie at K_I or γ values higher than would be obtained if a crack had been present. Nevertheless, we have included data obtained in this way because it did provide trends otherwise unobtainable.

Despite the problems associated with the wide variability in the fracture toughness data, it is still useful to consider the correlations that having this large body of data makes possible. As noted earlier, K_{IC} or γ can be plotted as a function of the mole percent of a particular oxide for a given family of glass or as a function of Young's modulus. The examples presented indicate a number of interesting observations.

Figure 1 shows a plot of K_{IC} as a function of the mole percent Na_2O in all glasses containing both Na_2O and SiO_2; other constituents are present in most of these glasses in smaller quantities. It can be seen that there is no dependence of K_{IC} on Na_2O content. Using this same data set, but plotting γ versus Young's modulus (fig. 2) provides an entirely different picture. Here we see that there is a distinct minimum in γ at an $E \cong 72$ GPa. If we plot K_{IC} ($= 2E\gamma$) versus E (fig. 3), we see that there is a trend to increasing K_{IC} with increasing Young's modulus. This latter trend might be expected if Young's modulus is considered to be in part a measure of the strength as well as the stiffness of the Si-O bond in silicate glasses.

Figure 4 shows a trend of K_{IC} for Al_2O_3-P_2O_5 glasses as a function of Young's modulus similar to that seen in the Na_2O-SiO_2 series. The plot of K_{IC} versus the mole % P_2O_5 (fig. 5) indicates that K_{IC} rises with an increase in the amount of glass former.

Figure 6 shows a plot in which K_{IC} increases with the mole % of B_2O_3 for all B_2O_3 glasses. However, one must be cautious in analyzing this data since many of the investigators reporting this data discuss the fact that phase separation was observed in their glass systems especially at high B_2O_3 contents. The existence of two phases in the glass will likely contribute to increases in K_{IC} above those for single phase glasses. These microstructural effects may, in fact, explain the relatively large values of K_{IC} observed in figure 7 at low values of Young's modulus.

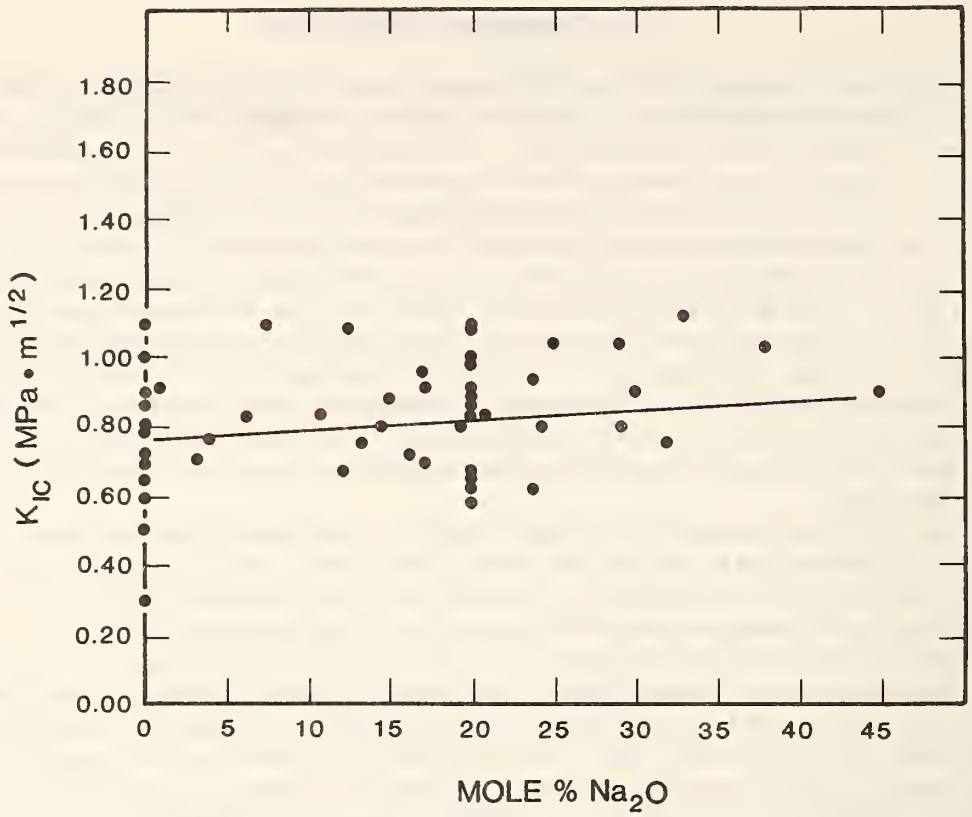

Figure 1. *Critical fracture toughness, K_{IC}, plotted as a function of the mole % Na_2O for all glasses containing both Na_2O and SiO_2. The line is the best fit curve to a quadratic equation for K_{IC} in terms of the mole % Na_2O.*

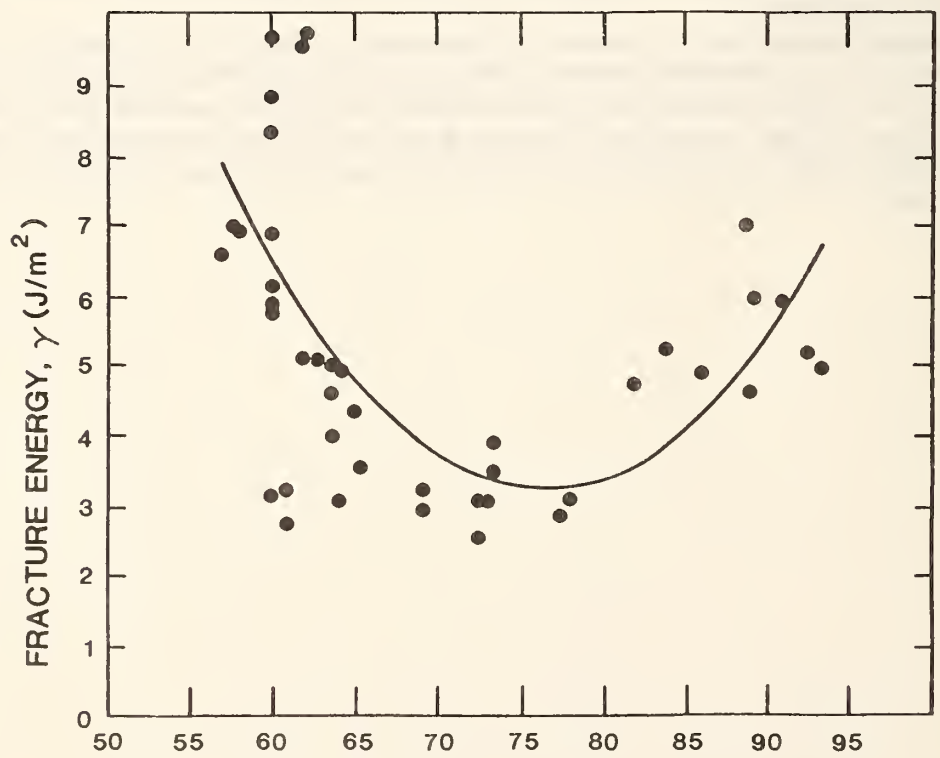

Figure 2. *The same data as in figure 1, plotted as γ versus the Young's modulus of each glass. The curve is the best fit to a quadratic equation for γ in terms of Young's modulus.*

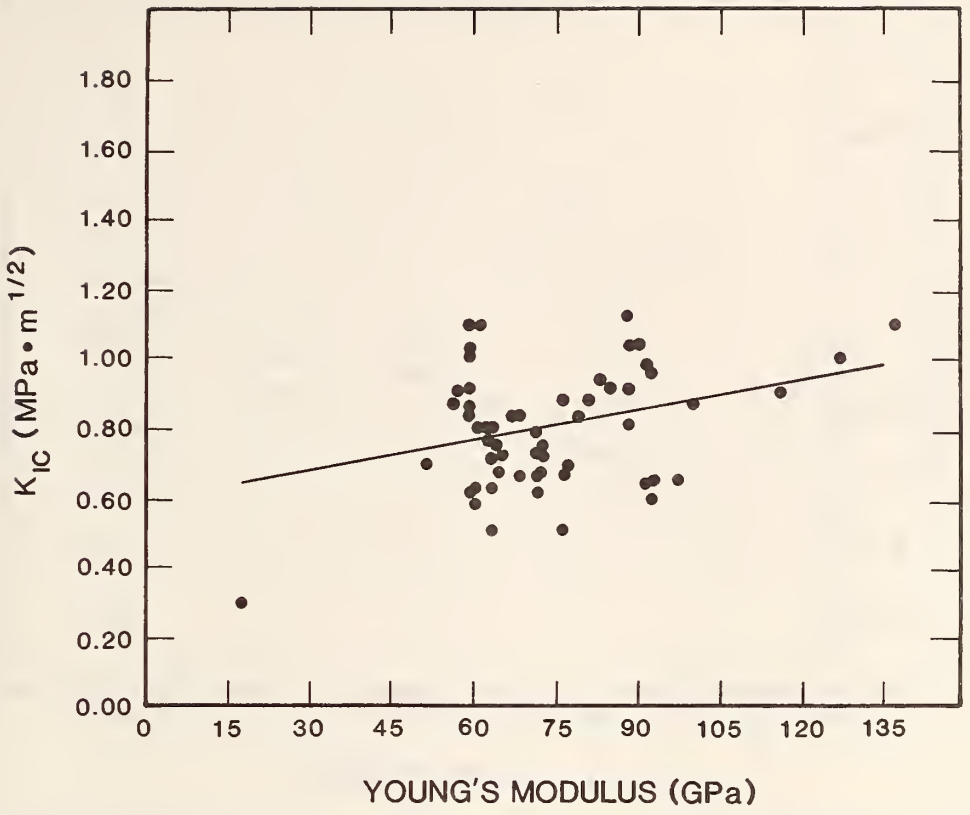

Figure 3. *The same data as in figures 1 and 2, plotted as* K_{IC} *as function of Young's modulus. The curve is the best fit to a quadratic equation for* K_{IC} *in terms of Young's modulus.*

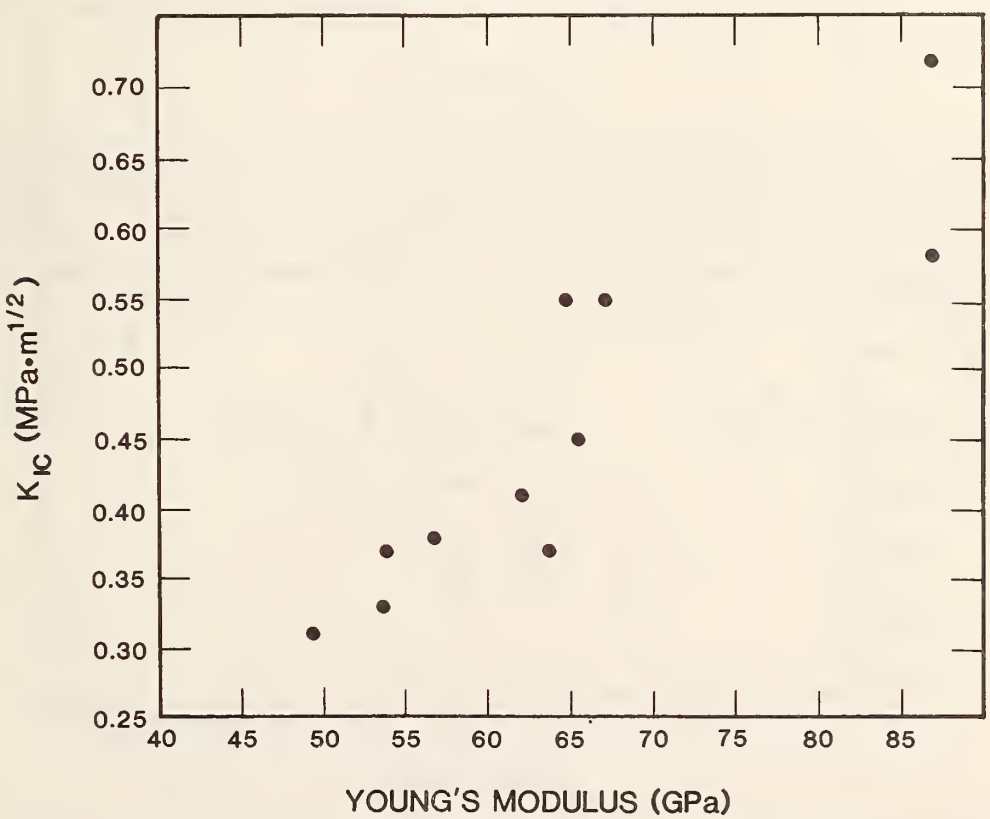

Figure 4. K_{IC} *plotted versus the Young's modulus of* Al_2O_3-P_2O_5 *glasses.*

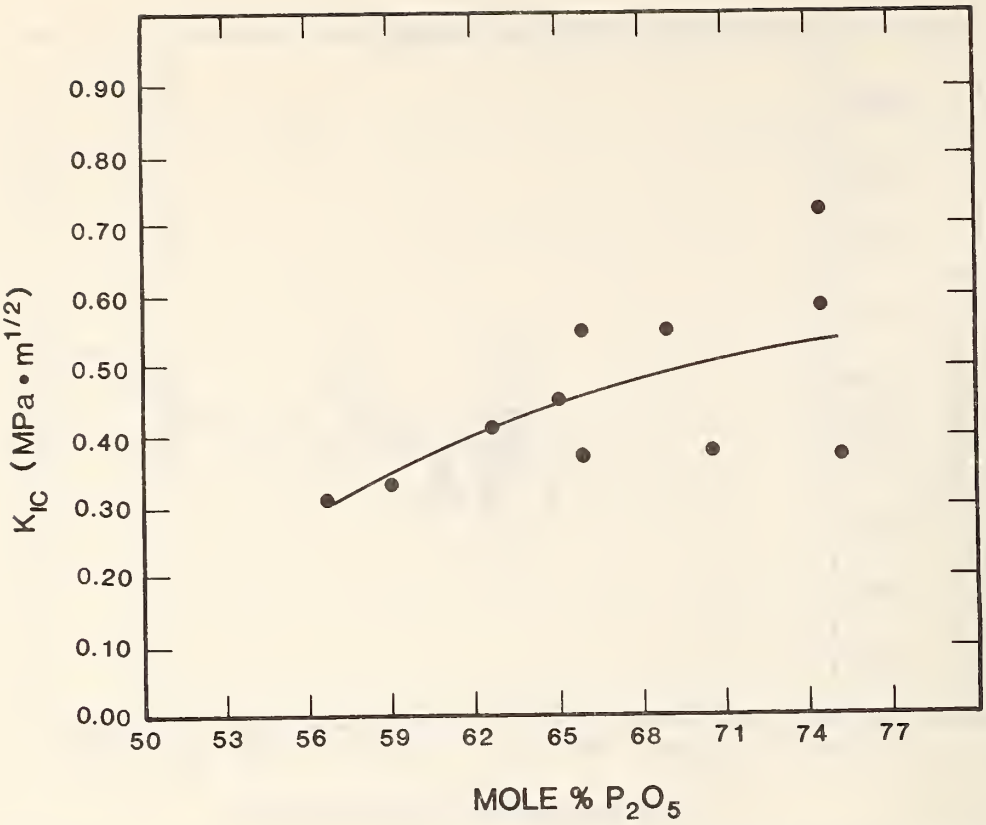

Figure 5. *The same data shown in figure 4 plotted as* K_{IC} *versus the mole % P_2O_5.*

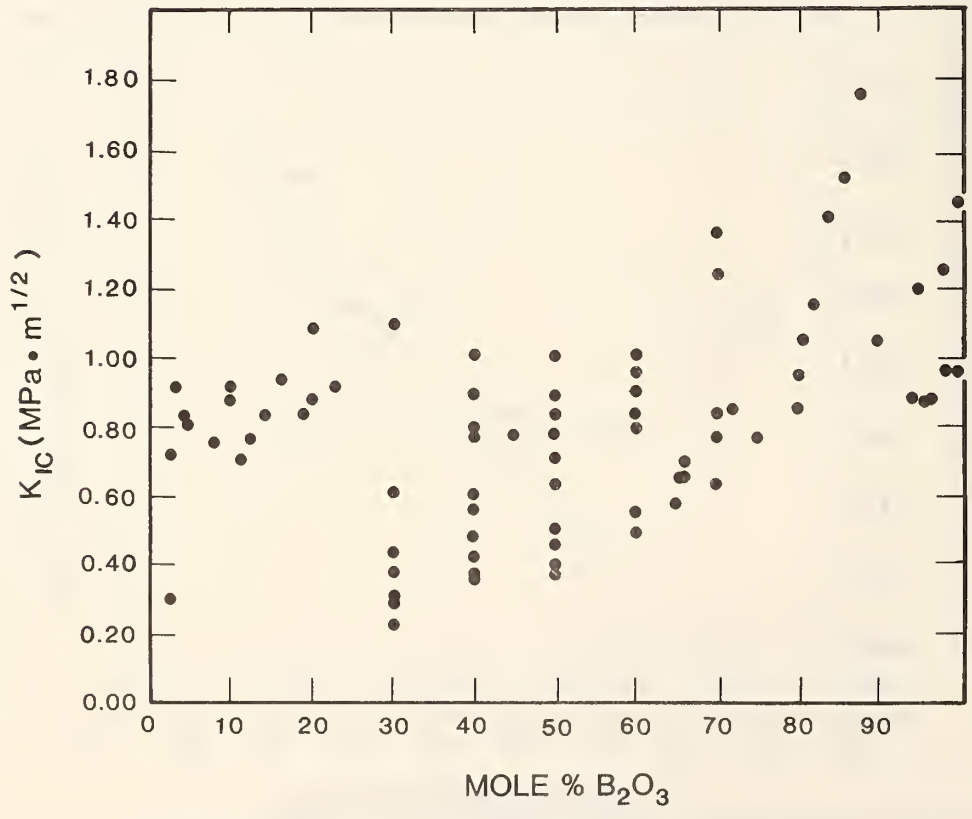

Figure 6. K_{IC} *plotted against the mole % B_2O_3 for all B_2O_3 containing glasses.*

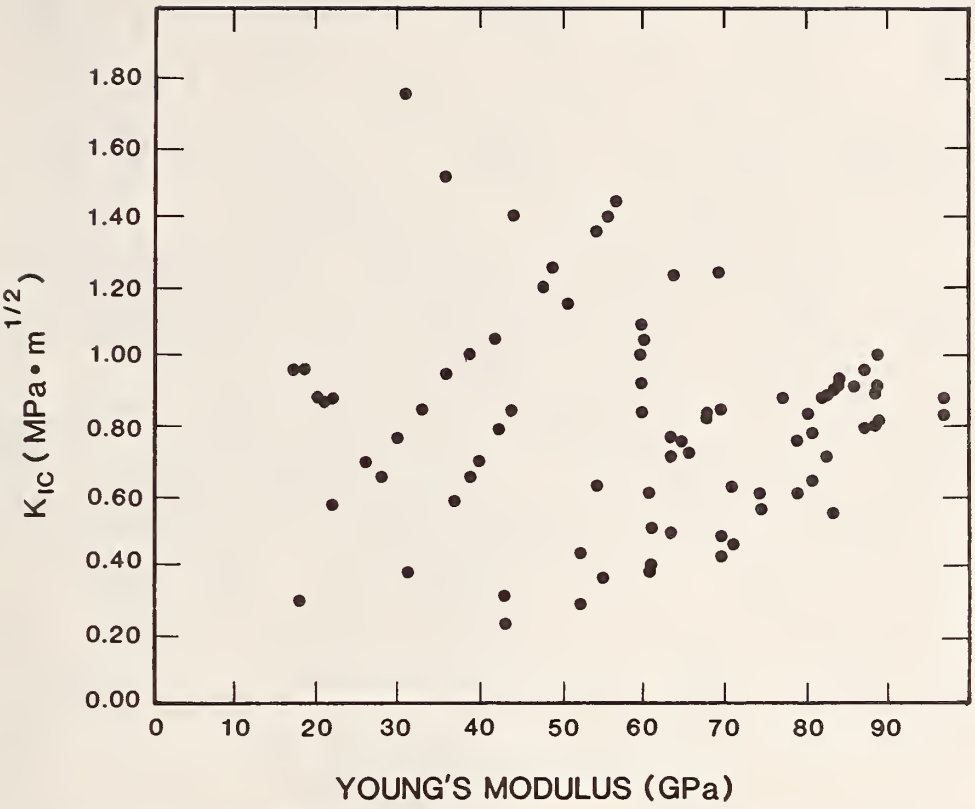

Figure 7. *The same data as in figure 6 plotted as* K_{IC} *versus the Young's modulus of the glasses.*

6. Summary

This paper presents details of a computerized data base of experimentally determined fracture mechanics parameters for oxide glasses. The philosophy behind the format of the system is described. The utility of this system in enabling a designer to choose a glass composition or for understanding fracture behavior is demonstrated through the presentation of plots of K_{IC} or γ as a function of glass composition or elastic modulus.

Finally, the system is capable of providing plots of n versus composition or Young's modulus. However, the values of n are quite sensitive to test environment as well, so this variable must be accounted for in any analysis.

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U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)	1. PUBLICATION OR REPORT NO. NBS/TN-1212	2. Performing Organ. Report No.	3. Publication Date June 1985

4. TITLE AND SUBTITLE

A Computerized Fracture Mechanics Database for Oxide Glasses

5. AUTHOR(S)

S. W. Freiman, T. L. Baker, and J. B. Wachtman, Jr.

6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions)

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11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

Values of critical fracture toughness (K_{IC}), fracture energy (γ), subcritical crack growth exponents (n) and Young's modulus (E), are compiled and tabulated for a wide variety of oxide glasses. A computerized data retrieval system has been formulated to allow for selection of data by either glass composition, investigator, or experimental technique, and year. Plotting routines allow K_{IC} or γ to be plotted versus the mole % of a particular component or the Young's modulus of the glass. A few illustrations are given to demonstrate trends in K_{IC} and γ as a function of composition and elastic modulus.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

crack growth exponents; elastic modulus; fracture database; fracture mechanics; fracture toughness; oxide glasses

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USCOMM-DC 85-6006

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