

Chapter 4 Detailed explanation of windows and operation

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1. Main window and common features

1.1 Common features

All INTERGLAD windows share the following features.

(1) Menu bar

The menu bar has pulldown menus called File, View, Tools, and Help.

(2) Icon menu

The icon menu on the toolbar at the top of the screen includes the following icons.

System:



File:



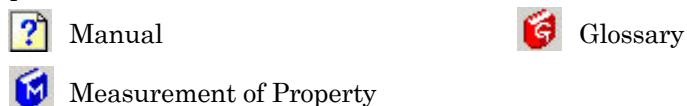
Environment:



Window navigation:



Help:



(3) Input and selection

There are four modes of data input and item selection to the screen:

- **Free input** (white cells): The user can input numerical values or text using the keyboard, and numerical values can be either fixed-point numbers or indices(exponential style). Decimal points of numerical value should be period (.), not comma (,).
- **Selection from a list** (light-blue cells): The user can choose items from a fixed list using the dialog boxes that open after double-clicking any light blue cell.
- **Selection by pulldown menu**: When the user clicks a button that contains a down arrow (▼), he/she can select an item from the available list of items.
- **Checkboxes**: Items are selected or deselected by clicking the appropriate checkboxes.
- **Balloon**: Explanation appears by pointing an item with a mouse-pointer.

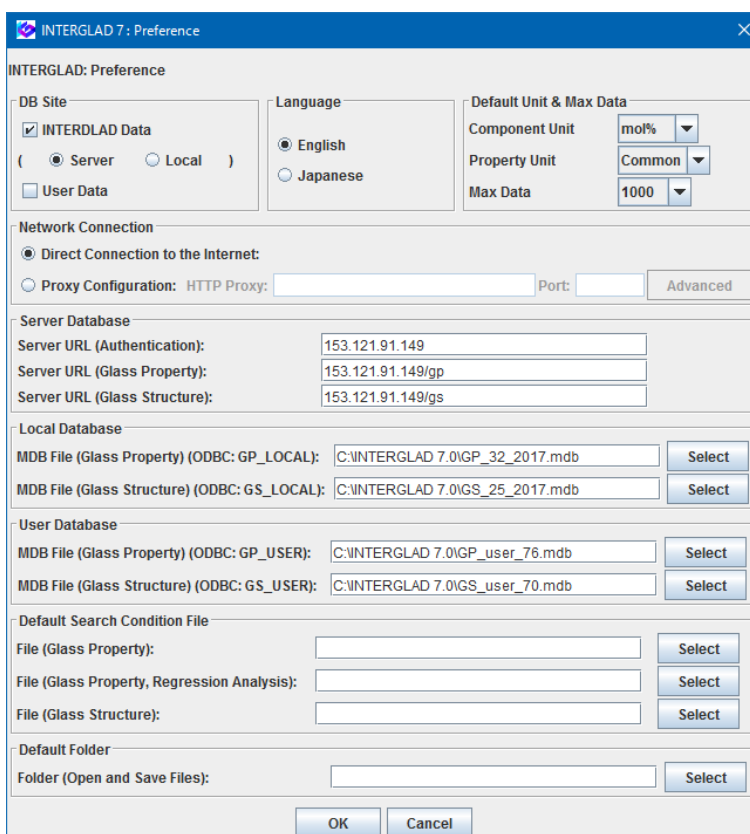
1.2 [Main] window

The [Main] window appears when INTERGLAD Ver. 7 is started.

(1) Window configuration

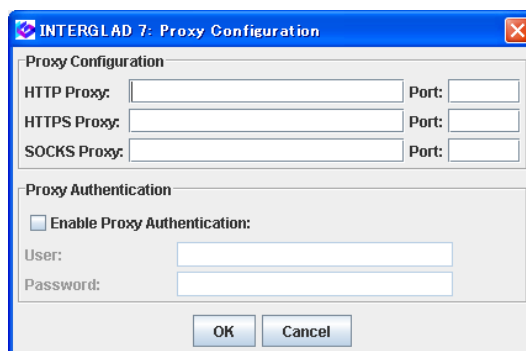
- 1 Menu bar
2 Tools bar

[Main] window



[Preference] dialog box

[Proxy Configuration] dialog box



(2) Details

Select the functions called Search Property Data, Property Prediction, User Data, or Search Structure Data using buttons in the [Main] window. The users can know the numbers of datasets clicking Contents of Property Data, Contents of Structure Data, or Contents of Glass-Forming Region of Tools on the menu bar. From the Search Property Data, the numbers of glasses of each State, Appearance, Feature, Process, Usage, Data Source, Component, Glass System and Property are shown by developing the list. From the Search Structure Data, the number of glasses of each State, Shape, Measurement, Data Source, Component, Glass System and Structure is shown. From the Contents of Glass-Forming Region the user can know the numbers of the composition with 2 or 3 components. Clicking [Check Update] of Help opens the web-page for download of the new version of INTERGLAD.

The [Preference] icon  opens a dialog box that allows the user to modify the user environment. The [Exit] button closes INTERGLAD.

The following options are available in the [Preference] dialog box. Click the [OK] button to fix the conditions, and click the [Cancel] button to cancel the conditions in this dialog box.

1) Database (DB) Site

- To use INTERGLAD data, check the [INTERGLAD Data] checkbox and select either the [Server] or [Local] radio button. The Server option links to the database stored on the New Glass Forum server, and the Local option links to the local database stored on the user's computer. The local database can be downloaded from the Web page of INTERGLAD or installed from the INTERGLAD CD. The local database is renewed at least once a year.
- To use the INTERGLAD data with User Data, check both the [INTERGLAD Data] and the [User Data] checkboxes. Here, User Data refers to the user database registered on the user's computer.
- To use the User Data alone, select only the User Data option.

2) Language

- Choose a language by clicking on either the English or the Japanese radio button.

3) Default Unit & Max Data

- Select a Component Unit from the pulldown menu.
- Select a Property Unit from the pulldown menu. Common refers to the most commonly used unit, shown in the ID list of 5.1, Chapter 6.
- Select a maximum number of glasses for the search from the [Max Data] pulldown menu.
- Do not change the default settings unless necessary.
- These settings can also be changed from the [Search Property Data] window.

4) Network Connection

- Select a network connection method.
- If using a proxy server, select the proxy configuration. Clicking the [Advanced] button opens the [Proxy Configuration] dialog box and input the IP address and Port in the dialog box. When Proxy Authentication is required, check the [Enable Proxy Authentication] checkbox, input the User ID and the Password, and click the [OK] button.

5) Server Database

- The Server Database to search for property or structure can be checked and changed. However, usually, these settings do not need to be changed.

6) Local Database

- The Local Database to search for property or structure can be checked and changed. Click the [select] button and select an mdb file for the database. Usually, these settings do not need to be changed. The file codes are set to ODBC for the local databases.

7) User Database

- The user can select a registered user database to search when two or more user database files are stored on the local computer. Usually, these settings do not need to be changed.

8) Default Search Condition File

- A default search condition can be selected from the stored search conditions on the user's computer.
- The default file can be set for each of Property/Search, Property/Multiple Regression Analysis, and Structure/Search.

9) Default Folder

- The user can select a default folder in which to save a search, analysis, or prediction data.

2. Search for Property Database

2.1 [Search Property Data] window

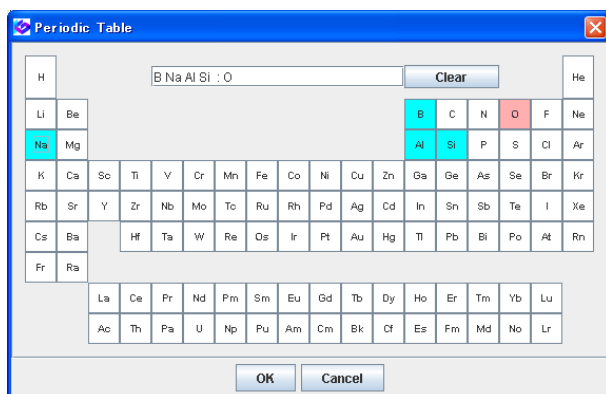
(1) Window configuration

The screenshot shows the 'INTERGLAD 7: Search Property Data' window with the 'Simple Search' tab selected. The 'Composition' section has 'mol%' selected, and the 'Periodic Table' button is visible. A table lists components: B2O3, Na2O, Al2O3, and SiO2, with checkboxes for selection and columns for %min and %max. The 'Property' section has a table with 'Density at RT' specified, with columns for Unit, Value Min, and Value Max. The 'Search' and 'Reset' buttons are at the bottom right.

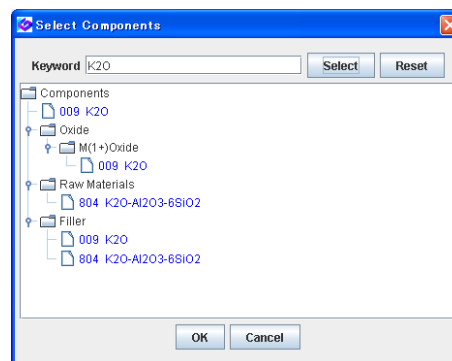
[Simple Search] window

The screenshot shows the 'INTERGLAD 7: Search Property Data' window with the 'Detail Search' tab selected. The 'Composition' section includes a 'Main' table with columns for Component, Component, Component, Component, %min, and %max. The 'Property' section has a table with 'Density at RT' specified, with columns for Unit, Value Min, and Value Max. The 'Data Source' section has a table with columns for Specified, Year (fro), Year (to), Number, and Pat Co/ Cat No. The 'Search' and 'Reset' buttons are at the bottom right.

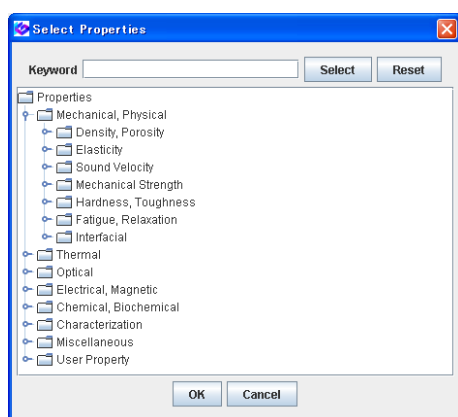
[Detail Search] window



[Periodic Table] dialog box



[Select Components] dialog box



[Select Properties] dialog box

(2) Details

(A) The [Search] window ([Simple Search] or [Detail Search])

The user can switch between the [Simple Search] and the [Detail Search] windows by using the tabs just below the tool bar. The [Simple Search] window sets the composition and property conditions, and the [Detail Search] window sets those and various other search conditions, such as Glass State, Shape, Feature and Process, and Usage. The contents of both windows remain the same, even after making the selections. After a set of search conditions has been saved as a Default Search Condition File in the [Preference] dialog box, these conditions then appear when either search window is opened.

(B) Selecting a database

The user can choose to search either the INTERGLAD Database and/or the User Database from the [DB Site] column of the [Detail Search] window. In the case of the INTERGLAD Database, the user can select either the newest Server Database or the Local Database installed on the local computer. These are set as the default conditions in the [Preference] dialog box. In the case of the Internet edition, only the Server Database is selected automatically.

(C) Specifying search conditions

The search operation is performed assuming that each condition is linked by the AND operator.

1) State

Select Not-Specified in order to scan all the stored data. Choose among Glass General, Melt, and Non-Vitrified to limit the search to a particular state of glass. Under Glass General, a single sub-state can be selected from among Glass (usual), Glass-Ceramics, Composite, Modified glass, and Thin Film.

Glass General is set as the default.

2) Gold-Data

Highly reliable glass data are distinguished as Gold-Data, and it is possible to limit a search to Gold-Data by checking the relevant checkbox. Each Gold-Data glass has an analyzed composition, a description of cooling conditions, property data of more than five items, and property data that does not differ to a large extent from those of glasses with similar compositions.

The addition of Gold-Data takes place via the confirmation of individual glass data. Glass numbers with an "R" attached at the end denote Gold-Data.

3) Glass-forming-region data

Only glasses with glass-forming-region data can be searched by checking the [Glass-Forming-Region Data] checkbox.

4) Composition

a) Chemical components and amounts

Components are classified into 11 groups: Oxides, Fluorides, Chlorides, Bromides, Iodides, Elemental, Sulfides (S, Se, Te compounds, P, As compounds, NH_3), Raw Materials, Fillers (for Composites), Substrates (for Thin Films), and Glass-Ceramics (Crystals). The user can specify a component from the Periodic Table or from the list in the [Select Component] dialog box with a keyword column (described in the following b) and c)).

Minimum and maximum component values can be specified in the [%min] and [%max] columns. When either the %min or %max value is entered, non-numerical compositional data, denoted by an asterisk (*), are not searched. Values from 0.01 to 100.00 can be entered in steps of 0.01. In the case of a value in E (exponent) style, the minimum available value is $1\text{E-}4$, which is 0.0001%. In this case figures before and after E are limited to be integral. When the sum of the %min exceeds 100%, the warnig dialog "Total of min% exceeds 100%" appears. By clicking the [OK] button, the search is performed, but usually "Data:0" is found by the Information dialog. In such a case, a new inputting of %min is required for the sum to be less than 100%. When inputting, decimal points of numerical value should be period (.), not comma (,).

Glasses without a certain component can be also extracted by inputting "0" or "-1" in the [%min] cell of the component. When only a maximum value is entered without a minimum amount, the search is the same.

[Common name for similar compounds (*Italic*) RmOn]

R_mO_n is used to specify all the member compounds of a particular chemical component group. When *RmOn* (*Italic*) is selected, every compound belonging to the group is connected by the OR operation. In such cases, %min and %max limit the aggregate content of the group.

The groups are as follows:

<i>R2O</i>	= Li_2O , Na_2O , K_2O , Rb_2O , Cs_2O , R_2O
<i>RO</i>	= MgO , CaO , SrO , BaO , RO
<i>R2O3</i>	= Al_2O_3 , Fe_2O_3 , Cr_2O_3 , R_2O_3
<i>RO2</i>	= TiO_2 , ZrO_2 , HfO_2 , RO_2
<i>R2O5</i>	= P_2O_5 , V_2O_5 , Nb_2O_5 , Ta_2O_5 , R_2O_5
<i>RO3</i>	= MoO_3 , WO_3 , RO_3
<i>RE2O3</i>	= Ce_2O_3 , Pr_2O_3 , Nd_2O_3 , Pm_2O_3 , Sm_2O_3 , Eu_2O_3 , Gd_2O_3 , Tb_2O_3 , Dy_2O_3 , Ho_2O_3 , Er_2O_3 , Tm_2O_3 , Yb_2O_3 , Lu_2O_3 , Sc_2O_3 , Y_2O_3 , La_2O_3 , Re_2O_3
<i>AnO2</i>	= ThO_2 , PaO_2 , UO_2 , NpO_2 , PuO_2 , AmO_2 , CmO_2 , BkO_2 , CfO_2 , EsO_2 , FmO_2 , MdO_2 , NoO_2 , LrO_2 , AcO_2 , AnO_2

Note: The common name RmOn when not italicized is treated as a usual component. This notation indicates that RmOn is used in the data source.

b) Specification of components by Periodic Table

The [Periodic Table] dialog box opens upon clicking the [Periodic Table] button. In the case of oxide components, click the relevant cation elements and then click the [OK] button. In the case of non-oxide components such as halides, first click on oxygen (O), and then on an anion element (the pink background moves from O to other anion elements). Two or more anions can be selected simultaneously. The specified elements in the Periodic Table can be deleted by re-clicking on the elements one by one, and all the specified elements can be deleted by clicking the [Clear Component] button. The [Periodic Table] dialog box is closed by clicking the [Cancel] button or clicking the cross at the top right corner of the dialog box.

The specified components appear in the [Component] column. Components with different cations are in the cells of the first vertical column, and components with different oxidation numbers of the same cation are in the cells of the horizontal row (from small oxidation number to large lines, from left to right). When multiple anions are specified, they appear in the order of oxides, chlorides, bromides, and iodides from top to bottom. It is unable to specify components in the second from the left or right cells using the periodic table.

c) Specification of components from [Select Components] dialog box or by entering a keyword

The [Select Components] dialog box opens by double-clicking on a light-blue cell in the [Component] column. Select a specified component, and then click the [OK] button. To expand the dialog box, click the fork mark of the items or double-click on the item letters or icon. The dialog box can be collapsed in the same manner. Multiple components can be selected simultaneously by holding down the Ctrl key while clicking components.

Components can easily be searched for by inputting a keyword in the [Keyword] cell and clicking the [Select] button. All items, including the keyword, appear in blue-colored letters. Click on the specified component, and then click the [OK] button. Click the [Reset] button to cancel a keyword-based search. To close the [Select Components] dialog box, click the [Cancel] button or click the cross at the top right corner of the dialog box.

d) [AND, OR, NOT] pulldown menu

AND, OR and NOT can be selected for each row from the [Component] column to specify relationships among components.

In this system AND(A), OR(A), NOT(A) mean the following:

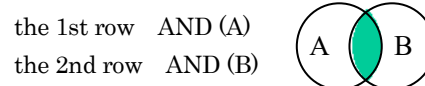
AND(A): must contain A (common region with other AND and NOT components)

OR(A): may contain A (unrelated to other AND and NOT components)

NOT(A): must not contain A (common region with other AND and NOT components)

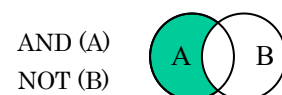
See the figure alongside.

The region in green is the specified region.



When there are two or more AND, OR, and NOT conditions, the processing order is as follows:

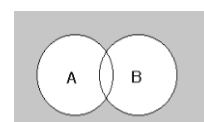
- 1) When three or more components are selected, ANDs and NOTs are assessed first, and then OR is assessed.
- 2) When there are two or more components in a horizontal row, OR is assessed for the components and then the leftmost bold AND, OR, NOT is assessed.



NOT(A OR B) (A and B in the same horizontal row)

= NOT(A) and NOT(B) (A and B in the leftmost vertical column)

In the figure the region in grey is specified.



e) Numerical data

When the [Numerical] checkbox is checked, non-numerical data, denoted by an asterisk (*), are not searched.

f) Unit

One of three units, mass%, mol%, and at% can be specified by radio buttons in the [Composition] column. The default unit is mol%, but this can be changed from the [Preference] dialog box. In the case of chalcogenide glasses, we recommend selecting at% to obtain more data.

g) Total of Main Components

The total percentage of main components can be selected using the [≤Total of Main Components] pulldown menu, but this is only active when the [Main] checkbox of each component is checked.

When the main components are specified, the bold OR and NOT cannot be used, and only AND can be used. However, the horizontal ORs can be used to specify alternatives.

h) Glass System

A glass system can be specified from the [Select Glass System] dialog box, which is activated by double-clicking a light-blue cell in the [Glass System] column. Specification using the [Keyword] field in the [Select Glass System] dialog box is also available. Three glass systems can be specified using AND or OR connections.

i) Commercial (User) Glass

Commercial glasses and user glasses are listed in the [Select Commercial and User Glass] dialog box, which is opened by double-clicking the [Commercial (User) Glass] column. A commercial glass can be selected from the list, and clicking the [Develop] button to the right of the [Commercial (User) Glass] column displays the chemical composition of the commercial (user) glass in the [Component], [%min], and [%max] cells. When more than one composition exists for a listed commercial glass, the composition is shown as a range from %min (minimum value) to %max (maximum value). Specification using the [Keyword] field in the [Select Commercial and User Glass] dialog box is also available. The [Component, %min, %max] column and the [Commercial (User) Glass] column are connected by the OR operation.

j) Filler/Crystal/Substrate

When [Composite] is specified as the [State], it becomes possible to specify fillers. The filler type can be selected from the [Select Filler] dialog box, which can be opened by double-clicking a light-blue cell in the [Filler] column.

When [Glass-Ceramics] is specified as the [State], it becomes possible to specify crystals. The crystal type can be selected from the [Select Crystal] dialog box, opened by double-clicking a light-blue cell in the [Crystal] column.

When [Thin Film] is specified as the [State], it becomes possible to specify a substrate. A substrate type can be selected from the [Select Substrate] dialog box, opened by double-clicking a light-blue cell in the [Substrate] column. Specification using the [Keyword] field in each dialog box is also available.

k) Sol-Gel Raw Material

The choice of [Sol-Gel Material] becomes possible when the [Sol-Gel] checkbox in the [Appearance, Feature & Process] column is checked or [Sol-Gel] is specified from the [Glass-forming Method] in the [Select Appearance, Feature & Process] dialog box by double-clicking a light-blue cell. The material can be selected from the [Select Sol-Gel Material] dialog box, opened by double-clicking a light-blue cell in the [Sol-Gel Material] column. Specification using the [Keyword] field in the [Select Sol-Gel Material] dialog box is also available.

5) Property**a) Specifying properties**

Select properties from the [Select Properties] dialog box, which can be opened by double-clicking any cell in the [Property] column. Search for a property item by entering a keyword in the [Keyword] field of the dialog box in the same manner as that for components. Bold-face items of the medium category in the dialog box can be specified as search conditions. [AND] or [OR] can be specified for

each item in and after the 2nd row of the [Property] column.

b) Unit

The unit system (Common, SI, CGS, or PSI) can be specified separately for each property. The default unit is Common, but this default can be changed from the [Preference] dialog box. A hash (#) in the [Unit] column indicates that the property is recorded in a unit that cannot be converted.

c) Minimum and Maximum Values

Minimum and maximum values of properties can be specified in the [%min] and [%max] cells. Input the values in decimal style or exponent style (E) with an integral ($\pm$) exponent. Decimal points of numerical value should be period (.), not comma (,).

d) Numerical

When the [Numerical] checkbox is checked, the search ignores non-numerical data, which are denoted by an asterisk (*).

e) Extension Search

The extension search applies to glasses with high-temperature properties such as high-temperature density or viscosity. When the [Extension Search] checkbox is checked, the search checks glasses those do not have the corresponding property data, but those do have data at the other temperatures. The corresponding data can be calculated by interpolation or extrapolation from other temperature data of the glass.

[Typical Data]

Property items with various measurement conditions are registered with different IDs for each condition. Typical data are defined for six property categories: Vickers Hardness, Linear Expansion Coefficient, Glass Transition Point, Refractive Index Visible, Birefringence, and Dielectric Constant. Refer to the Typical Data table in the Appendix at the end of Chapter 3, which shows the IDs and the priority order for each property.

When a property item with “typical” is chosen as a search condition, the value with the highest priority order ID in the table is indicated as typical if at least one data item of the property is registered in the database. Searching with typical data is useful for collecting data for properties with many IDs.

[Electric Conductivity, AC Resistivity, and DC Resistivity]

When any one of electric conductivity, AC resistivity, or DC resistivity is specified as a search condition, the other two properties are also searched at the same time. When two or more of the three items are registered in a glass, one value is listed in the [Data List of Property] window according to the priority order in the following table. When the specified item is conductivity, the value of resistivity is converted to the reciprocal value, and when resistivity, the value of conductivity is converted to the reciprocal value.

Specified Item	Priority 1	Priority 2	Priority 3
Electric Conductivity	Electric Conductivity	Reciprocal of AC Volume Resistivity	Reciprocal of DC Volume Resistivity
AC Volume Resistivity	AC Volume Resistivity	Reciprocal of Electrical Conductivity	DC Volume Resistivity
DC Volume Resistivity	DC Volume Resistivity	Reciprocal of Electrical Conductivity	AC Volume Resistivity

6) Appearance, Feature, and Process

Items can be specified from the [Select Appearance, Feature & Process] dialog box, which can be opened by double-clicking a light-blue cell in the [Appearance, Feature & Process] column. Specification using the [Keyword] field in the [Select Appearance, Feature & Process] dialog box is also available. When two or more items are specified, they are connected by the [AND] operator. Any item including

Appearance etc. can be set as a search item. Checking the [Sol-Gel] checkbox opens the [Sol-Gel Material] column. See point k) in 4) Composition.

7) Usage

Select a usage by double-clicking a light-blue cell in the [Usage] column and selecting items from the list. Specification using the [Keyword] field in the [Select Usage] dialog box is also available. When two or more usages are specified, they are connected by the [OR] operator. Any item including such as 'Energy, Nuclear, Radiation' can be put as a search item.

8) Author

Enter a data-source author's name by typing it in. An author of First Author or Any Author may also be specified from the pulldown menu. Example: Hill J.C.

9) Data Source

Specify a specific data source type by double-clicking a light-blue cell in the [Data Source] column and choosing an option from the [Select Data Source] dialog box. Specification using the [Keyword] field in the [Select Data Source] dialog box is also available. 4 data sources can be specified, and AND, OR and NOT can be selected for each data source like component.

a) Data source item

Select a category (data book, journal, proceedings, patent, catalogue, and user data) or subordinate classification from the [Select Data Source] dialog box. Here, you can specify the title of a data book [Book], academic journal [Journal], proceedings [Proceeding], European, US, or Japanese patents [Patent], or a company name [Catalogue].

b) Year

Specify the year of publication of a data source using four digits in the [Year] cell. Japanese years must be converted to years of the Christian calendar in the case of Japanese patents. Specify a single year by entering the same year in both cells.

c) Number

Double-click on the [Number] cell to enter a number. The method of specifying a number depends on the category:

Data book: Specify volume number and page number of the data book in the [Number] cell. Enter a volume number using three digits or letters such as 00B or 002, and after that enter a four-digit page number (e.g. 0102). Example: 0010521 (volume number: 001, page number: 521)

Journal and Proceedings: Specify the volume number of a journal or proceeding. The three-digit volume number (e.g. 002) may also be combined with a four-digit page number (e.g. 0035) as a seven-digit number in the order 0020035. When dealing with a combined volume, only one volume number is used. For example, input either 059 or 060 for Vol. 59-60.

Occasionally there are five digits in the number of pages. In such cases, page 10000 is shown by "t" instead of the first 10. Similarly, the first 10 of page numbers 11000, 12000, 13000, 14000, 15000, 16000, 17000, 18000, 19000 and 20000 are represented by "e", "w", "h", "f", "i", "s", "v", "g", "n", and "y," respectively. Lately the page number is registered as the six-digit number in a nine-digit number.

Patent: Specify a patent. Enter a six-digit patent number after "A" (appears automatically) for a Japanese patent or a seven-digit patent number for a European or US patent. In the case of US patent, published patents after 18 months from the earliest filing date have been registered after 2002. In this case the next figure after A is 0. Lately, number of Japanese Re-publication of PCT International Publication is registered as AW+six-digit number. Examples in patents are registered in the database. The registered examples were up to 10 for a patent with 1-100 examples, 10% examples for a patent with more than 100 examples, but from 2011 the registered examples have been the all for a patent with 1-20 examples, and $\{(N-20) \times 0.1 + 20\}$ examples for a patent with N (21 or more) examples.

d) Patent Company (company to which patent belongs) and Catalogue No.

A patent company (organization) can be specified when selecting either [Patent] in bold type,

[European Patent], [US Patent], or [Japanese Patent]. Double-click on the [Pat Co/ Cat No.] cell and select a patent company from the [Select Pat. Company] dialog box. When a patent applicant is an individual, or a company name appeared only once, the patent company is registered as Others. When selecting [Catalogue Company] by developing [Catalogue] in the [Select Data Source] dialog box, Catalogue No. (Code) can be selected by double-clicking on the [Pat Co/ Cat No.] cell. When a company name has been renewed, the previous name is also shown with parentheses after the new name. For a company merger, one of the previous company names is rested.

The following abbreviations are used for the countries of origin of companies, journals, etc.

BE: Belgium, CN: China, DE: Germany, FR: France, GB: Great Britain (United Kingdom),
IT: Italy, J: Japan, KR: Republic of Korea, LI: Liechtenstein, NL: Netherlands, PT: Portugal,
R: Russian Federation, SU: Former Soviet Union, US: United States of America.

10) Glass ID (six-digit number)

Search for glasses by entering a Glass ID or ID range (e.g. 23–1000) in the [Glass ID] column.

11) Max Data

Max Data specifies the maximum number of glasses to search. The default is 1000, but this default number can be changed from the [Preference] dialog box.

(D) Buttons and icons

1) [Search] button

Perform a search.

2) [Reset] button

Initialize the [Search Property Data] window.

3) [Save] icon

Save the specified search conditions in a file.

4) [Open] icon

Open a previously saved search condition from a file selected in the [Open] dialog box. The selected search condition appears after resetting the window.

5) [Print] icon

Print the contents of the current window.

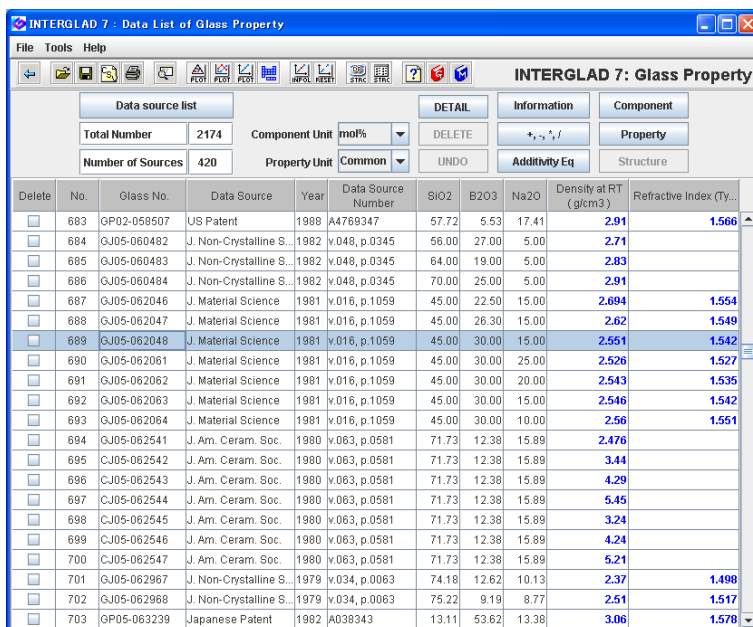
6) [Forward] icon

Go to the next [Data List of Property] window. To open a saved search result, go to the [Data List of Property] window by the [Forward] icon without any specification in the [Search Property Data] window, and open it from the [Open] icon in the [Data List of Property] window.

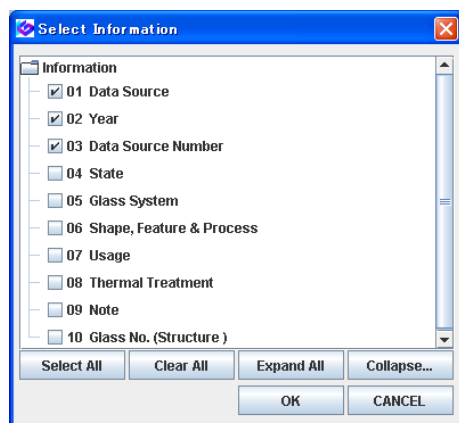
2. 2 [Data List of Property] window

(1) Window configuration

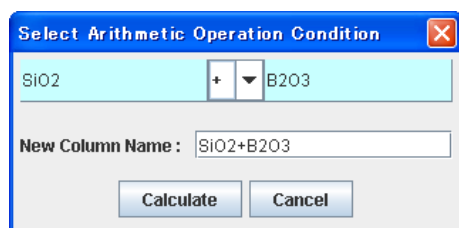
[Data List of Property] window



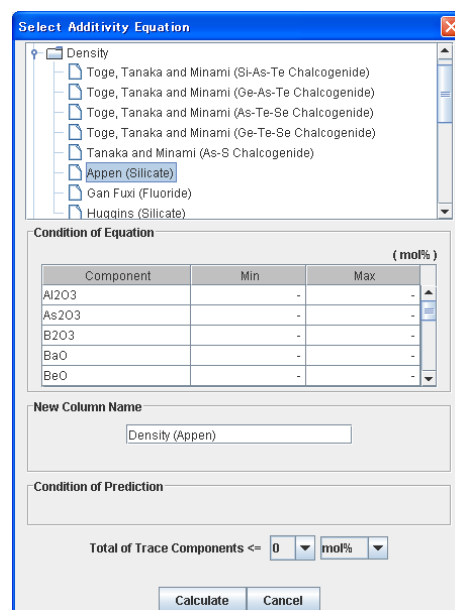
Delete	No.	Glass No.	Data Source	Year	Data Source Number	SiO2	B2O3	Na2O	Density at RT (g/cm3)	Refractive Index (Ty...)
☐	683	GP02-058507	US Patent	1988	A4769347	57.72	5.53	17.41	2.91	1.566
☐	684	GJ05-060482	J. Non-Crystalline S...	1982	y.048, p.0345	56.00	27.00	5.00	2.71	
☐	685	GJ05-060483	J. Non-Crystalline S...	1982	y.048, p.0345	64.00	19.00	5.00	2.83	
☐	686	GJ05-060484	J. Non-Crystalline S...	1982	y.048, p.0345	70.00	25.00	5.00	2.91	
☐	687	GJ05-062046	J. Material Science	1981	y.016, p.1059	45.00	22.50	15.00	2.694	1.554
☐	688	GJ05-062047	J. Material Science	1981	y.016, p.1059	45.00	26.30	15.00	2.62	1.549
☐	689	GJ05-062048	J. Material Science	1981	y.016, p.1059	45.00	30.00	15.00	2.551	1.542
☐	690	GJ05-062061	J. Material Science	1981	y.016, p.1059	45.00	30.00	25.00	2.526	1.527
☐	691	GJ05-062062	J. Material Science	1981	y.016, p.1059	45.00	30.00	20.00	2.543	1.535
☐	692	GJ05-062063	J. Material Science	1981	y.016, p.1059	45.00	30.00	15.00	2.546	1.542
☐	693	GJ05-062064	J. Material Science	1981	y.016, p.1059	45.00	30.00	10.00	2.56	1.551
☐	694	GJ05-062541	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	2.476	
☐	695	CJ05-062542	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	3.44	
☐	696	CJ05-062543	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	4.29	
☐	697	CJ05-062544	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	5.45	
☐	698	CJ05-062545	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	3.24	
☐	699	CJ05-062546	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	4.24	
☐	700	CJ05-062547	J. Am. Ceram. Soc.	1980	y.063, p.0581	71.73	12.38	15.89	5.21	
☐	701	GJ05-062967	J. Non-Crystalline S...	1979	y.034, p.0063	74.18	12.62	10.13	2.37	1.498
☐	702	GJ05-062968	J. Non-Crystalline S...	1979	y.034, p.0063	75.22	9.19	8.77	2.51	1.517
☐	703	GP05-063239	Japanese Patent	1982	A038343	13.11	53.62	13.38	3.06	1.578



[Select Information] dialog box



[Arithmetic Operation] dialog box



[Additivity Equation] dialog box

(2) Details

(A) Glass Number

- 1) **Total Number**: The total number of glasses searched.
- 2) **Number of Sources**: The total number of data sources used in the search.

(B) Table

The searched glasses are listed in the order of their Glass ID. Each dataset is shown in a horizontal row. Only the components and properties data that exist in the search conditions, Glass Number, Data Source, Year, and Data Source Number are tabulated; however other data items can be added to the list.

- **Column shuffling**: Move a column to the left or right by dragging and dropping it into the desired position.
- **Sorting**: Sort the data in a column in ascending or descending order. Hold down the Shift key and click on the column header to change the sort order.
- **Transfer to the [Detail Data of Property] window**: View detailed data for a glass (the [Detail Data of Property] window) in the list by double-clicking on the row.

1) Delete checkbox column

If a glass dataset has the [Delete] checkbox ticked, it cannot be used for analysis (arithmetic operations, additivity equation, XY plot, ternary plot, etc.). These datasets are deleted by clicking the [Delete] button. When a point on an XY or ternary plot is deleted, the [Delete] checkbox for the same data is automatically checked in the search table.

Note that a row cannot be selected (activated) by clicking the [Delete] checkbox.

2) No. column

Display the serial number of the output data row.

3) Glass No. column

Show the Glass No. of each glass in INTERGLAD.

Glass No.:

Example G C 03 - 052224

① ② ③ ④

① State G: Glass, X: Glass-Ceramics, C: Composite, M: Modified, T: Thin Film
F: Melt, N: Non-Vitrified

② Data Source B: Book, J: Scientific Journal, I: Proceedings, etc.,
P: Patent, C: Company Catalogue, U: User Data

③ Glass System 01: Silica, 02: Alkali Silicate, 03: Alkaline-earth Silicate...

④ Glass ID the serial number of six-digit figure in order of registration
When R is attached after the figure, this shows Gold-Data. Refer to
2.1(2) (C) 2).

4) Data Source column

The title of the data source (journal name, company name in case of patent, etc.), year, and data source number appear in this column. They may be cancelled by clicking the [Information] button at the top of the window and deleting the check for the item in the list.

5) State, Glass System, Appearance, Feature & Process, Usage, Thermal Treatment, Note column

These items are shown or hidden by using the checkbox for the items in the [Information] dialog box from the [Information] button. For Appearance, Feature & Process, Usage, the subclass items are shown in the list.

6) Composition

The components specified in the [Search Property Data] window are listed in the searched glasses table. Any component of the listed glasses can be shown or hidden by using the checkbox for the component in the [Component] dialog box. The default [Component Unit] is the unit specified in the [Search Property Data] window. Filler, Crystal, or Sol-Gel Material cannot appear in the list. To see these units, it is necessary to open the [Glasses from a Data Source] window or the [Detail Data of Property] window.

7) Property

Any property specified in the [Search Property Data] window appears in the searched glasses table. All registered property items in the search appear in the [Select Properties] dialog box, opened by clicking the [Property] button. Therefore, any property in the list can be shown in the table by clicking the [show/hide] checkbox for the relevant property. The default Property Unit system is the Common unit system. The properties in the table use the default unit, not the selection specified in the search window. However, the default can be changed from the [Default Unit & Max Data] column in the [Preference] dialog box in the [Main] window. Property values are shown as exponent (E) style with maximum 3 decimal places. Example: $156.3 = 1.563E+2$. For a value with E+00, it is shown as normal style with maximum 3 decimal places.

- Blue-colored property data are conditional, so we recommend that such conditions be checked in the [Detail Data of Property] window.
- Red-colored property data are (converted) values of priority 2 or 3 from among the three categories of electric conductivity, AC resistivity, and DC resistivity. See 2. 1 (2) (C) 5) Property.
- Data described as [Figure] with a blue color represents table data. (See Chapter 5, 3). Figures can be displayed from the [Detail Data of Property] window.

(C) Pulldown menus, buttons, and icons**1) [Component Unit] pulldown menu**

Conversion between mol% and mass% units is possible using the [Component Unit] pulldown menu. In the case of glass containing components with an uncertain molecular weight, such as R₂O, Kaolin and Others, conversion is not possible, so the pre-existing numerical data is replaced by a red asterisk *. When returning to the initial unit, the values go back to the initial values. In some cases, a black asterisk is replaced by a red one after unit conversion, even if numerical data of the content in the changed unit has been registered for the glass. This is the case for glass with at least one component with an uncertain molecular weight. Such a case is shown when the search is performed except the unit in which the numerical values appear in the [Detail Data of Property] window. When the sum of the components does not become 100% by unit conversion, the component values are replaced by a red asterisk *. (Ex. 72981 after searching with mol%, unit conversion to mass%)

2) [Property Unit] pulldown menu

Convert property values to a new unit using the [Property Unit] pulldown menu.

3) [Information] button

Clicking the [Information] button opens the [Select Information] dialog box, and allows the following data items to be shown or hidden in the list: Data Source, Year and Number of Data Source, Glass State, Glass System, Appearance, Feature & Process, Usage, Thermal Treatment, Note, and Glass No. (Structure Database).

4) [Component] button

Click to show or hide any component data contained in the search results.

5) [Property] button

Click to show or hide any property data registered in the search results.

6) [Structure] button

Click to show or hide any structural data in the Structure Database for the listed glasses. The [Structure] button becomes clickable only after the [Search Structure DB] icon (See 19)) is clicked or Glass No. (Structure) is checked in the [Select Information] dialog box (See 3)).

7) [Delete] button

Click to delete the rows that have been marked for deletion by means of the [Delete] checkbox.

8) [Undo] button

Click to cancel the previous [Delete] operation.

9) [Detail] button

Click after clicking on any part of a row, other than the delete checkbox, to open the [Detail Data of Property] window for a glass. Double-clicking on a row has the same result.

10) [+ , - , * , /] button

Click to conduct one of the four basic arithmetic operations on Components, Properties, or Component/Property combinations. The [Select Arithmetic Operation Condition] dialog box appears when the [+ , - , * , /] button is clicked. Set the conditions of the operation in this box to have the result shown in a new column.

Condition of operation:

- Two Component and Property columns can be arbitrarily chosen as operands. It is also possible to select a new column formed by the arithmetic operation.
- Operator: +, -, * (x), / (÷). An operator is chosen from the pulldown menu in the dialog box.
- New column name: editable.

The new column resulting from the + or - operation between two Component columns is treated as a Component column, and labeled as such. The new column resulting from the × or ÷ operation between two Component columns is treated as a Property column, because the numerical result may exceed 100 (%). The new column resulting from an arithmetic operation between a Component column and a Property column, or between two Property columns, is treated as a Property column, and labeled as such. Show or hide a column using the checkboxes in the list. Access the list by clicking the [Component] button or the [Property] button. The new column name appears at the top of the list of the Component or

Property items in the [Select Item] dialog box.

Unit of values by arithmetic operation:

- Arithmetic operation results displayed in the Component column: the unit of the values cannot be changed.
- Arithmetic operation results displayed in the Property column: the values have no unit.

11) [Additivity Eq] button

Click to show the [Additivity Equation] dialog box and to calculate property values for the listed glass items using an additivity equation. The result of the calculation is shown in a new column in pink color.

<[Additivity Equation] dialog box>

When an equation is chosen from the list of equations, the constraints are shown below the list. Click the [Calculate] button after entering the temperature or viscosity, as necessary. In the [New Column Name] column the selected property name is shown, and it can be changed to a new name.

The property value is calculated using all component values of each glass. Therefore, the property of glass with components that are not treated with the additivity equation is not calculated. In most cases, all the calculated values may be accurate, even if the calculation ignores components with small contents. By setting “Total of trace components< =” using the pulldown menu, the calculation can be performed while ignoring the total maximum value of components with small contents. The total maximum value can be one of nine values: 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, and 5.0%.

An asterisk is shown in the result table for glass that is unsuited to the conditions of the chosen additivity equation.

See Sec.1 of Chapter 6 for Additivity Equation.

Take care to only apply the additivity equation to glass with a state of “Glass,” although the calculation can be performed for other states as well.

12) [Data Source List] button

Click to open the [Data Source List] window. See 2.4 Data Source list.

13) [Ternary Plot] icon

Click to open the [Select Ternary Plot Condition] dialog box for Ternary Plot. See 3.1 [Ternary Plot] window.

14) [XY Plot] icon

Click to open the [XY Plot] window. See 3.2 [XY Plot] window.

15) [Temperature-Property Plot] icon

Click to show the [Temperature-Property Plot] window after clicking on a glass row with high-temperature property data in the search results. See 3.3 [Temperature-Property Plot] window.

16) [Element Distribution] icon

Click to open the [Element Distribution] window. See 3.4 [Element Distribution] window.

17) [Data Interpolation] icon

Click to open the [Select Data Interpolation Condition] dialog box for Data Interpolation. Data Interpolation can be performed to obtain property data at certain temperatures using data at the other temperatures registered in the Property Database. See 3.3 (B) Data Interpolation.

18) [Data Interpolation Reset] icon

Click to delete the interpolated data and reset its condition.

19) [Search Structure DB] icon

Click to search structural data from the Structure Database of the glass listed in the [Data List of Property] window. By clicking the [Search structure DB] icon, the [Glass No. (Structure)] column is added to the list and the Glass Nos. (Structure) appear when structural data of the glasses are in the Structure Database. In some cases, a glass in the list has two or more Glass Nos. (Structure).

20) [Detail Data of Structure] icon

Click to open the [Detail data of Structure] window of the glass after clicking on a glass row with Glass No. (Structure). See 5.3 [Detail Data of Structure] window.

21) [Glasses from a Data Source] icon

First select a row, and then click to open the [Glasses from a Data Source] window to check all the

glasses that are included in the same data source as that of the selected row. See 2. 5 [Glasses from a Data Source] window.

22) [Save] icon

Click to save the [Data List of Property] window. In the [Save] dialog box, select a save folder, enter a file name, and click the [Save] button.

23) [Open] icon

Click to open the [Data List of Property] window of a saved file. In the [Open] dialog box, select a saved folder, and click the [Open] button. After the [Data List of Property] window opens, the search conditions in the [Search Property Data] window can be checked by clicking the  [Back] icon.

24) [CSV File] icon

Click to save the search result and its search conditions as a CSV file. In the [Save] dialog box, select a save folder, enter a file name, and click the [Save] button. When data for Information, Component, Property, Structure, etc. appear in the table, the saved CSV file includes those. Usually the file-type extension “.csv” is appended, which ensures that the file is compatible with Microsoft Excel.

25) [Print] icon

Click to print the data list of the window.

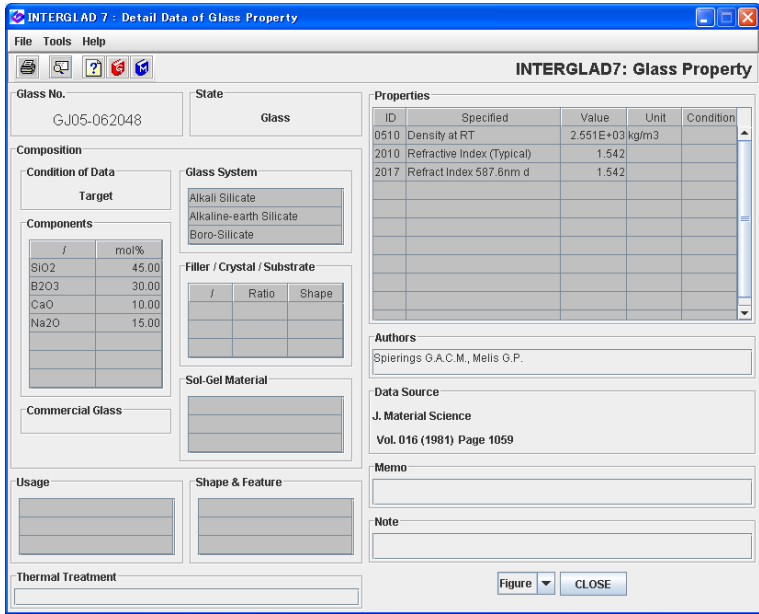
26) [Back] icon

Click to go back to the previous [Search Property Data] window.

2. 3 [Detail Data of Property] window

(1) Window configuration

[Detail Data of Property] window



INTERGLAD 7 : Detail Data of Glass Property

File Tools Help

Glass No. GJ05-062048 State Glass

Composition

Condition of Data Target

Components

f	mol%
SiO2	45.00
B2O3	30.00
CaO	10.00
Na2O	15.00

Commercial Glass

Usage

Shape & Feature

Thermal Treatment

Properties

ID	Specified	Value	Unit	Condition
0510	Density at RT	2.551E+03	kg/m3	
2010	Refractive Index (Typical)	1.542		
2017	Refract Index 587.6nm d	1.542		

Authors

Spiersings G.A.C.M., Melis G.P.

Data Source

J. Material Science
Vol. 016 (1981) Page 1059

Memo

Note

Figure CLOSE

(2) Details

The [Detail Data of Property] window shows all registered information for a searched glass. This window appears by selecting a glass in the following windows: [Data List of Property], [Glasses from a Data Source], [Ternary Plot], [XY Plot], [Data List for Regression Analysis], and [Verification of Regression Analysis]. The units of component and property are the same as those specified during data input.

The unit for the Ratio of the [Filler/Crystal/Substrate] column is mass%, although vol% is used in rare cases. When vol% is used, such a description is in the [Note] column.

- Condition of Data: Component value (%) is one of analyzed data, batch data (preparation values by those of raw materials), or target data (values calculated from those of raw materials).
- Thermal Treatment: Thermal treatment conditions for a given glass are listed in this column.
- Authors: All authors of the data source for a given glass are listed in this column.

- Memo: Glass manufacturing process, measurement method of property, patent main claim about composition, patent applicant of Others, etc., for a given glass are listed in this column.

(A) Pulldown menus, buttons, and icons

1) [Figure] pulldown menu

When a glass has figure data, display the figure by selecting any figure on the 2nd row or below in the [Figure] pulldown menu.

a) Two types of figures

- Figures resulting from a property equation (See Sec. 2 of Chapter 6)

When the constants of any of the following property equations of a glass are registered in the database, the equation can be selected to show the resultant figure.

- Fulcher's equation of viscosity (VFT equation)
- Temperature dependence of diffusion (Arrhenius equation)
- Refractive index dispersion equation
- Temperature dependence of electric conductivity (Arrhenius equation)
- Temperature dependence of DC resistivity (Arrhenius equation)
- Temperature dependence of AC resistivity (Arrhenius equation)

- Figures registered as table data (See Sec. 3 of Chapter 6).

- Thermal expansion curve
- Optical transmission spectrum
- Optical absorption spectrum
- Optical reflection spectrum
- Optical radiation spectrum

b) [X Axis, Y Axis, Style] pulldown menu in the [Figure] window

The style of the X axis, Y axis and plot can be changed by using this pulldown menu.

c) Option (Axis), Option (Mark)

The Option (Axis) and Option (Mark) from the Tools menu for the graph are available. (See 3. 2. (2) (A) 4) of Chapter 3.)

d) Saving as a jpg file

The figure can be saved as a jpg file by clicking the [Save] icon in the [Plot] window.

e) [Print] icon

Click to print the figure.

2) [Close] button

Click to close the [Detail Data of Property] window.

3) [Print] icon

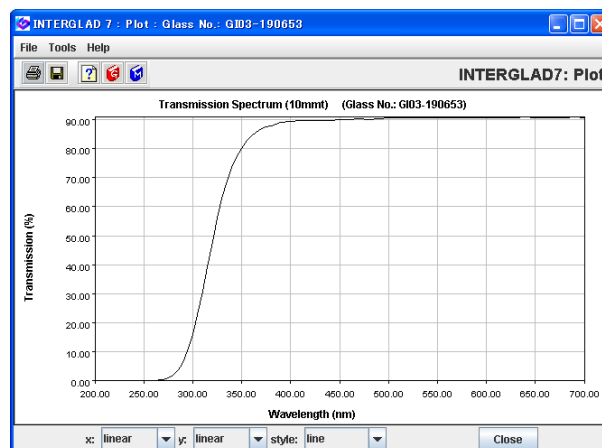
Click to print the contents of the **re** window as a list.

4) Saving as a CSV file

The contents of the window can be saved as a CSV file by selecting Save Data (CSV) of File on the menu bar.

5) [Glasses from a Data Source] icon

Click to open the [Glasses from a Data Source] window for glasses that belong to the same data source as that of the glass displayed in the [Detail Data of Property] window. See 2. 5 [Glasses from a Data Source] window.



Example of Figure: UV-IR transmission spectrum

2. 4 [Data Source List] window

(1) Window configuration

[Data Source List] window

Data Source	Year	Data Source Number	Author	Memo	Num of Data
1 Japanese Patent	1982	A077041			19
2 Japanese Patent	2000	A340124			10
3 Handbook of Glass Prop.	1986	Vol. 001 Page 0173			19
4 Matsunami Glass (J)		GC-538			1
5 Japanese Patent	2002	A326839			7
6 Japanese Patent	2006	A262501		Melting : in Pt crucible at ...	10
7 US Patent	2001	A6197429			10
8 Okuno Chemical Ind (J)		OKJNO-OC-780			1
9 Handbook of Glass Data	1987	Vol. 00C Page 0138			26
10 Japanese Patent	1980	A113641			7
11 European Patent	2009	A2072477		Melting : in Pt crucible at ...	10
12 Japanese Patent	1998	A236844			6
13 Nippon Electric Glass (J)	1989	GP-014			1
14 Japanese Patent	2011	A079684		Melting : in Pt crucible at ...	10
15 Japanese Patent	1981	A026746			6
16 Japanese Patent	1992	A254434			12
17 Japanese Patent	1991	A215328			32
18 Data Book of Glasses C...	1991	Vol. 001 Page 0060			7
19 US Patent	1986	A4618590			2
20 European Patent	1991	A0454734			7
21 J. Material Sci.: Mater. Elec	2010	Vol. 021 Page 000889	Abu-Mosallam H.A., Dar...	Melting : in Pt-Rh crucibl...	6
22 Proc. ICO	1998	Vol. 005 Page 005	Lazutova L.I., Rabkin V...		12
23 European Patent	1991	A0445877		Company: Ceramica Fili...	4
24 US Patent	2008	A7452607		Melting : in Pt crucible at ...	15

(2) Details

The [Data Source List] window appears by clicking the [Data Source List] button in the [Data List of Property] window. This window shows all data sources for the glasses shown in the [Data List of Property] window. Each row of the table indicates data for a data source. Number of Data refers to the number of glasses included in each data source.

(A) Buttons and icons

1) [Close] button

Click to close the [Data Source List] window.

2) [CSV File] icon

Click to save the contents of the [Data Source List] window as a CSV file. In the [Save] dialog box, select a save folder, enter a file name, and click the [Save] button.

3) [Print] icon

Click to print the contents of the display window.

4) [Glasses from a Data Source] icon

Click to open the [Glasses from a Data Source] window for glasses that belong to the selected data source in the [Data Source List] window. See 2. 5 [Glasses from a Data Source] window.

2. 5 [Glasses from a Data Source] window

(1) Window configuration

[Glasses from a Data Source] window

	Glass No.	SiO2	B2O3	CaO	Na2O	K2O	GeO2	Density at RT (kg/m3)
1	GJ02-062040	45.00		10.00	15.00		30.00	3.059E+03
2	GJ02-062041	45.00	3.80	10.00	15.00		26.20	3.009E+03
3	GJ02-062042	45.00	7.50	10.00	15.00		22.50	2.945E+03
4	GJ02-062043	45.00	11.30	10.00	15.00		18.70	2.898E+03
5	GJ02-062044	45.00	15.00	10.00	15.00		15.00	2.834E+03
6	GJ05-062045	45.00	18.80	10.00	15.00		11.20	2.760E+03
7	GJ05-062046	45.00	22.50	10.00	15.00		7.50	2.694E+03
8	GJ05-062047	45.00	26.30	10.00	15.00		3.70	2.620E+03
9	GJ05-062048	45.00	30.00	10.00	15.00			2.551E+03
10	GJ02-062049	45.00		10.00		15.00	30.00	2.931E+03
11	GJ02-062050	45.00	3.80	10.00		15.00	26.20	2.891E+03
12	GJ02-062051	45.00	7.50	10.00		15.00	22.50	2.854E+03
13	GJ02-062052	45.00	11.30	10.00		15.00	18.70	2.804E+03
14	GJ02-062053	45.00	15.00	10.00		15.00	15.00	2.747E+03
15	GJ05-062054	45.00	18.80	10.00		15.00	11.20	2.685E+03
16	GJ05-062055	45.00	22.50	10.00		15.00	7.50	2.619E+03
17	GJ05-062056	45.00	25.00	10.00		15.00	5.00	2.580E+03
18	GJ05-062057	45.00	30.00	10.00		15.00		2.491E+03

(2) Details

Data for all glasses from the same data source as that of the selected glass are shown in the [Glasses from a Data Source] window. To open this window, select a glass row in the [Data List of Property] window or the [Data Source List] window and click the [Glass from a Data Source] icon. This window can be also opened by clicking the [Glasses from a Data Source] icon in the [Detail Data of Property] window. The light-blue row shows the selected glass in the [Data List of Property] window or the [Detail Data of Property] window.

(A) List

The following key data for each glass are given in the list.

1) Glass number

2) Component

The unit of components is that specified in the [Data List of Property] window. Conversion between mol% and mass% is possible by using the [Component Unit] pulldown menu.

3) Filler/Crystal/Substrate

The unit for the Ratio of Filler/Crystal/Substrate column is usually mass%, although vol% is used in rare cases. When vol% is used, such a description appears in the [Note] column of the [Detail Data of Property] window.

4) Sol-Gel Raw Material

5) Property

Property values indicated in blue refer to conditional data. It is possible to confirm the condition in the [Properties] column of the [Detail Data of Property] window. The property unit can be changed using the [Property Unit] pulldown menu. The default unit is the one that is specified in the [Data List of Property] window. A figure in the list implies that table data (See Sec. 3 of Chapter 6) or property equation data exists (See Sec. 2 of Chapter 6). The figure can be opened from the [Detail Data of Property] window.

(B) Information regarding data source

The upper-left section of the window shows information for the Data Source, Data Source Number (volume, page), year, and all authors, as well as memos concerning glass preparation methods, heat treatment, methods of property measurement, etc.

(C) Pulldown menus, buttons, and icons

1) [Component Unit] pulldown menu

Conversion between mol% and mass% units is possible using the [Component Unit] pulldown menu. In the case of glass containing components with an uncertain molecular weight, such as R₂O, Kaolin and Others, conversion is not possible, so the pre-existing numerical data is replaced by a red asterisk *. When returning to the initial unit, the values go back to the initial values. In some cases, a black asterisk is replaced by a red one after unit conversion, even if numerical data of the content in the changed unit has been registered for the glass. This is the case for glass with at least one component with an uncertain molecular weight. Such a case is shown when the search is performed using the unit in which the numerical values do not appear in the [Detail Data of Property] window.

2) [Property Unit] pulldown menu

Click to change the property unit.

3) [Detail] button

Click the [Detail] button after selecting a row to show the [Detail Data of Property] window.

4) [Close] button

Click to close the [Glasses from a Data Source] window.

5) [XY Plot] icon

Click to open the [XY Plot] window for glasses from the list in the [Glasses from a Data Source] window. See 3.2 [XY Plot] window.

6) [Ternary Plot] icon

Click to open the [Select Ternary Plot Condition] dialog box for glasses from the list in the [Glasses

from a Data Source] window. See 3.1 [Ternary Plot] window.

7) **[Print] icon**

Click to print the contents of the displayed window as a table.

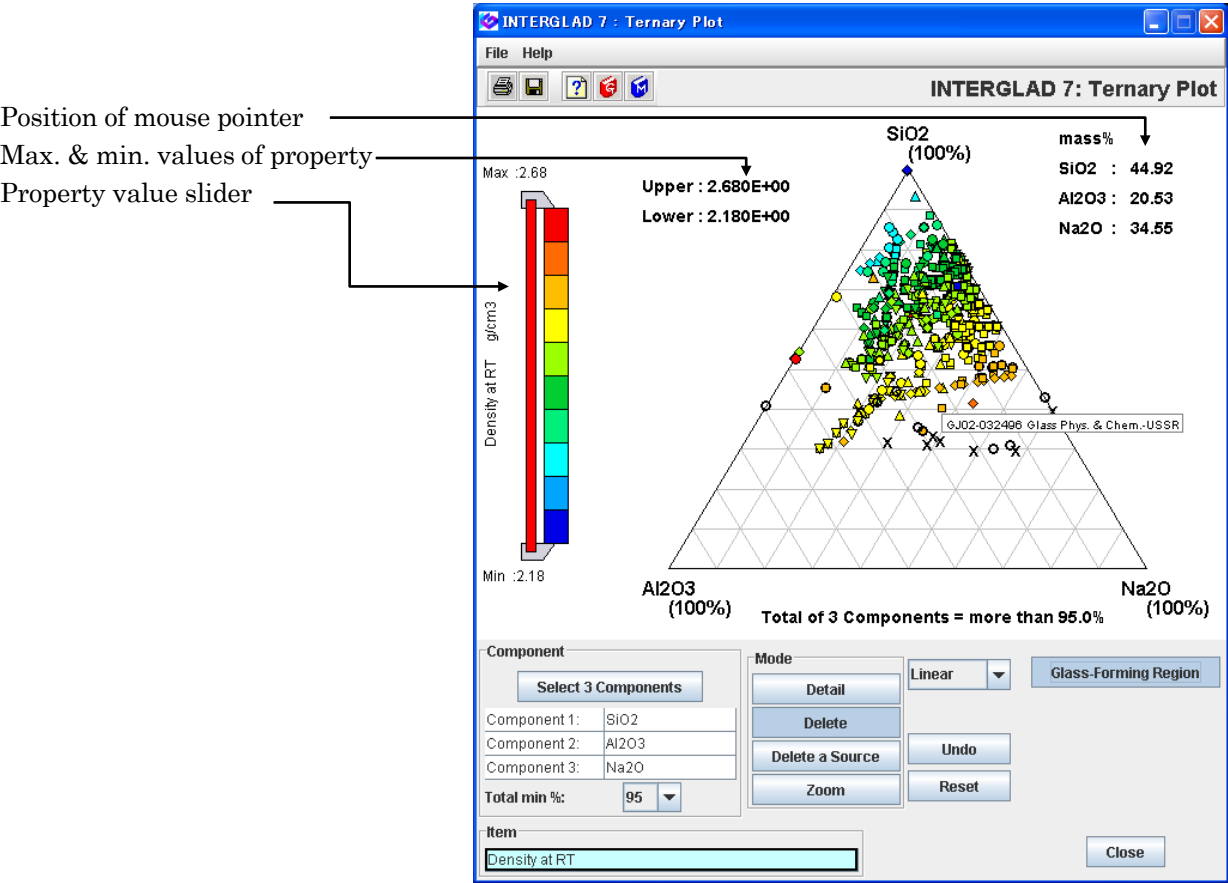
8) **Print Detail Data of Property**

Click [Print (Detail of Glass Data)] of File on the menu bar to print the contents of the all Detail Data of Property as tables.

3. Analysis for Property Database

3.1 [Ternary Plot] window

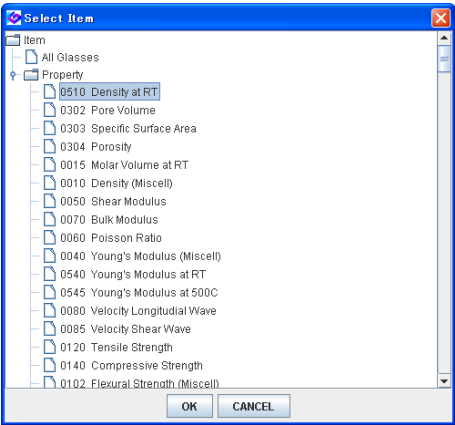
(1) Window configuration



[Ternary Plot] window



[Select 3 Components] dialog box



[Select Item] dialog box

(2) Details

The property data of the glasses searched are shown on a ternary diagram of three components.

(A) [Select Ternary Plot Condition] dialog box

By clicking the [Ternary Plot] icon in the [Data List of Property] window, the [Ternary Plot] window opens. In the [Component] column in the left-hand lower part of the window, first click the [Select 3 Components] button and select three components for a ternary plot in the [Select 3 Components] dialog box. Then a Ternary Plot appears under the default conditions. In the [Select 3 Components] dialog box, checks for Main components in the [Search Property Data] window are reflected.

Secondly select a total minimum % of the selected three components by the [Total min%] pull-down menu. The default value is 95%. In most cases of glasses with four or more components, the total minimum % is recommended to be lower than 100% to show many data. Glasses for which the sum of the three components does not reach the minimum value are excluded, and the three components of the remaining glasses are proportionally converted to total 100%.

Thirdly select an item for a ternary plot in the [Select Item] dialog box opened by double-clicking the [Item] column. The default item is All Glasses, which shows all compositions of the 3 components with the specified total minimum % in the list. The user can select a property item with numerical data.

When the 3 conditions described above are changed, the corresponding Ternary Plot appears.

(B) [Ternary Plot] window

1) [Property value] slide bar

The Max and Min value at the both sides of the slider correspond to the maximum and minimum values of the specified property for the specified glasses. The property label and the unit are indicated in the left-hand side of the slider bar. By sliding the upper pointer and/or lower slider by dragging, the maximum value and minimum value of plot-points can be changed. The Upper and Lower values correspond to the positions of the upper and lower slider respectively. Drag the red bar up and down to move the upper and lower slider together.

2) Plot-points

The property data are shown in a ternary diagram as plot-points with ten steps of colors from dark blue to red, which indicate the height of the property value on the slide bar. Only plot-points of glasses with property between the Upper and Lower value appear.

When "All Glasses" is selected in the [Select Item] dialog box, all the positions of 3 components are plotted for all the specified glasses. Shapes of plot-points are different according to their data sources. Five kinds of shapes are used. By putting the mouse pointer at a plot-point, its glass number and data source are shown in a balloon. The position of the mouse pointer is indicated in the right-hand upper part with unit%.

Selecting Option (Mark) in the Tools menu on the menu bar opens the [Option (Mark)] dialog box. When All Glasses is selected, the shape and color of plot-points can be changed. When a property is selected as an item, only the shape can be changed. (See 3. 2. (2) (A) 4) of Chapter 3.)

3) [Glass-Forming Region] button

Clicking the [Glass-forming Region] button shows the glass-forming region of the two or three component system plotted on a ternary diagram. Only the data with 100% of the total amount of 2 or 3 components are registered as the glass-forming region data.

Completely transparent glass is denoted by a circle ○, while the composition with which it is difficult to produce transparent glass is denoted by an ×. The region to the circle ○ side of a boundary line of ○ and × is the glass-forming region. The glass-forming region is indicated also by only a boundary line. By re-clicking the button the glass-forming region data are deleted.

(C) Other Buttons, Pull-down menus, Icons

1) [Detail] button

With the [Detail] button active, click on any plot-point. The [Detail Data of Property] window for the

pointed glass appears. The detail window for any plot-point can also be shown through a dialog box called up by right-clicking the mouse.

2) [Delete] button

With the [Delete] button active, click on any plot-point to delete it. The result of the deletion is simultaneously recorded in the checkbox for the glass in the [Data list of Property] window. The deletion of any plot-point can also be achieved using a dialog box called up by right-clicking the mouse. By the data deletion, the Upper and Lower values and colors of the points change.

3) [Delete a Source] button

With the [Delete Source] button active, clicking on any plot-point deletes all plot-points belonging to the same data source. The result of the deletion is simultaneously recorded in the checkboxes for the glasses in the [Data list of Property] window. The deletion can also be achieved using a dialog box called up by right-clicking the mouse. By the deletion of a Source, the Upper and Lower values and colors of the points change.

4) [Undo] button

- ① Click to undo the last 'Delete' or 'Delete a Source' operation.

(イ) 5) [Zoom] button

- ① With the [Zoom] button active, specify a part of the window by dragging with the mouse to enlarge the part of the window.

6) [Reset] button

Click to undo the previous 'Zoom' operation.

7) [Property Scale] pull-down menu

Change the scale of the X and Y axes using the pull-down menu. Linear, logarithmic scales are available. Linear is set as the default. When logarithmic scale is chosen, log (property value) values are shown without negative values and zero.

8) [Close] button

Click to close the window.

9) [Print] icon

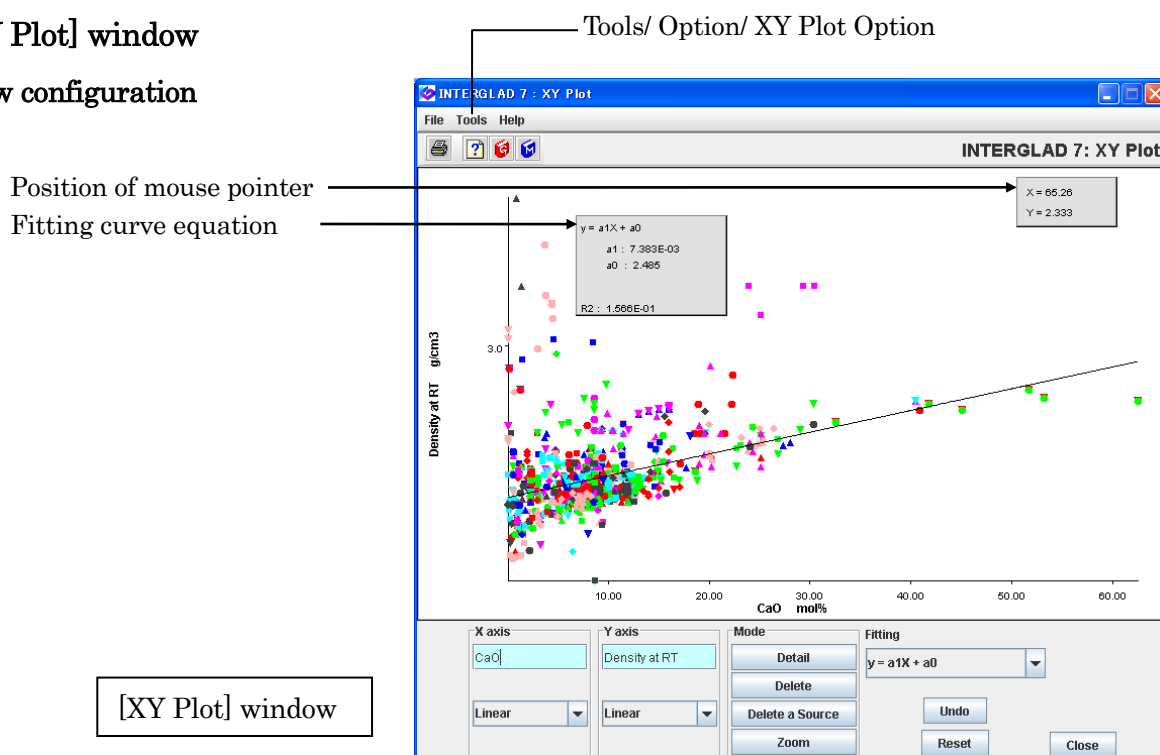
The window is printed.

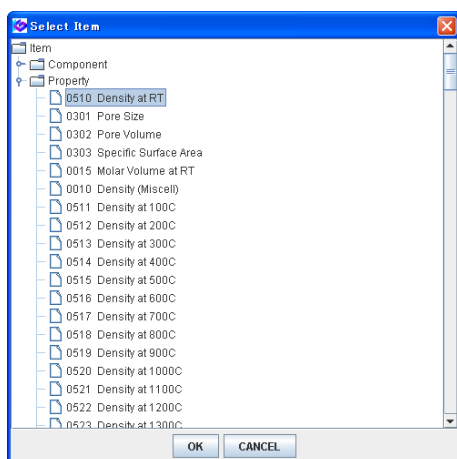
10) [Save] icon

Click to save the image of the window.

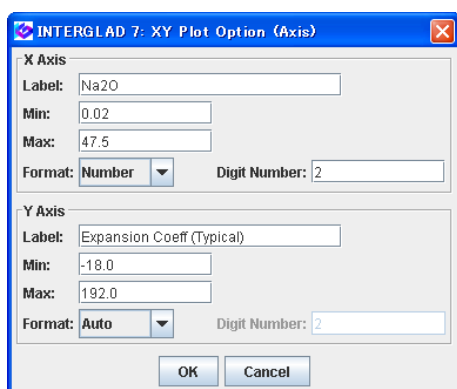
3.2 [XY Plot] window

(1) Window configuration

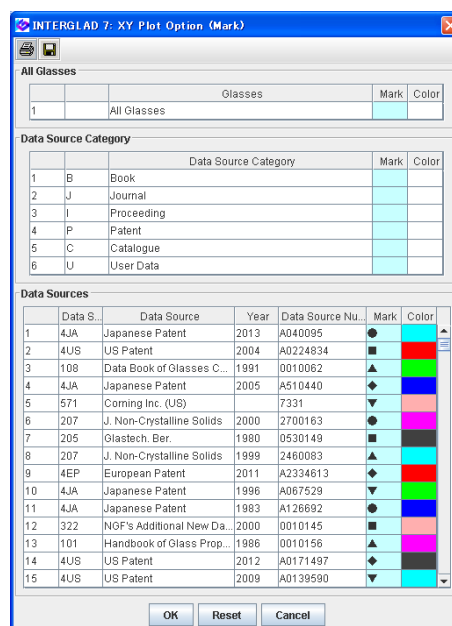




[Select Item] dialog box



[XY Plot Option (Axis)] dialog box



[XY Plot Option (Mark)] dialog box

(2) Details

XY plots can be drawn using the data of glasses in the [Data List of Property] window.

(A) Graph

By clicking the [XY Plot] icon in the [Data List of Property] window, the [XY Plot] window opens. The data are plotted after specifying the X and Y axes. The plot-points are differentiated by both shape and color, according to their data source. When the mouse-pointer is put at a plot-point, the No. of the [Data list of Property] window, the Glass No. and the Data Source are shown in a balloon.

1) Specification of X and Y axes

Specify required items for X and Y axis in the [Select Item] dialog box opened by clicking the [X axis] and [Y axis] light blue-colored cells. Component and/or property items with numerical data can be selected.

2) Transform the scale of axis

Transform the scale of the X-axis and Y-axis independently using the pull-down menu below each axis cell. Linear, inverse, logarithmic and reverse scales are available, with linear preset as the default. When logarithmic is chosen, negative values and zero are not shown.

3) Fitting curve

A fitting curve for the plot can be drawn using the [Fitting] pull-down menu. Linear, quadratic, or cubic equation is selected. The equation, its coefficients, and R^2 (Contribution Rate) are shown in an appearing column in the graph.

4) XY Plot Option

By selecting Option (Axis) from Tools on the menu bar, the [XY Plot Option (Axis)] dialog box opens. The labels, value ranges (minimum and maximum values), and format of values for both axes can be specified. As the format of values, Auto, Number (decimal style), Scientific (E style) can be selected by the [Format] pull-down menu. When Number or Scientific is selected, number of decimal places (of figure before E for Scientific) can be input in the [Digit Number] cell.

By selecting Option (Mark) from Tools on the menu bar, the [XY Plot Option (Mark)] dialog box opens. The shape and color of plot-points can be specified. The defaults are those of the [Data Sources] column in the lower part of the dialog box, indicated in combination of 5 shapes and 7 colors. When Mark and/or Color in the [All Glasses] column are selected in the non-specified cells, the all plot-points in the graph become the same. By selecting in the cells of the [Data Source Category] column, the shape and/or color of the plot-points can be specified in each Data Source Category. By selecting in the cells of the [Data Sources] column, the shape and/or color of the plot-points can be specified in each Data Source. The priority of the selection in the [All Glasses] column is the highest and the 2nd in the [Data Source Category] column. Clicking the [Reset] button and the [OK] button goes back to the default state.

(B) Other functions

1) [Detail] button

With the [Detail] button active, click on any plot-point. The [Detail Data of Property] window for the pointed glass appears. The detail window for any plot-point can also be shown through a dialog box called up by right-clicking the mouse.

2) [Delete] button

With the [Delete] button active, click on any plot-point to delete it. The result of the deletion is simultaneously recorded in the checkbox for the glass in the [Data list of Property] window. When checks in the checkboxes are changed with open of the [XY Plot] window, the change does not reflect to the graph. The deletion of any plot-point can also be achieved using a dialog box called up by right-clicking the mouse.

3) [Delete a Source] button

With the [Delete Source] button active, clicking on any plot-point deletes all plot-points belonging to the same data source. The result of the deletion is simultaneously recorded in the checkboxes for the glasses in the [Data list of Property] window. The deletion can also be achieved using a dialog box called up by right-clicking the mouse.

4) [Undo] button

Click to undo the last 'Delete' or 'Delete a Source' operation. To reshow previously deleted data, delete the checks in the [Delete] checkboxes in the [Data List of Property] window, and remake the XY Plot.

5) [Zoom] button

With the [Zoom] button active, specify a part of the window by dragging with the mouse to enlarge the part of the window.

6) [Reset] button

Click to undo the previous Zoom operation.

7) [Close] button

Click to close the window.

8) [Print] icon

The window is printed.

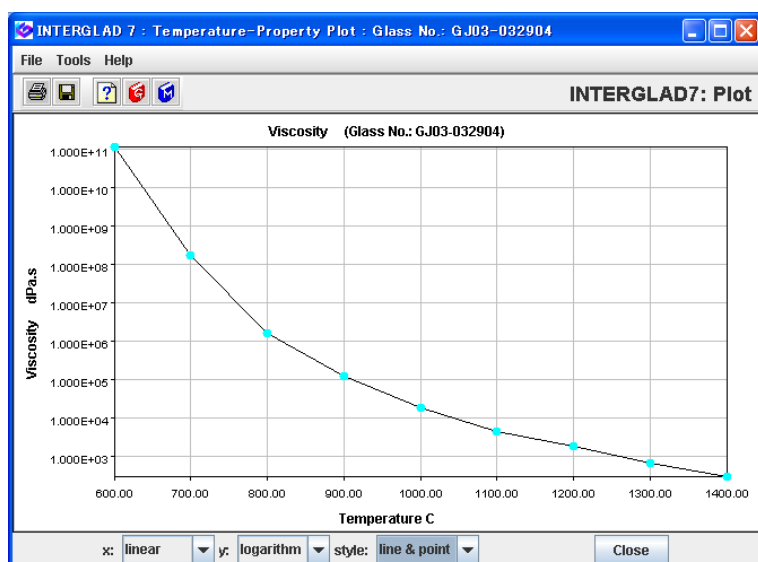
9) [Save] icon

Click to save the image of the window.

3.3 [Temperature-Property Plot] window

When data of property such as density, viscosity at high temperatures are searched, temperature-property XY plot can be displayed for a glass in the [Data List of Property] window. For standard point of viscosity, x axis is for viscosity, and y axis is for temperature. Also data interpolation or expolation can be achieved.

(1) Window configuration



[Temperature-Property Plot] window

[Data Interpolation] dialog box

(2) Details

(A) Graph

Property data searched and the same category property data at different temperatures are plotted in a Temperature-Property Plot by clicking the  [Temperature-Property Plot] icon after selecting a glass in the [Data List of Property] window. The plotted data is limited for the selected glass. Data at room temperature is not displayed in the graph. When calculated data by interpolation or extrapolation exist in the [Data List of Property], those data are also plotted.

The properties for which Temperature-Property Plot can be performed are the following 13 categories:

Density, Young's Modulus, Surface Tension, Specific Heat, Thermal Conductivity, Viscosity, Electric Conductivity, DC Volume Resistivity, AC Volume Resistivity, Dielectric Loss Tangent 1kHz, Dielectric Loss Tangent 1MHz, Dielectric Loss Tangent 1GHz, Standard Point of Viscosity (Temperatures at viscosity of 1×10^1 dPa·s– $1 \times 10^{14.5}$ dPa·s). (See Table 1 in Appendix 2 of Chapter 3.)

When two or more high temperature property data are registered for the selected glass, the [Temperature-Property Plot] window for each property appear one upon another.

(B) Pull-down menus, buttons, and icons

1) [Scale Transform] pull-down menu

Transform the scale of the X-axis and Y-axis independently using the pull-down menu below the graph. Linear, inverse, logarithmic scales are available. The default scale depends on property. The scale for Viscosity, Electric Conductivity, DC Volume Resistivity, or AC Volume Resistivity of Y axis is logarithmic, and that for the Temperature of X axis is linear. That for Viscosity of Standard Point of X axis is also logarithmic. In other cases the default scale is linear.

2) [Plot Style] pulldown menu

The plot style can be changed using the pulldown menu. Style of line, point, line & point are available.

3) Option (Axis), Option (Mark)

The Option (Axis) and Option (Mark) from the Tools menu for the graph are available.

(See 3. 2. (2) (A) 4) of Chapter 3.)

4) [Close] button

Click to close the window.

5) [Print] icon

The image of the window is printed.

6) [Save] icon

The image of the window can be saved. Click the [Save] button after inputting a file name and selecting a folder in the [Save] dialog box opened by clicking the [Save] icon or by selecting Save Image of File on the menu bar. The saved image can be opened using Internet Explorer, etc.

(C) Data Interpolation or Extrapolation

High-temperature property values can be calculated for given temperatures by interpolating or extrapolating with available data in the database. This function can be used for 13 property categories as shown in (A) of this section. For Standard Point of Viscosity, temperatures are calculated.

To use this function, select a property item at a temperature with the [Extension Search] checkbox ON, or select a property category with bold letters including property items at 2 or more temperatures and click the [Search] button in the [Search Property Data] window or the [Search for Regression Analysis] window. Or select plural property items at different temperatures and bind them with OR for search.

By clicking the  [Data Interpolation] icon in the [Data List of Property] or the [Data List for Regression Analysis] window, the [Data Interpolation] dialog box opens to select conditions of interpolation. When two or more high temperature property data appear in the data list, the [Data Interpolation] dialog box for each property appear one upon another. The dialog box is explained as follows.

1) Property

A property category (ex. Density, Viscosity) for interpolation appears on the top of the dialog box.

2) Interpolation Condition

a) Rough TG (Glass Transition Point)

Rough TG can be set not to interpolate using both side data separated by the temperature of TG. When the [Avoid to interpolate beyond Tg] checkbox ON, interpolation or extrapolation is performed using data of the lower temperature or higher temperature than the rough TG, which include the data at the given temperature.

b) Temperature Limit

When the data do not exist near the given temperature, reliable interpolation cannot be done. To

avoid such a problem, a temperature limit ($\pm T^{\circ}\text{C}$ of the given temperature) can be selected as a temperature for usable data. When the [Avoid to interpolate too away] checkbox ON, interpolation or extrapolation is performed using the data within the temperature limit. The temperature Limits are 7 steps: $\pm 0^{\circ}\text{C}$, $\pm 50^{\circ}\text{C}$, $\pm 100^{\circ}\text{C}$, $\pm 150^{\circ}\text{C}$, $\pm 200^{\circ}\text{C}$, $\pm 300^{\circ}\text{C}$, $\pm 400^{\circ}\text{C}$. The viscosity limits for Standard Point are 5 steps: $\log \eta = \pm 0$, ± 1 , ± 2 , ± 3 , ± 4 . The default limits are $\pm 200^{\circ}\text{C}$ and ± 2 ($\log \eta$). The calculation is conducted using the data which are in and out of the limit, when at least a value exists in the limit range.

c) Interpolation Equation

Interpolation by linear equation or n-th order polynomial equation can be selected by using the [Interpolation Equation] radio button. 'n' = (the number of data) - 1. The default equation is linear. The n-th order polynomial equation can be applied only for interpolation, not for extrapolation.

d) Variables

The user can compose equations using x, 1/x or log x as an independent variable and y, 1/y or log y as a dependent variable, when x is temperature and y is property value in most cases. The default independent variable is 1/x (reciprocal of absolute temperature) for Viscosity, Electric Conductivity, DC Volume Resistivity, or AC Volume Resistivity, and x for other properties. The default dependent variable is log y for Viscosity, Electric Conductivity, DC Volume Resistivity, or AC Volume Resistivity, and y for other properties. Absolute temperature can be used as temperature by clicking the [use absolute temperature (K)] checkbox.

3) [OK] button

Click to calculate by interpolation or extrapolation under the specified conditions.

4) [CANCEL] button

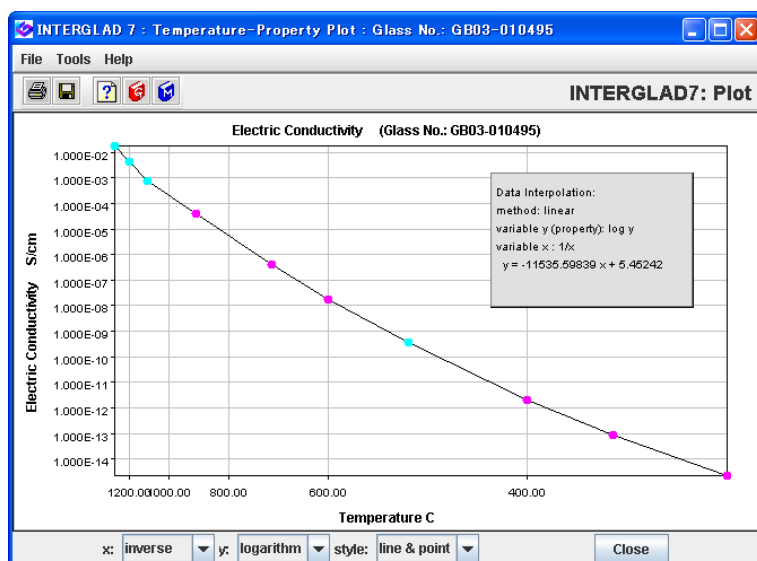
Click to cancel the specified conditions.

5) [Data Interpolation Reset] icon

Click to reset the interpolated or extrapolated values in the [Data List of Property] window or the [Data List for Regression Analysis] window.

6) [Temperature-Property Plot] icon

Click to show the Temperature-Property Plot including the interpolated or extrapolated values in a red-purple color for a selected glass in the [Data List of Property] window or the [Data List for Regression Analysis] window. The interpolation or extrapolation equation is shown in a box on the graph. When n-th order polynomial is used as the interpolation equation, the number 'n' is indicated instead of the equation. The Option (Axis) and Option (Mark) from the Tools menu for the graph are also available. (See 3. 2. (2) (A) 4) of Chapter 3.)

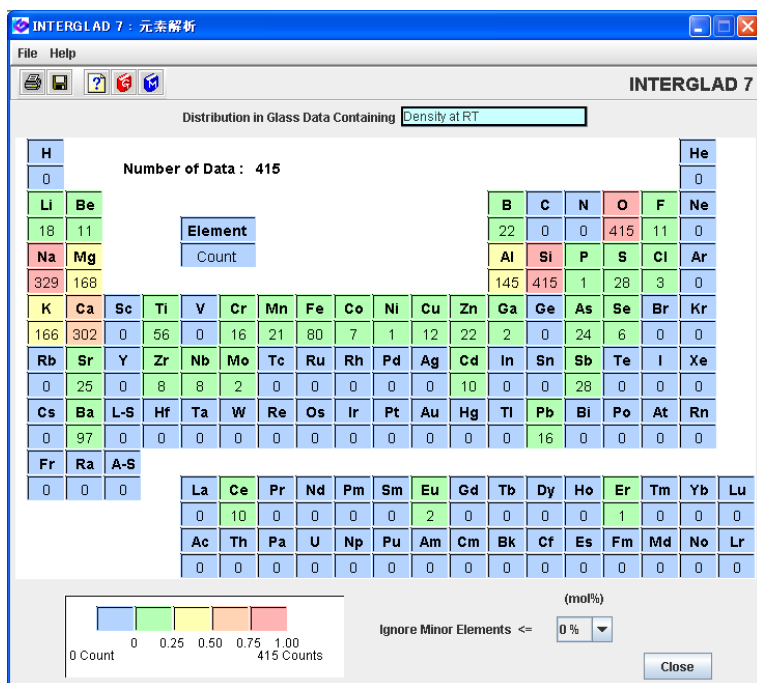


Example of a Temperature - Electric Conductivity Plot with interpolated values in red-purple color.

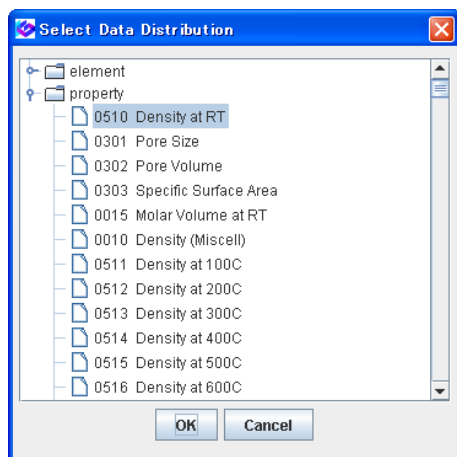
3.4 [Element Analysis (Distribution)] window

Information about composition in the searched glasses is shown in the form of a frequency count for each element in the periodic table.

(1) Window configuration



[Element Distribution] window



[Select Element Distribution] dialog box

(3) Details

By clicking the [Element Distribution] icon in the [Data List of Property] window, the [Element Distribution] window opens.

(A) Property item

The user can select a property item for element analysis in the [Select Element Distribution] dialog box which is opened by double-clicking the [Distribution in Glass Data containing] column (light-blue colored cell). Also all glasses in the searched list can be selected by selecting "all glasses" of element in the [Select Data Distribution] dialog box.

(B) Periodic table

Under each element of the Periodic Table, number of glasses containing the element as a component is

indicated for glasses with the specified property data in the [Data List of Property] window. The number of glasses with * as a component value in the [Data List of Property] window or the [Detail Data of Property] window is also counted. Five different colors are used for the elements and numbers assigned according to the ratio from 0 to the maximum of the color bar in the bottom of the window. The element with 0 glass is light-blue colored. The counting is done as follows. When Al_2O_3 and B_2O_3 are contained in a given glass, 1 for Al, 1 for B, and 1 for O regardless of amount.

(C) Minor Elements

The upper limit of components with minor elements can be selected from 8 levels (0, 1, 5, 10, 15, 20, 25, 30%) in the [Ignore Minor Elements] pulldown menu. Glasses containing the upper limit or less of components with minor elements are not counted for the element. The unit of the specified limit is that of components used for the search.

(D) Other button and icons

1) [Close] button

Click to close the [Element Analysis] window.

2) [Print] icon

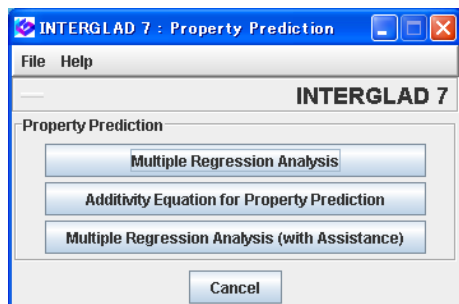
Click to print the contents of the window.

3) [Save] icon

Click to save the image of the window.

4. Property Prediction & Material Designing (Composition Optimization)

Property prediction can be performed by using additivity equations or multiple regression analysis. The [Property Prediction] dialog box opens by clicking the [Property Prediction] button in the [Main] window. Multiple regression analysis can also be used for material designing, i.e., composition optimization, of glasses.

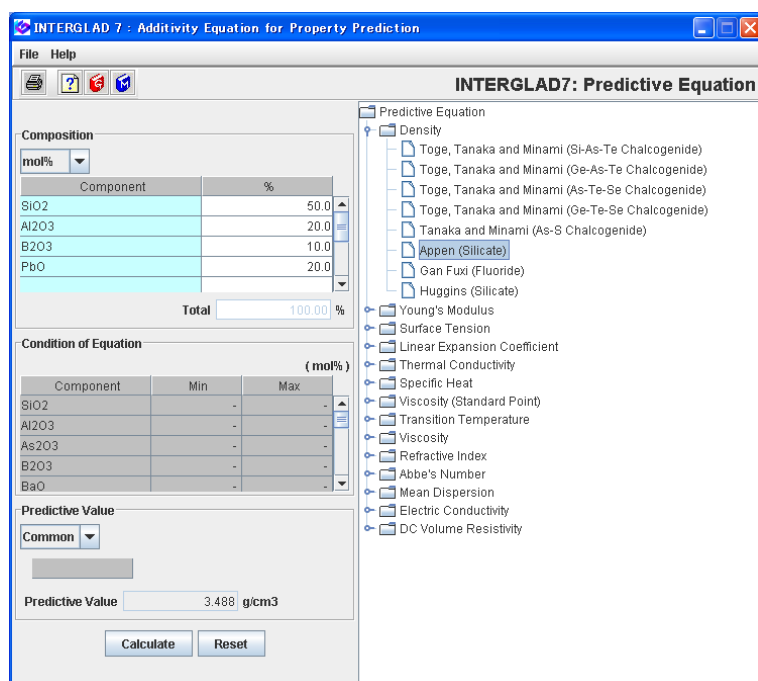


[Property Prediction] dialog box

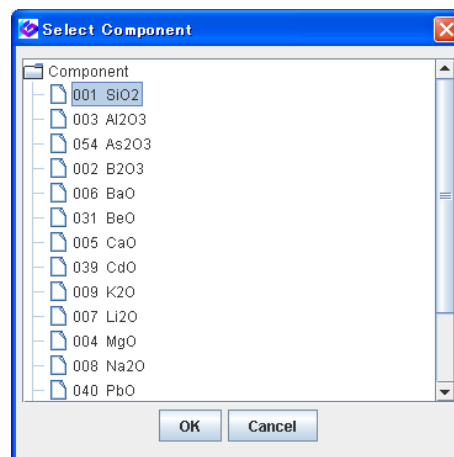
4.1 [Additivity Equation for Property Prediction] window

Click the [Additivity Equation for Property Prediction] button in the [Property Prediction] dialog box. The [Additivity Equation for Property Prediction] window opens. The prediction of a property for a given glass composition is conducted using a selected additivity equation.

(1) Window configuration



[Additivity Equation for Property Prediction] window



[Select Component] dialog box

(2) Details

(A) List of additivity equations

A list of additivity equations appears in the right-hand part of the window. Click the fork mark  next to an item to expand the list, and select an equation by clicking. Then, the constraints of the equation appear in the [Condition of Equation] field and the [Predictive Value] field at the left of the window.

(B) Condition of Equation field

The constraints of the equation regarding the composition are indicated in the list. Components and the minimum and/or maximum limits for the equation are shown.

(C) Composition field

Select components and enter their content values for a specified composition in the [Composition] field. Only components that are applicable to the equation are listed in the [Select Component] dialog box. Multiple components can be selected simultaneously by holding down the Ctrl key while clicking components. The content values have to be in the range indicated in the [Condition of Equation] field.

(D) Predictive Value field**1) Constraints for calculation of the property**

In most cases, the applicable glass system, temperature, and/or viscosity appear below the [Property Unit] pulldown menu. In some cases, white cells appear for entering a temperature or viscosity for calculation.

2) [Predictive Value] column

A predictive property value appears in the [Predictive Value] column after calculation. The unit of the property can be changed by using the [Property Unit] pulldown menu.

(E) Calculation

After selecting an additivity equation, enter a target composition in the [Composition] field, and enter a temperature or viscosity in the white cell of the [Predictive Value] field. After clicking the [Calculate] button, the predictive value appears. When the [Question] dialog box, "Aggregate of composition ratios is not 100%; operation will divide composition proportionally," opens, click the [OK] button. When the composition does not satisfy the condition, a [Warning] dialog "Check equation condition" appears. Moreover, occasionally the calculation is not executed even if the composition fulfills the constraints. In such cases, a [Warning] dialog box, "Check special condition in manual," appears. Refer to the description of the equation in Sec. 1 of Chap. 5, and correct the conditions for the calculation.

4.2 [Search for Regression Analysis] window

Click the [Multiple Regression Analysis] button in the [Property Prediction] dialog box. The [Search for Regression Analysis] window opens. For beginners, the use of the Multiple Regression Analysis (with Assistance) by selecting the [Multiple Regression Analysis (with Assistance)] button is recommended.

(1) Window configuration

This window has a configuration similar to the [Search Property Data (Detail Search)] window. Refer to 2.1 [Search for Property Data] window. There are no [Shape, Feature & Process], [Usage], [Author], or [Glass ID] columns. The property column has three rows.

[Search for Regression Analysis] window

(2) Details

Here, the details those are different from the description in the 2.1 [Search Property Data] window are described.

(A) State

The available glass States for the multiple regression analysis are “Glass,” “Glass+Melt,” and “Melt.” Select the State by clicking the [State] pulldown menu.

(B) Composition

Only glasses with numerical composition data are searched. When the user intends to estimate the influences of small amounts of components, it is effective to enter “0” for the [%min] cells in the [Composition] column.

(C) Property

Three properties can be specified simultaneously in a multiple regression analysis. There are three search modes for the properties as follows. Each differs from the others in the multiple regression analysis process.

1) Specifying with horizontal OR operator

Select property items for the 1st leftmost cell of the [Component] cells. Although there are 2nd and 3rd columns for property items, the data related to these items do not appear in the [Data List for Regression Analysis] window and are not used for the regression analysis.

2) Specifying with vertical AND operator

When the property items are specified vertically in the leftmost column with the AND operator, all of

the searched glasses have values for each search property item. A set of glasses collected for the multiple regression analysis regarding plural property items is composed of the same set. Therefore, the relation among several predicted property values can be expected to have high reliability. However, when the data to be collected are more tightly limited, there are more cases in which a multiple regression analysis is impossible.

3) Specifying with vertical OR operator

When the property items are specified vertically with the OR operator, all of the searched glasses do not necessarily have values for each search property item. A set of glasses collected for the multiple regression analysis may be composed of different sets of glasses for each property item. Therefore, the relationship among the predicted values for each property becomes more tenuous. Specifying search conditions using the vertical OR operator is thus recommended only for compositions and properties with a limited amount of data.

4.3 [Data List for Regression Analysis] window

The searched glasses are listed in the order of their Glass IDs. These data are used for the regression analysis. This window has not only the searched result, but also the result (predictive values) after the regression analysis.

(1) Window configuration

Tools/ Display Glass Data using Regression Analysis
/ Reset Glass Data using Regression Analysis
[Verification of Regression Analysis] icon
[Property Prediction] icon
[Composition Optimization] icon
Dark-grey display for glasses not used for regression analysis

Delete	No.	Glass No.	Data Source	Year	Data Source Number	SiO2	B2O3	Al2O3	Na2O	MgO	CaO	Density at RT (g/cm3)	Density at RT (Predictive Value)
☐	338	GB05-174631	Data Book of Glass...	1991	v.001, p.0090	69.18	1.13	2.53	8.12			2.49	2.476
☐	339	GB05-174683	Data Book of Glass...	1991	v.001, p.0099	63.94	2.77	1.86	2.57			2.5	2.577
☐	340	GB05-174631	Data Book of Glass...	1991	v.001, p.0110	69.18	1.13	2.53	8.12			2.49	2.476
☐	341	GB05-174767	Data Book of Glass...	1991	v.001, p.0130	62.72	18.02	5.84	10.11			2.53	2.326
☐	342	GB06-174798	Data Book of Glass...	1991	v.001, p.0143	73.07	4.24	11.22	1.79			2.58	
☐	343	GB06-174799	Data Book of Glass...	1991	v.001, p.0145	83.34	11.28	1.39	3.99			2.23	
☐	344	GB06-174799	Data Book of Glass...	1991	v.001, p.0145	73.07	4.24	11.22	1.79			2.58	2.574
☐	345	GB05-174801	Data Book of Glass...	1991	v.001, p.0145	83.34	11.28	1.39	3.99			2.23	2.234
☐	346	GB05-174802	Data Book of Glass...	1991	v.001, p.0146	78.49	14.26	1.22	5.41	0.22		2.23	2.264
☐	347	GB05-174807	Data Book of Glass...	1991	v.001, p.0149	73.87	10.33	3.07	10.59			2.39	2.371
☐	348	GP02-178440	Japanese Patent	1997	A052730	72.10	0.45	6.09	15.90	5.37		2.461	2.492
☐	349	GP02-178744	Japanese Patent	1997	A124338	77.84	0.87	2.03	15.04	3.47		2.398	
☐	350	GP02-178745	Japanese Patent	1997	A124338	77.15	1.31	2.03	13.36	4.08	0.98	2.409	
☐	351	GP02-178746	Japanese Patent	1997	A124338	78.28	1.32	0.60	11.34	1.52	4.36	2.428	
☐	352	GP02-178747	Japanese Patent	1997	A124338	76.97	1.29	0.59	11.15	7.45		2.419	
☐	353	GP02-178763	Japanese Patent	1997	A124339	77.84	0.87	2.03	15.04	3.47		2.398	
☐	354	GP02-178764	Japanese Patent	1997	A124339	77.15	1.31	2.03	13.36	4.08	0.98	2.409	2.408
☐	355	GP02-178765	Japanese Patent	1997	A124339	78.28	1.32	0.60	11.34	1.52	4.36	2.428	
☐	356	GP02-178766	Japanese Patent	1997	A124339	76.97	1.29	0.59	11.15	7.45		2.419	
☐	357	GP02-178773	Japanese Patent	1997	A124340	77.62	0.44	2.02	14.87	2.56	2.49	2.413	2.427

[Data List for Regression Analysis] window

Select Component Terms
-Selection of 1-Component Terms-

If necessary, change the following condition : Apply

☒ Min. num. of glasses = 1 % of total retrieved glasses
☒ Min. num. of glasses = 2 glasses to one component

Select All Component Clear All Component

Component	Number of Glasses	Max. Content %
☒ SiO ₂	731	97.210
☒ B ₂ O ₃	731	59.000
☒ Al ₂ O ₃	731	35.000
☒ Na ₂ O	731	30.000
☒ MgO	158	7.450
☒ CaO	386	10.000
☒ BaO	171	8.900
☒ Li ₂ O	157	10.000
☒ K ₂ O	375	8.060
☐ Ag ₂ O	1	0.110
☐ MnO	1	0.004
☒ FeO	14	0.170
☐ CoO	4	0.560
☐ NiO	4	6.720
☐ CuO	2	0.020
☒ ZnO	94	8.800
☒ SrO	33	5.000
☐ CrO	3	1.980

BACK Next OK Cancel

Selection of 1-Component Terms

Select Component Terms
-Selection of 2-Component Terms-

If necessary, change the following condition : Apply

☒ Min. num. of glasses = 7 % of total retrieved glasses
☒ Min. num. of glasses = 10 glasses to one component
☒ Max. num. of components = 50 % of num. of 1-component terms

Select All Component Clear All Component

Component	Number of Glasses	Max. Content %
☒ SiO ₂	731	97.210
☒ B ₂ O ₃	731	59.000
☒ Al ₂ O ₃	731	35.000
☒ Na ₂ O	731	30.000
☒ MgO	158	7.450
☒ CaO	386	10.000
☒ BaO	171	8.900
☒ Li ₂ O	157	10.000
☒ K ₂ O	375	8.060
☐ Ag ₂ O	1	0.110
☐ MnO	1	0.004
☐ FeO	14	0.170
☐ CoO	4	0.560
☐ NiO	4	6.720
☐ CuO	2	0.020
☒ ZnO	94	8.800
☐ SrO	33	5.000
☐ CrO	3	1.980

BACK Next OK Cancel

Selection of 2-Component Terms

Select Component Terms
-Selection of 3-Component Terms-

If necessary, change the following condition : Apply

☒ Min. num. of glasses = 15 % of total retrieved glasses
☒ Min. num. of glasses = 10 glasses to one component
☒ Max. num. of components = 30 % of num. of 1-component terms

Select All Component Clear All Component

Component	Number of Glasses	Max. Content %
☒ SiO ₂	731	97.210
☒ B ₂ O ₃	731	59.000
☒ Al ₂ O ₃	731	35.000
☒ Na ₂ O	731	30.000
☒ MgO	158	7.450
☒ CaO	386	10.000
☒ BaO	171	8.900
☐ Li ₂ O	157	10.000
☒ K ₂ O	375	8.060
☐ Ag ₂ O	1	0.110
☐ MnO	1	0.004
☐ FeO	14	0.170
☐ CoO	4	0.560
☐ NiO	4	6.720
☐ CuO	2	0.020
☐ ZnO	94	8.800
☐ SrO	33	5.000
☐ CrO	3	1.980

BACK Next OK Cancel

Selection of 3-Component Terms

[Select Component Terms] dialog boxes

Selection of Explanatory Variables in Multiple Regression Analysis:
1-Component Terms: 28
2-Component Terms: 91
3-Component Terms: 56

OK Cancel

[Confirm Component Terms] dialog box

(2) Details

This window has a configuration similar to the [Data List of Property] window. Refer to 2.2 [Data List of Property] window. Here, the details those are different from the description in 2.2 are described.

(A) Property

The properties specified in the [Search for Regression Analysis] window appear in the searched glasses table. No other property items can be added to this window. Each property is shown in three columns:

- 1) **Property Value** (the first column): The searched fact values.
- 2) **Predictive Value**: Calculated values from the prediction equation obtained by the multiple regression analysis. These appear after the execution of the multiple regression analysis. Even when there is no numerical property value, a predictive value is calculated if its composition has numerical values.
- 3) **Residual**: Difference between fact value and predictive value. This also appears after the execution of

the multiple regression analysis.

The color of the property label is different for each property. When the user changes the component terms, or converts the unit system after the execution, he/she has to re-calculate the predictive and residual values.

(B) Selection of explanatory variables

Clicking the [Component] button opens the [Select Component Terms] dialog boxes, which are used for the selection of one-component terms to three-component terms. First, in the [Selection of 1-Component Terms] dialog box, select components to use as explanatory variables. When the user clicks the [OK] button, he/she can proceed to conduct the multiple regression analysis with a linear equation. When the user clicks the [Next] button, he/she can proceed to conduct the multiple regression analysis with a quadratic or cubic equation.

In each dialog box, the conditions for the component terms can be determined using the three checkboxes and cells in the upper field.

The first cell: the minimum percentage of glasses that contain the component out of the total searched glasses.

The second cell: the minimum number of glasses that contain the component.

The third cell (for the 2- and 3-component terms): the maximum percentage of components for the 2-component terms (3-component terms) to the number of 1-component terms.

The default value and checkbox in each row are set. When the user has changed the conditions, he/she must first click the [Apply] button and then click the [Next] button or [OK] button. Otherwise, the user can select the components for 1-, 2-, and/or 3-component terms optionally by using the [Select All Component] button, or the [Clear All Component] button and the checkbox for each component. In each dialog box, the [BACK] button returns to the previous dialog box, and the [Cancel] button returns to the state before clicking the [Component] button. After selecting the component terms by clicking the [OK] button, the [Confirm Component Terms] dialog box appears. When the numbers of 1-, 2-, and 3-component terms are appropriate, click the [OK] button. When not appropriate (there are too many or too few), click the [Cancel] button to re-select the component terms. It is recommended that the total number of component terms be less than 100. All of the selected component terms appear in the list of the [Data List for Regression Analysis] window.

(C) Other Checkbox, buttons, and icons

1) [Delete] checkbox

Glass data with the [Delete] checkbox checked are not used for the regression analysis. A checkbox is checked automatically when the [OK] button is clicked in the [Question] dialog box of the [Execution of Regression Analysis] window, or its plot-point is deleted in the [Verification of Regression Analysis] window.

2) [Analyze] button

After the component terms are selected, clicking the [Analyze] button opens the [Execution of Regression Analysis] window.

3) [Verification of Regression Analysis] icon

Click to open the [Verification of Regression Analysis] window. This icon becomes active after the regression analysis has been conducted in the [Execution of Regression Analysis] window.

4) [Property Prediction] icon

Click to conduct property prediction for a given composition. This icon becomes active after the regression analysis has been conducted in the [Execution of Regression Analysis] window.

5) [Composition Optimization] icon

Click to conduct composition optimization for given properties. This icon becomes active after the regression analysis has been conducted in the [Execution of Regression Analysis] window.

6) Display Glass Data using Regression Analysis

After the execution of the regression analysis, clicking [Display Glass Data using Regression Analysis] of Tools on the menu bar changes the [No.] cells of glasses which are not used for the regression analysis

to dark-grey color. So the glasses with noncolored [No.] cells are those which are used for the regression analysis. The user can check that depending on the conditions in the [Execution of Regression Analysis] window there exists glasses which are not used for the regression analysis, even when whose delete checkbox is not checked. The dark-grey color disappears by clicking [Reset Glass Data using Regression Analysis] of Tools on the menu bar. When the regression analysis is performed for 2 or 3 properties, [No.] cells of glasses which are not used for the regression analysis of at least one property changes to dark-grey. The user can know for which property the glass data is not used by ascertaining that there is not a value in the 'Predictive Value' column of the property for the glass.

7) [Save] icon

By this icon the result of the regression analysis including the contents of the [Search for Regression Analysis] window, the [Data List for Regression Analysis] window, and the [Execution of Regression Analysis] window can be saved. When a save folder has been registered for the [Default Folder] in the [Preference] dialog box, click the [Save] icon to open the save folder, and save the file with a name in it in the [Save] dialog box.

8) [Open] icon

By clicking this icon in a [Data List for Regression Analysis] window, a saved result of the regression analysis can be opened. Open a save file in the [Save] dialog box, and the corresponding [Execution of Regression Analysis] window and the [Data List for Regression Analysis] window open overlapped. Clicking the [Back] icon in the [Data List for Regression Analysis] window opens the corresponding [Search for Regression Analysis] window.

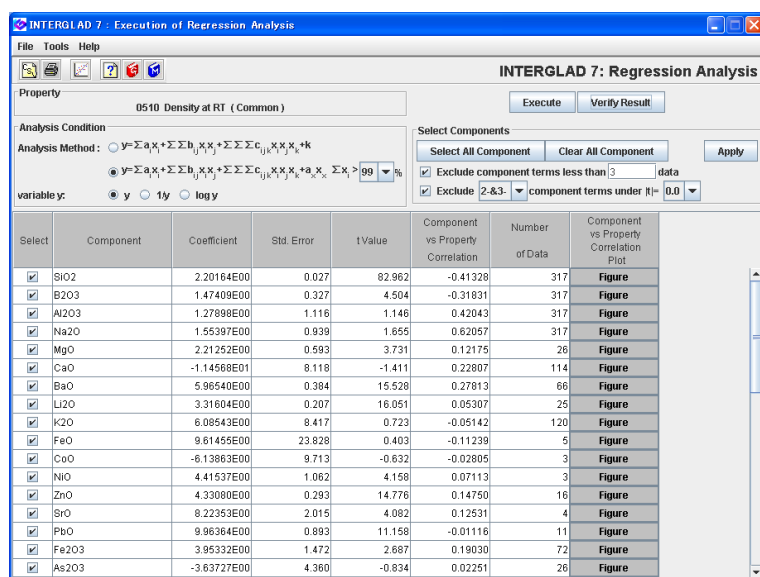
9) [CSV] icon

The table in the [Data List for Regression Analysis] window can be saved as a CSV file. Click the [CSV] icon, select a save file in the [Save] dialog box, and save the table with a file name. Usually the file-type extension ".csv" is appended, which ensures that the file is compatible with Microsoft Excel. If necessary, add and/or delete items such as information in the list before saving.

4.4 [Execution of Regression Analysis] window

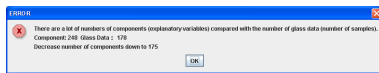
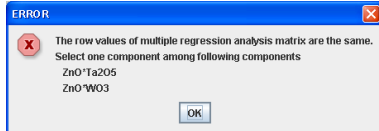
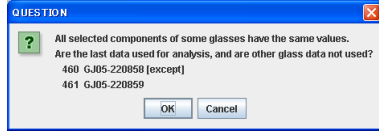
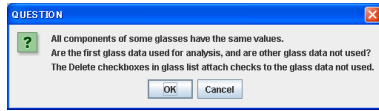
The multiple regression analysis is executed and the regression equation is obtained.

(1) Window configuration

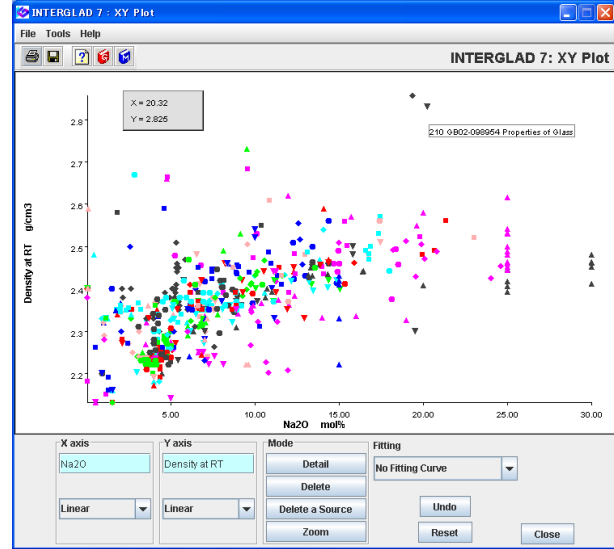


Select	Component	Coefficient	Std. Error	tValue	Component vs Property Correlation	Number of Data	Component vs Property Correlation Plot
☒	SiO2	2.20164E00	0.027	82.982	-0.41328	317	Figure
☒	B2O3	1.47409E00	0.327	4.504	-0.31831	317	Figure
☒	Al2O3	1.27898E00	1.116	1.146	0.42043	317	Figure
☒	Na2O	1.55397E00	0.939	1.655	0.62057	317	Figure
☒	MgO	2.21252E00	0.593	3.731	0.12175	26	Figure
☒	CaO	-1.14568E01	8.118	-1.411	0.22807	114	Figure
☒	BaO	5.96540E00	0.384	15.528	0.27813	66	Figure
☒	Li2O	3.31604E00	0.207	16.051	0.05307	25	Figure
☒	K2O	6.08543E00	8.417	0.723	-0.05142	120	Figure
☒	FeO	9.61455E00	23.828	0.403	-0.11239	5	Figure
☒	CoO	-6.13863E00	9.713	-0.632	-0.02805	3	Figure
☒	NiO	4.41537E00	1.062	4.158	0.07113	3	Figure
☒	ZnO	4.33080E00	0.293	14.776	0.14750	16	Figure
☒	SrO	8.22353E00	2.015	4.082	0.12531	4	Figure
☒	PbO	9.96364E00	0.893	11.158	-0.01116	11	Figure
☒	Fe2O3	3.95332E00	1.472	2.687	0.19030	72	Figure
☒	As2O3	-3.63727E00	4.360	-0.834	0.02251	26	Figure

[Execution of Regression Analysis] window



[Question] or [Error] dialog boxes



[Figure/ XY Plot] window

(2) Details

First, the selected component terms, the component vs. property correlation coefficients, and the number of the glass data for the component terms all appear in the table. After execution of the regression analysis, the other cells for regression coefficients, etc. of the table are filled.

(A) Analysis condition

The user can select one of the two types of multiple regression equations as the analysis method. One has no constant ($k = 0$), while the other has a constant ($k \neq 0$).

In the case of $k \neq 0$,

$$y = \sum a_i x_i + k \quad (\text{linear equation with only 1-component terms})$$

$$y = \sum a_i x_i + \sum \sum b_{ij} x_i x_j + \sum \sum \sum c_{ijk} x_i x_j x_k + k \quad (\text{cubic equation with 1-, 2-, and 3-component terms})$$

In the case of $k = 0$,

$$y = \sum a_i x_i + a_x x_x \quad (\text{linear equation with only 1-component terms})$$

$$y = \sum a_i x_i + \sum \sum b_{ij} x_i x_j + \sum \sum \sum c_{ijk} x_i x_j x_k + a_x x_x \quad (\text{cubic equation with 1-, 2-, and 3-component terms})$$

y : the property value (the dependent variable)

a_i, b_{ij}, c_{ijk} : the multiple regression coefficients for 1-, 2-, and 3-component terms

x_i, x_j, x_k : the contents of the i -th, j -th, and k -th components

(the independent, explanatory variables)

a_x : the multiple regression coefficient for the other components

x_x : the sum of the contents of the other components

k : a constant

$$\sum x_i + x_x = 1, \quad i \neq j \neq k$$

In each case, a quadratic equation with 1- and 2-component terms is also available. In the case of $k = 0$, the sum of the component contents of the 1-component terms, $\sum x_i$, can be selected in the pulldown menu (90–99%). The default equation is that without the constant ($k = 0$), and the default $\sum x_i$ is 99%. As the dependent variable, $1/y$ or $\log y$ (y = property value) may be used by selecting the [variable y] radio button.

For viscosity, electric conductivity, or resistivity, the default is $\log y$, with y used for the other properties.

A multiple regression analysis using $k \neq 0$ is conducted only for component terms in the list with select checked. In the case of $k = 0$, the multiple regression analysis includes components that are not selected as 1-component terms by treating the other components as a single component, when the sum of the other components does not exceed 10%. The equations in the case where $k = 0$ are recommended when the user wants to obtain a multiple regression equation for all of the components of the glass data.

(B) Select components

The user can increase the accuracy of the multiple regression analysis by excluding component terms with few glass datasets or a small $|t|$ value. In the [Select Components] column, the default for the minimum needed number of glass data is 3, and that of the minimum $|t|$ value for 2- and 3-component terms is 0.0. To change the analysis conditions, re-enter values in the cells, select the pulldown menu, click the [Apply] button, and then click the [Execute] button. In addition, the component terms can be optionally re-selected by using the [Select All Component] button, the [Clear All Component] button, and/or the checkbox of each component term.

[t Value]

t = regression coefficient/standard error of the regression coefficient

The standard error refers to the error that the obtained regression coefficient can include for each component term. When the value of $|t|$ is high, the reliability of the regression coefficient for the component term is high.

It is recommended that a $|t|$ value higher than 2 be used for each component term because the significance level becomes $\geq 1\%$ when the $|t|$ value is ≥ 2 . In many cases, the significant component terms are excluded if a high $|t|$ value limit is applied after the first analysis. It is appropriate to apply a low limit for the $|t|$ value step-by-step. For instance, the low limit could first be set to 0.1, then to 0.5, and finally to 1.0 for the 2- and 3-component terms, after which 0.5 and then 1.0 could be used for the 1-component terms. Last, $|t|$ values of 2 or more could be used for all the component terms.

In cases in which the data used for the analysis have a high correlation factor, that is, in cases where the multiple regression analysis population is composed of data for similar glass compositions, it may not be possible to obtain an appropriate coefficient for the regression analysis. In such cases, the standard error becomes very large or zero compared with the regression coefficient ($|t| \rightarrow 0$ or ∞). Such cases require that the range of components used or the scope of the population be changed and then re-executed.

(C) Buttons and icon

1) [Execute] button

The regression analysis is conducted by clicking the [Execute] button, which causes the regression coefficients, standard errors, and t values to appear in the list. At the same time, the Predictive Values and Residuals appear in the [Data List for Regression Analysis] window.

In many cases, after clicking the [Execute] button, various [Question], [Warning], or [Error] dialog boxes open one after another. When the dialog is acceptable, follow the instructions, and then re-click the [Execute] button. If not, click the [Cancel] button, and then check in the checkboxes of the unnecessary glasses in the [Data List of Regression Analysis] window or change $\Sigma x_i > (\%)$ in the [Analysis Condition] column of the [Execution of Regression Analysis] window, and re-click the [Execute] button.

In some cases, the multiple regression analysis cannot be performed. When there are 2 or more glasses with the same composition among the selected glasses in the [Data List for Regression Analysis] window, one glass has to be selected. Similarly, when 2 or more glasses have the same contents of the selected components, one glass has to be selected. The multiple regression equation cannot be obtained when the number of sample glasses is less than that of the explanatory variables (component terms) plus 3. A [Question] dialog box also appears when the number of glasses for each explanatory variable is not more than 2.

2) [Verification of Regression Analysis] icon or [Verify Result] button

Click to open the [Verification of Regression Analysis] window. This button and icon can be used after the regression analysis has been completed obtaining the regression coefficients, etc.

3) [Figure] button

Click to open the component term vs. property [Figure/XY Plot] window for each component term.

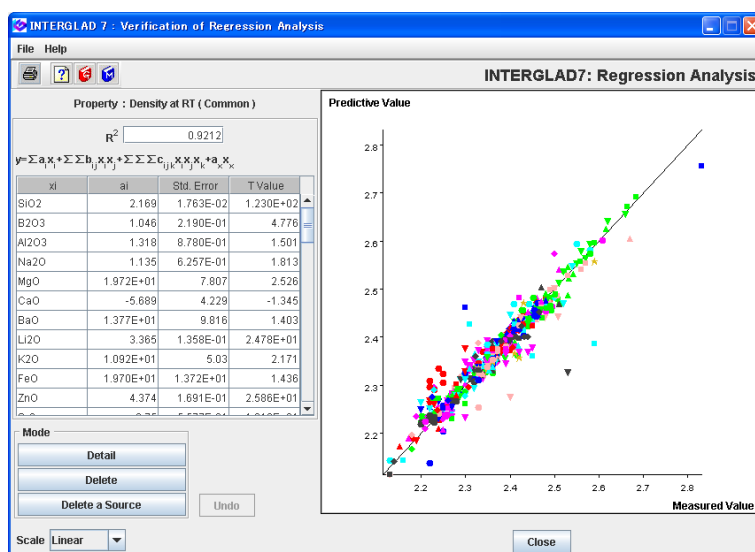
4) [CSV File] icon

Save the table data as a CSV file.

4.5 [Verification of Regression Analysis] window

The result of the multiple regression analysis is visualized and the accuracy of the prediction is verified.

(1) Window configuration



[Verification of Regression Analysis] window

(2) Details

(A) Graph

The predictive values vs. the measured values are plotted on an XY chart. If the predictive values coincide with the measured values, all of the plot-points fall on a line inclined 45 degrees to both axes. The accuracy of the prediction can be roughly gauged by viewing the dispersion of the plot-points around the 45-degree mid-line.

The explanation of the graph is the same as that of the [XY Plot] window in 3.2.

(B) Contribution rate (R²)

The contribution rate (coefficient of determination), R², is a factor that is used to indicate the explanatory strength of the obtained regression model and has a value between 0 and 1.

$$R^2 = 1 - Se/St$$

$$Se = \sum (Y_i - \hat{Y}_i)^2, St = \sum (Y_i - Y_m)^2$$

Se: Residual sum of squares, St: Total sum of squares,

Y_i: Measured value, $\hat{Y}_i$: Predictive value, Y_m: Mean value of measured values

The closer the contribution rate is to 1, the higher the accuracy of the prediction, with an R² value higher than 0.8 recommended for effective prediction.

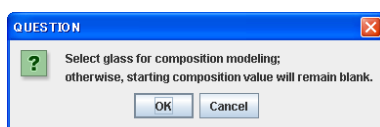
(C) Other items

This [Verification of Regression Analysis] window also shows the multiple regression equation with the component terms (x_i, j, k), regression coefficients (a_i, b_{ij}, c_{ijk}), constant (k), standard error, and t value. These are the same contents as those in the [Execution of Regression Analysis] window. The magnitude of each regression coefficient indicates the order of influence of a given component term to the property. Regarding the t value, refer to 4.4 (2) (B). After excluding the component terms with low $|t|$ values, R^2 becomes slightly less than its previous value.

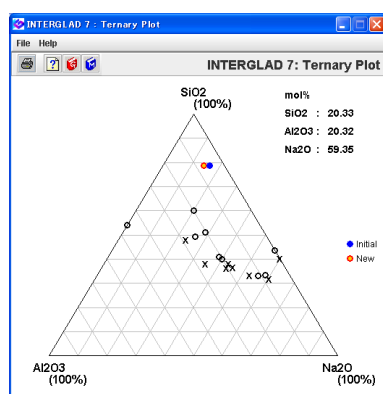
4.6 [Property Prediction] window

The predictive property value for a given composition is calculated in this window by using the obtained regression equation.

(1) Window configuration



[Question] dialog box



INTERGLAD 7: Property Prediction					
Regression Equation					
Component	Density at RT	coefficient		Initial	New
SiO2	2.169E00			61.150	55.000
B2O3	1.046E00			16.290	20.000
Al2O3	1.318E00			3.890	5.000
Na2O	1.135E00			12.850	10.000
MgO	1.972E01			0.000	0.000
CaO	-5.689E00			5.820	10.000
Component	Density at RT			Initial	New
SiO2*B2O3	8.862E-01			0.100	0.110
SiO2*Al2O3	2.575E00			0.024	0.028
SiO2*Na2O	3.005E00			0.079	0.055
SiO2*MgO	4.936E01			0.000	0.000
Total				100.000	100.000 %

Property			
	Specified	Unit	Predictive Value
●	Density at RT	g/cm3	1.745
●			
●			

[Property Prediction] window

[Ternary Plot/Glass-Forming Region] window

(2) Details

After the execution of the multiple regression analysis, in the [Data List of Regression Analysis] window, click the [Property Prediction] icon. When a [Question] dialog box appears, click the [OK] button, and the [Property Prediction] window opens.

(A) Regression Equation Table

The 1st column: the component terms and constant.

The 2nd to 4th columns: regression coefficient for each property.

The 5th column: the initial composition (Initial).

The 6th column: the new composition (New).

The regression coefficient for each component term is the same as that in the [Verification of Regression Analysis] window or the [Execution of Regression Analysis] window. The largest 3 coefficients for each property are indicated in red and the smallest 3 are shown in blue to facilitate finding components with a

large influence on the regression equation. When a glass data row is not selected in the [Data List of Regression Analysis] window, a [Question] dialog box appears. After clicking the [OK] button in the dialog box, the user sees that the [Initial] and [New] columns are null. When a glass is selected from the list by clicking the row, the values of the components of the selected glass appear in the [Initial] and [New] columns. The user can enter component values in the [New] column. He/she does not need to enter values that total 100%.

(B) Property Table

The 2nd column: Property item (Specified).

The 3rd column: Unit of the property.

The 4th column: Predictive value of the property (Predictive Value).

(C) Buttons

1) [Calculate] button

After entering the values of the components in the [New] column, click the [Calculate] button. The glass composition is first proportionally converted to values totaling 100%, and then its properties are calculated and the calculated property values appear in the [Predictive Value] column of the [Property] table.

2) [Clear New Content] button

Click this button to clear the [New] column.

3) [Reset] button

Click this button to return the values of the [New] column to those of the initial composition.

4) [Glass-Forming Region] button

Clicking the [Glass-Forming Region] button shows the glass-forming region of 3 components of the [New] composition in a ternary diagram. Three components totaling less than 100% are converted proportionally to total 100%. This information is used to check whether the [New] composition actually forms a glass or not, when the content of the other components besides the 3 components is small. Refer to 3.1 (2) (B) 3). The plot-point [Initial] is used for the composition of the [Initial] column.

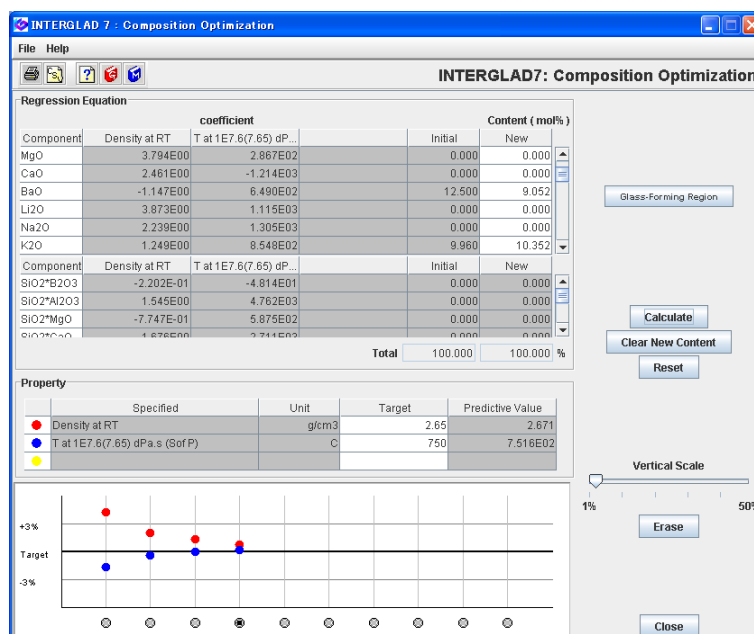
5) [CSV File] icon

Click to save the table data of the [RegressionEquation] column and the [Property] column (with predictive values) as a CSV file.

4.7 [Composition Optimization] window

This window is used to design a new glass composition or optimize a glass composition with target values of properties by using the obtained regression equation.

(1) Window configuration



[Composition Optimization] window

(2) Details

After the execution of the multiple regression analysis in the [Data List of Regression Analysis] window, select a glass that has composition and properties with values close to the target. Then, click the [Property Prediction] icon, and the [Composition Optimization] window opens.

(A) Regression Equation Table

This table is the same as that in the [Property Prediction] window. Refer to 4.6 (2) (A).

(B) Property Table

The 1st column: Color of plot-point for each property.

The 2nd column: Property item (Specified).

The 3rd column: Unit of the property.

The 4th column: Target value of the property (Target).

The 5th column: Predictive value of the property (Predictive Value).

Enter the target values in the [Target] column.

(C) Graphic display of property prediction

The predictive values divided by the target value are shown for each property on this graph. The horizontal line in the middle of the graph indicates the target value. The vertical scale can be changed from 1 to 50% by using the [Vertical Scale] slider to the right of the graph. The radio buttons at the bottom of the graph allow for multiple trials, with the number of plot-points increasing with each trial. The initial plot-points correspond to the predictive property values of the initially specified glass in the [Data List of Regression Analysis] window. The plot-points with the radio button ON correspond to the predictive values for the composition in the [New] content at all times. Different colors are assigned to the plot-points, as shown at the left of the [Property] table.

(D) Buttons

1) [Calculate] button

Click the [Calculate] button after entering numerical values in the [New] content column. The glass composition is first proportionally converted to values totaling 100%, and then its properties are calculated. The results are shown in the [Predictive Value] column of the [Property] table and in the property prediction graph. By first clicking the button before entering a new composition, the predictive values for the composition of the selected glass in the [Data List of Regression Analysis] window appear.

The number of trials shown on the graph is initially ten, but the plots shifts to the left to allow for more than ten trials. When the number of trials exceeds ten, the left-most plot is deleted and the latest plot appears at the right.

To approximate the values of the properties to the target values for composition optimization, repeat the trials. To increase the property value, it is effective to increase the contents of components with large regression coefficients (red-colored, etc.) or to decrease those with large negative regression coefficients (blue-colored, etc.). To decrease the property value, execute the procedure in reverse.

2) [Clear New Content] button

Click to delete the values in the [New] column, and all values become null.

3) [Reset] button

Click to reset the values in the [New] column to those of the [Initial] column.

4) [Erase] button

Click to delete the plot-points with a radio button that is ON, along with the corresponding composition data. After the deletion, the plot-points of the right trials move to the left to adjust the graph and the trial of the plot-points with the ON value shifts one place to the right. The last set of plot-points after the deletion cannot be erased.

5) [Glass-forming Region] button

The function is the same as that in the [Property Prediction] window. Refer to 4.6 (2) (C) 4).

6) [CSV File] icon

Click to save the table data of the [Regression Equation] column and the [Property] column (with

target and predictive values) as a CSV file. The calculation process corresponding to the graph on the bottom of the window are also saved.

(2) Details

This window has the [Structure] and [Measurement Method] columns instead of the [Property] column in the [Search Property Data] window. In this window, the user can enter search conditions for the structure database. Compared to the Property Database, as the Glass State, the user cannot select Composite, Modified, Non Vitrified, but can select Crystal. Appearance, Features & Manufacturing Process and Usage also cannot be specified.

(A) [Structure] column

Doubleclick a light-blue cell of the [Description] column, and the [Select Structures] dialog box opens to allow the selection of structure items for searching. Regarding the registered structure items, see below in this section and refer the ID List for the Structure Database in 5.2 of Chapter 6. The selection of elements for the selected structure item can be performed in the [Periodic Table] dialog box by double-clicking the [Periodic Table] button. When the user clicks two elements, they are connected by a hyphen. For example, in the case of the bond angle when O, B, and O are selected, O-B-O appears in the cell, which indicates the bond angle of $\angle OBO$. In the selection of the elements by right-clicking of Fe, Sn, Eu, B, Al, O, the user can select Fe^{2+} , Fe^{3+} for Fe, Sn^{2+} , Sn^{4+} for Sn, Eu^{2+} , Eu^{3+} for Eu, B(3), B(4) for B (3, 4: Coordination Number), Al(4), Al(5), Al(6) for Al (4, 5, 6: Coordination Number), NBO, BO, O^{2-} , =O, O(3) for O (Refer to 5. Bridging Oxygen Information). The minimum and/or maximum values cannot be entered in the [Value Min] and/or [Value Max] cells for the selected structure information. Figures such as spectral curves are usually not registered, and only the Figure Nos. in the original paper are registered in the database.

Typical data are defined for each combination of elements in 6 structure categories: First Interatomic Distance, Second Interatomic Distance, n-th Interatomic Distance, Bond Angle, Coordination Number, and Ring Size. At present, no combination of elements for Ring Size is registered. Refer the table of Typical Data in the Appendix of Chapter 3, which shows the IDs and the priority order for each structure.

1) Spectrum

- Spectral information contains a Spectral Curve and “Peak or Valley.” Each contains information for IR-Visible, Visible-UV, Luminescence/ IR-Visible, Luminescence/ Visible-UV, Raman, NMR, Moessbauer, ESR, XPS, XAFS, X-ray, Neutron, Computational Chemistry, and others.
- Spectral curves are not registered, but their Fig. No. are described in the [Comment] column of the [Detail Data of Structure] window.
- In the case of “Peak or Valley,” the wave number or wave length at the peak or valley of a spectral curve is registered, primarily when the value is described in the original source.
- When “Peak or Valley” is selected, one or more elements related to the peak or valley can be selected.

2) Interatomic Information

- Interatomic Distance, Bond Angle, Radial Distribution Function (RDF) (Fig.), Interference Function (Fig.), Structure Factor (Fig.), etc. are registered.
- The Interatomic Distance contains information for the 1st Interatomic Distance, 2nd Interatomic Distance, and n-th Interatomic Distance, which are in the order of short to long distance, for each atomic pair. The n-th Interatomic Distance means that of the 3rd or more.
- The search is performed by selecting an atomic pair (e.g., Si-O). When the selection is reversed (e.g., O-Si), the result is the same.
- The Interatomic Distance contains information about the Average and Peak (Peak value of RDF).
- The Distance Variance of the Interatomic Distance has several values such as Debye-Waller factor or FWHM (Full Width at Half Maximum) of the RDF peak. Its units are Å (Å: angstrom), Å², nm, nm², etc., which are not comparable.
- Regarding the Bond Angle, the values of the Average, Most Probable, 1st Peak, 2nd Peak, etc. of the Bond Angle and Angle Variance are registered for each combination of 3 atoms. The search can be performed with or without selecting elements (1 to 3).
- The typical data defined for the Interatomic Distance are the Average and Peak, which are in priority order, for each atomic pair of the 1st Interatomic Distance, 2nd Interatomic Distance, and n-th Interatomic Distance.
- The typical data defined for the Bond Angle are the Average, Most Probable, 1st Peak, 2nd Peak, and

Bond Angle Distribution, which are in priority order, for each combination of elements.

- The interatomic information is obtained by measurements using X-Ray Diffraction, Neutron Diffraction, XAFS, or Computational Chemistry.

3) Ring Structure

- Glass formation atoms such as Si-O and B-O compose ring structures. Ring Size refers to the number of cations (Si, B, etc.) that compose a ring. Ring Size (Average), Ring Size (1st Peak), and Ring Size (2nd Peak) are registered.
- The existence ratios (%) of 2- to 10-Membered Rings are also registered, and in some cases the Distribution of the Ring Structure (Fig. No.) is registered.
- The typical data defined for a Ring Structure are the Ring Size (Average), Ring Size (1st Peak), Ring Size (2nd Peak), and Distribution of Ring Structure, which are in priority order.

4) Coordination Number

- The Coordination Number is the number of atoms or ions coordinating around an atom or ion. It is described for every pair of atoms or ions (Si-O, etc.). Coordination Numbers related to an atom or ion whose partner is not specified are also registered.
- There are also items for the 1st Neighbor Coordination Number, 2nd Neighbor Coordination Number, and 3rd Neighbor Coordination Number, which are in the order of the proximity of the specified atom to the center atom.
- The search is conducted by selecting elements (0, 1, 2) (e.g., Si and O).
- The existence ratios (%) of Coordination Numbers 1 to 12 are also registered, and in some cases the Distribution of the Coordination Number (Fig. No.) is registered.
- The typical data defined for the Coordination Number are the 1st Neighbor Coordination Number, 2nd Neighbor Coordination Number, 3rd Neighbor Coordination Number, and Distribution of Coordination Number, which are in priority order.
- The coordination numbers are obtained by measurements using X-Ray Diffraction, Neutron Diffraction, or XAFS, or NMR.

5) Bridging Oxygen Information-Bridging Oxygen

- Bridging Oxygen Information has two categories: Bridging Oxygen and Q^n Distribution (refer to 6)).
- There are data for the ratios of each of the four types of oxygen to the total O and to the total X (Si, B, Al, P, Ge, etc.).

The four types of O are as follows.

Bridging Oxygen (BO or OB): Oxygen where both sides bond to atoms X (Si, B, Al, P, Ge, etc.).

Non-bridging Oxygen (NBO or TO = Terminal Oxygen): Oxygen where one side bonds to atom X.

Isolated Oxygen (O2-): Oxygen where both sides do not bond to atom X.

3-Coordinated Oxygen (3 Coord O): Oxygen that coordinates to 3 atoms.

- NBO Fraction/[total O], BO Fraction/[total O], Isolated Oxygen [O2-]/[total O], and 3-Coordinated Oxygen/[total O] are ratios of the corresponding O to the total O. The unit is %.
- NBO Fraction/[total X], BO Fraction/[total X], Isolated Oxygen [O2-]/[total X], and 3-Coordinated Oxygen/[total X] are numbers representing the corresponding O in a tetrahedron, which is composed of X (Si, Al, P, etc.) and O (e.g. SiO₄). The value of NBO/[total X] or BO/[total X] is 0 to 4 (e.g., 3.5).
- This bridging oxygen information is obtained by measurements using NMR, Raman Scattering, XPS, or Computational Chemistry.

6) Bridging Oxygen Information- Q^n Distribution

- Q^n represents a tetrahedron (SiO₄, etc.) that has n bridging oxygens, where “n” is an integer between 0 and 4. This item shows the bond structure of glass by focusing on the number of bridging oxygens in a tetrahedron of glass forming atoms.
- Five items are registered. The unit is %.
 Q^0/totalX : Q^0 fraction in tetrahedra XO₄.
 Q^1/totalX : Q^1 fraction in tetrahedra XO₄.
 Q^2/totalX : Q^2 fraction in tetrahedra XO₄.
 Q^3/totalX : Q^3 fraction in tetrahedra XO₄.

Q⁴/totalX: Q⁴ fraction in tetrahedra XO₄.

X: Si, B, Al, P, Ge.

- These are obtained by measurements using NMR, Raman Scattering, XPS, XAFS, or Computational Chemistry.

7) Oxidation Number

- The valences of cations (Si, B, Al, etc.) or anions are registered.
- The fractions of the -6 to +6 valences of each atom are also registered. The average valence is calculated from the Fractions of Valences.

8) Structure Model

- When the specified original source includes a proposed structure model, it is shown by a figure No. or a comment.

9) Basicity

- The optical basicity is registered, which is calculated from the shift wave number of UV absorption by ions Tl, Pb, Bi, etc.

10) Induced Structure

- The microstructures of nanoglass, etc., which are induced by an external force such as a femtosecond laser, are registered.

11) Phase Separation

- The type of phase separation, like spinodal or binodal, the size of the phase separation structure, etc. are registered.

12) FSDP and Boson Peak

- The Q Value (cm⁻¹) and Quasi-Bragg Plane Spacing (nm) of the First Sharp Diffraction Peak (FSDP) are registered. FSDP is observed in a low Q range (approximately 10-20 nm⁻¹) using X-ray or Neutron Diffraction. The Boson Peak is also registered, which is observed in a low wave number range (10-100 cm⁻¹) using Raman Scattering or Neutron Inelastic Scattering. These are factors pertaining to medium-distance glass structures.

13) Raman Data

- Depolarization Ratio ρ is registered. ρ is 0-0.75 in the case of a solid with isotropic irregularity, and less than 0.1 in a case of that with a high symmetrical mode. The dependency of the vibration number on ρ gives information about the irregularity and localized symmetry, along with the non-proportionality.

14) ESR Data

- The g Value (g factor, g perpendicular, g parallel), Hyperfine Coupling Constant (A, A perpendicular, A parallel, cm⁻¹), Hyperfine Structure Spacing (cm⁻¹), Dipolar Hyperfine Coupling Parameter, Fermi Contact Interaction Parameter, and ESR-FWHM are registered.

15) XAFS Data

- The Absorption Edge Position (eV) is registered.

16) NMR Data

- There are 21 registered items for NMR. The main items are Chemical Shift (δ , ppm), Isotropic Chemical Shift (δ_{iso} , ppm), Proportions Present (%), Asymmetry Parameter (η), and Quadrupolar Coupling Constant (Q_{cc}, MHz).

17) Moessbauer Data

- The registered items are Isomer shift (δ , mm/s), Quadrupole Splitting (Δ , mm/s), and FWHM (Γ , mm/s).

18) Others

- Other items such as the existence of an Si-N bond and Force Constant are registered.

(B) [Measurement Method] column

The Measurement (Analysis) Method is classified into 14 categories as follows.

- IR-Visible Spectroscopy (Transmission, Absorption, Reflection),
- Visible-UV Spectroscopy (Transmission, Absorption, Reflection),
- Luminescence (IR-Visible),
- Luminescence (Visible-UV),

- Raman Spectroscopy,
- Nuclear Magnetic Resonance (NMR),
- Moessbauer Spectroscopy,
- X-ray Photoelectron Spectroscopy (XPS),
- Electron Spin Resonance Spectroscopy (ESR),
- X-ray Diffraction (Common, Small-angle X-ray Scattering (SAXS), AXS, WAXS, etc.),
- Neutron Diffraction (Common, Small-angle Neutron Scattering (SANS), Isotope Substitution, etc.),
- X-ray Absorption Fine Structure (XAFS) (Transmission, Total Electron Yield, Fluorescence, etc.),
- Calculation (MD-ab Initio, MD-empirical, Molecular Orbital Calculation-ab Initio, MO-semi-empirical),
- Others.

Two or more items may be selected.

(C) [Measurement Condition] column

By double-clicking the light-blue cell of [Temperature] or [Pressure], the user can select a condition for each in the dialog box. The temperature is classified as High, Room Temperature (RT), Low, and Unknown, and the pressure is classified as High, Room Pressure (RP), Low, and Unknown, both roughly.

5.2 [Data List of Structure] window

(1) Window configuration

This window has a configuration similar to the [Data List of Property] window. Refer to 2.2.

Delete	No.	Glass No.	Data Source	Year	Data Source Number	SiO ₂	B ₂ O ₃	Na ₂ O	Coordination Num. (B-O) (%)	Coordination Num. (Al-O) (%)	Coord.
☐	1	S-00312	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	45.00	5.00	1.100E+01		
☐	2	S-00313	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	40.00	10.00	2.800E+01		
☐	3	S-00314	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	35.00	15.00	3.900E+01		
☐	4	S-00315	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	30.00	20.00	5.400E+01		
☐	5	S-00316	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	25.00	25.00	6.000E+01		
☐	6	S-00317	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	20.00	30.00	7.100E+01		
☐	7	S-00318	J. Non-Crystalline S.	1999	v.255, p.0233	50.00	10.00	40.00	6.200E+01		
☐	8	S-00320	J. Non-Crystalline S.	1999	v.255, p.0233	60.00	30.00	10.00	3.300E+01		
☐	9	S-00321	J. Non-Crystalline S.	1999	v.255, p.0233	60.00	20.00	20.00	6.100E+01		
☐	10	S-00322	J. Non-Crystalline S.	1999	v.255, p.0233	60.00	10.00	30.00	7.800E+01		
☐	11	S-00324	J. Non-Crystalline S.	1999	v.255, p.0233	70.00	25.00	5.00	1.400E+01		
☐	12	S-00325	J. Non-Crystalline S.	1999	v.255, p.0233	70.00	20.00	10.00	4.100E+01		
☐	13	S-00326	J. Non-Crystalline S.	1999	v.255, p.0233	70.00	15.00	15.00	6.600E+01		
☐	14	S-00327	J. Non-Crystalline S.	1999	v.255, p.0233	70.00	10.00	20.00	7.000E+01		
☐	15	S-00697	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	40.00	4.100E+01		
☐	16	S-00698	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	38.50	4.300E+01		
☐	17	S-00699	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	35.00	5.400E+01		
☐	18	S-00700	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	30.00	3.700E+01		
☐	19	S-00701	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	25.00	1.700E+01		
☐	20	S-00702	Phys. & Chem. Gla.	1993	v.034, p.0052	30.00	30.00	20.00	0		

[Data List of Structure] window

(2) Details

The user can use this window in the same manner as that of the [Data List of Property] in 2.2.

(A) [Structure] button

Click to show or hide any structure data registered in the searched glasses in the [Select Structure] dialog box. The data of the selected items are added to the list.

(B) Refer the Property Database

Click the  [Search Property DB] icon to refer to data in the Property Database of the listed glasses in the [Data List of Structure] window. Then, the [Glass No. (Property)] column is added to the list and Glass Nos. (Property) appear when data for the glasses are contained in the Property Database.

Click the  [Detail Data of Property] icon to open the [Detail Data of Property] window of the glass after clicking on a glass row with Glass No. (Property). Refer to the [Detail Data of Property] window in 2.3.

Before the Structure Database started (~2007), structure data had been registered as asterisk in Structure Model of the Property Database. Therefore note that, in some cases, there are no specific data for the properties in the Property Database, when referring to the glass with Glass No. (Property)

(C) [Property] button

Click to show or hide any property data registered in the searched glasses. The data of the selected items are added to the list. This [Property] button is active after clicking the [Search Property DB] icon.

(D) [Data Source List] window

By clicking the [Data Source List] button, the [Data Source List] window opens in the same manner as that for the Property Database in 2.4.

(E) [Glasses from a Data Source] window

By clicking the [Glasses from a Data Source] icon, the [Glasses from a Data Source] window opens in the same manner as that for the Property Database in 2.5.

(F) Ternary Plot

By clicking the [Ternary Plot] icon on the menu bar, the [Ternary Plot] window can be shown in the same manner as that of the [Ternary Plot] window for the Property Database in 3.1. The numerical data for the structures and compositions of all of the glasses in the [Data List of Structure] window can be plotted by selecting items in the [Select Item] dialog box from the [Item] column of the [Select Ternary Plot Condition] dialog box. The numerical data for the properties can also be used for the Ternary Plot, after clicking the [Search Property DB] icon.

(G) XY Plot

By clicking the [XY Plot] icon on the menu bar, the [XY Plot] window can be shown in the same manner as that of the [XY Plot] window for the Property Database in 3.2. As the X or Y axis, not only a component or structure item with numerical data, but also a property item with numerical data can be specified after clicking the [Search Property DB] icon.

(H) Element Analysis (Distribution)

By clicking the [Element Distribution] icon on the menu bar, the [Element Distribution] window can be shown in the same manner as that of the [Element Distribution] window for the Property Database in 3.3.

Each group of glasses with data for one of the structure or measurement items can be analyzed in an Element Analysis. All of the glasses listed in “all glasses” can also be used for the analysis. Property items also appear in the [Select Item] dialog box after clicking the [Search Property DB] icon.

5.3 [Detail Data of Structure] window

(1) Window configuration

[Detail Data of Structure] window

INTERGLAD 7: Detail Data of Structure

File Tools Help

Glass No. S-00320 State Glass

Composition

Condition of Data Target

Components

	mol%
SiO ₂	60.00
B ₂ O ₃	30.00
Na ₂ O	10.00

Glass System

Alkali Silicate
Boro-Silicate

Relaxation Reagent

Enrichment

Thermal Treatment

Thermal Treatment

1st
2nd
3rd

Synthesis

Method melt
Melt Temp. 1300C

Measurement Condition

Shape powder Shape (Comment) Pressure

Note

Structure

Description	Atoms	Unit	Value	Comment 1
XAFS (Figure)				
Coordination Number 3	B-O	%	67	
Coordination Number 4	B-O	%	33	
Absorp Edge Position	B-O	eV	193.85	trigonal B
Absorp Edge Position	B-O	eV	198.78	tetrahedral...
Absorp Edge Position	B-O	eV	201.86	trigonal B...

Author

Fleet M.E., Muthupari S.

Data Source

J. Non-Crystalline Solids
Vol. 255 (1999)
Page 0233

Glass No. (Property)

GJxx-195289

Related Glass No.

Measurement

Description	Method	Condition	Note
XAFS	Total Electro...	Kind of XAFS (XAFS, X...	XANES
XAFS	Fluorescent...	Kind of XAFS (XAFS, X...	XANES
XAFS	Total Electro...	Element and Absorpt...	B-K
XAFS	Fluorescent...	Element and Absorpt...	B-K
XAFS	Total Electro...	Ray Source	SR
XAFS	Fluorescent...	Ray Source	SR

Close

(2) Details

The [Detail Data of Structure] window shows all of the information registered for a searched glass. Refer to [Detail Data of Property] in 2.3.

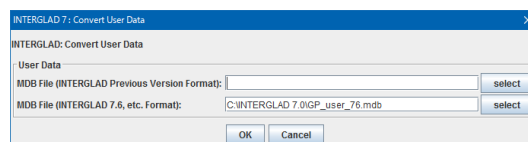
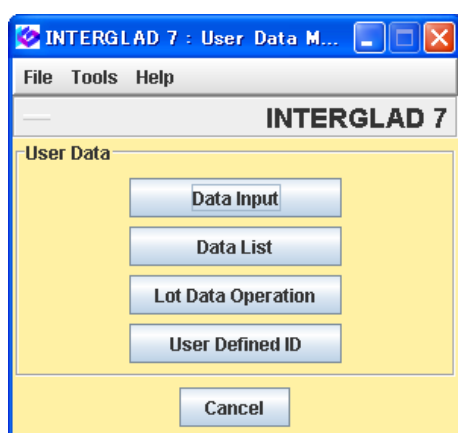
6. Registration of User data

The user can construct his/her own glass database for property. The registered User Data of Property can be used in conjunction with the stored data in the Property Database of INTERGLAD for the search, analysis, prediction, and composition optimization functions when the Standard Edition is applied. User Data registered is stored as a MDB file in the user's personal computer. Because the data is not externalized, no security problems can arise, when one's personal computer is connected to the Internet.

6.1 [User Data Menu] window

(1) Window configuration

The [User Data Menu] window opens by clicking the [User Data (Property Data)] button in the [Main] window.



[Convert User Data] dialog box

[User Data Menu] window

(2) Details

(A) [Data Input] button

Open the [Data Input] window to register new glass data.

(B) [Data List] button

Open the [Data List] window to glance the registered data of glasses. In the [Data List] window the user can delete the registered data, and can register a lot of dataset at a time.

(C) [Lot Data Operation] button

Open the [Data Lot Operation] dialog box for backup, recovery, or deletion of the registered data Lot by Lot.

(D) [User Defined ID] button

Open the [User Defined ID] window to define new code names of glass or new property IDs

(E) [Cancel] button

Close the [User Data Menu] window.

(F) Conversion of User Data stored in Ver. 7.5 or the previous version of INTERGLAD

When the user has registered User Data in Ver. 7.5 or the previous version, convert the User Data before the use of Ver. 7.6.

By clicking [Convert User Data (INTERGLAD 7.6, etc. Format)] in Tools of the menu bar, the [Convert User Data] dialog box appears. Select the MDB file of the stored User Data in Ver. 7.5 or the previous version (also Ver. 6) for the [MDB File (INTERGLAD Previous Version Format)] column. And select the MDB file (GP_user_76.mdb) for the [MDB File (INTERGLAD 7.6, etc. Format)] column. The default file is that selected in the [Preference] dialog box. The user can continue to utilize also "GP_user_70-75.mdb," although the new functions are unable to use.

When the user uninstalls the INTERGLAD7.0 (or 7.0SA) system and installs the new version, the User Data File "GP_user_76.mdb, etc." is saved. However it is recommended for secure saving the User Data File

outside of the INTERGLAD system and putting it back after the procedures. “GP_user_76.mdb, etc.” for Windows Vista, 7, 8 or 10 is on “C:\INTERGLAD7.0 (or 7.0SA).”

6.2 [Data Input] window

In this window new glass data can be registered. Data correction is also available for the items except the Glass ID.

(1) Window configuration

[Data Input] window

[Select Lot No.] dialog box

(2) Details

(A) Lot No. Selection

The glass data registered by the user are handled in groups called “Lot” (Lot No. 001, 002, etc.). A Lot is a unit group of data for operations such as backup, recovery, deletion. The Lot No. can be assigned to glass data regardless of their Glass Nos.(IDs). Two glasses cannot have the same Glass No., even though their Lot Nos. are different.

The use of Lot is beneficial from the operational side, because a Lot No. can be created by a specific user in each, when the system is shared by two or more users.

The [Select Lot No.] dialog box appears, when the [Data Input] window opens. The user can select Existing Lot No. by the pulldown menu or enter New Lot No for the glass newly registered.

Moreover, even after the new data is entered (or registered), it is possible to change the Lot No. by clicking the [Lot No.] button.

(B) Data Input

The user can enter data in white cells in this window. The essential items for registration are Character, State, Year, Number of Data Source, and Glass System. The [Composition] column changes depending on the selection of State.

<Basic information>

1) Glass ID

The Glass ID of the User Data is proper six-digit number, whose first figure is 8, assigned to each dataset. A new ID is made as a default No. by adding one to the last ID of the existing User Data. A

Glass ID can be changed at the time of registration, but an existing ID cannot be assigned to new data.

2) Glass No.

The Glass No. is generated automatically when State and Glass System are selected.

For example: GU02-800011

This denotes “State (1-digit alphabet) + Data Source (1-digit alphabet) + Glass System (2-digit figure) - glass ID (6-digit figure from 800001).” In case of the example, G: Glass, U: User Data, 02: Alkali Silicate, 800011: Glass ID. Refer to 2. 2 (2) (B) 3) of Chapter 4.

3) [Gold-Data] checkbox

“Gold-Data” denotes highly reliable data. By clicking this checkbox the dataset is ranked in “Gold-Data”. Refer to 2. 1 (2) (C) 2).

4) [Character] pulldown menu

Select from among Analyzed, Target, Batch, and Others to describe the values for the glass composition. The default Character is Batch. Refer to Condition of Data in 2. 3 (2).

5) [State] pulldown menu

Select from among Glass, Glass-Ceramics, Composite, Modified, Thin Film, Melt, and Non-Vitrified to specify the State. The default State is Glass. Glass General cannot be selected.

6) User Glass

By double-clicking the light-blue cell of the [User Glass] column, [Select Commercial and User Glass] dialog box opens to select a code name of Commercial Glass or User Glass. Specification using the [Keyword] field in the dialog box is also available. The User Glass folder does not appear when User Defined Glass ID (Refer to 6. 5 (2) (A)) is not registered.

7) Appearance, Feature & Manufacturing Process

Four items at a maximum can be selected in the [Select Appearance, Feature & Process] dialog box. Specification using the [Keyword] field in the dialog box is also available. When two or more items are specified, they are connected by the [AND] operator. When an item in the [Sol-Gel Material] column of Composition is selected, Sol-Gel appears in this column automatically.

8) Usage

Four items at a maximum can be selected in the [Select Usage] dialog box. Specification using the [Keyword] field in the dialog box is also available. When two or more items are specified, they are connected by the [AND] operator.

9) Note

Supplementary explanation can be outlined here. 200 letters (bites) at a maximum can be inputted.

10) Thermal Treatment

Thermal (heat) treatment conditions of glass have important influence on properties. The conditions such as annealing temperature and time can be outlined here. When the thermal treatment conditions are different for each property of a glass, it is described in the condition cell for the specific property. In such a case, “See condition of property” is entered in this column by clicking the [Ref.] button. 200 letters (bites) at a maximum can be inputted.

11) Operator

Name of the operator can be entered here. This name does not appear when using in search, etc.

12) Operator's Memo

The operator can enter memo. This memo does not appear when using in search, etc. 400 letters (bites) at a maximum can be inputted.

Note: Prohibiting use of double quotation marks in text cells.

Double quotation marks (") make impossible to read the text when saving CSV files. Do not use them when entering texts of Note, Thermal Treatment, Operator, Author, Year, Number, Memo, and Condition of Property.

<Data Source>

1) Category

“User Data” is automatically set. It cannot be changed.

2) Data Source

“User Data” is automatically set. It cannot be changed.

a) [...] button

Clicking this button opens the [Data Source List] dialog box of existing data sources, from which any source may be selected. Authors and Memo are shared in each data source. When selecting a Data Source, its Authors and Memo also appear.

b) Year

Year for the Data Source is entered.

c) Number

Number for the Data Source is entered. Number may include alphabetic letters, etc. 19 letters (bytes) at a maximum including letters and symbols can be inputted.

d) Author

Ten authors at a maximum can be entered one by one in each row.

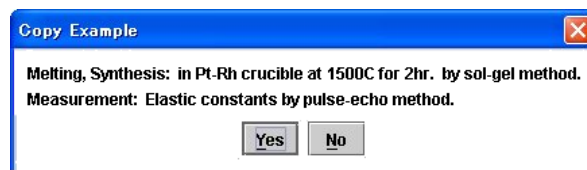
Example: Suzuki I.

The input rule is as follows: Family Name+space+Initial fo First Name+period (+ Initial of Middle Name+period).

150 letters (bytes) at a maximum can be inputted including spaces (2 spaces after each row).

e) Memo

The glass preparation method (manufacturing process), measurement method, etc., are entered here. Click the [Ex.] button to open the copy example. Click the [Yes] button to enter the content of the example in the [Memo] column. 400 letters (bytes) at a maximum can be inputted.



[Copy Example] dialog box

<Composition>

1) [Ratio Unit] pulldown menu

Specify the unit for entering the Component Ratio. Refer 6). The default unit is mass%.

2) [Main Unit] pulldown menu

The values of component content are stored with three units (mass%, mol% or at%). One of the three is specified as the main unit. The glass composition is shown with this main unit in the [Detail Data of Property] window. When the Ratio Unit is selected, the Main Unit is set to the same unit as the Ratio Unit automatically. In case of mol% as the Ratio Unit, also at% can be selected as the Main Unit. The default of the Main Unit is mass%.

3) [Calc] button

After specifying the components and their ratios, click the [Calc] button. The composition is first adjusted proportionally to total 100%, and then the contents are converted to the values for the other units. The components with italic general-purpose notation (*RO*, *R2O*, etc.) cannot be specified. In such cases a warning message appears.

The [Calc] button changes to the [Correct] button after calculation. The inputted ratio remains in the [Input Ratio] column, after saving or copying. The user can utilize this column, when he/she inputts compositions with the same system. For the save of the Input Ratio, the selection of the user data file, “GP_user_74.mdb” or newer is necessary. Refer 6.1 (2) (F).

4) Component

Select specified components in the [Select Component] dialog box, which opens by double-clicking a light-blue cell in the [Component] column. Specification using the [Keyword] field in the dialog box is also available. When the [Calc] button is clicked, except when at% is selected as the [Main Unit], the

composition elements are automatically added. 39 rows at a maximum can be set. When the components are oxides with each different element, 19 oxides can be selected. Chalcogenide glasses, etc. for which mostly elements are used for composition are recommended to be registered as follows. Select mol% for the [Ratio Unit] and at% for the [Main Unit], select elements in the [Component] column, input the values, and click the [Calc] button. In this manner the user can search glasses registered with elements for the [Main Component] also by using mol% or mass% as the unit.

5) Component Ratio

Enter ratios of components in the [Ratio] column. The values in exponent style can also be entered. By selecting components first asterisks appear in each cell. Clear the asterisks and enter the values. By clicking the Enter key, the values are fixed as figures with maximum 2 decimal places or exponent style figures with 4 significant digits. (Examples: 52.36, 4.879E-02) Decimal points of numerical value should be period (.), not comma (,).

6) mass%, mol%, at%

The values in the [Ratio Unit] column are converted to ratios in the other units by clicking the [Calc] button.

Note: The proportional adjustment and conversion rules are as follows.

- a) Total in the range 99.99-100.01% is not adjusted.
- b) When there is a component such as R₂O, Apatite, Others, by clicking the [Calc] button, an error message "Unit conversion failed," appears, and by clicking the [OK] button, asterisks appear in the inconvertible cells and nothing appears in the [at%] column.
- c) When values in the [Ratio] column include *, by clicking the [Calc] button, an information message "Inclusion of * in value prevents system from dividing proportionally" appears and then asterisks appear in the inconvertible cells including the [at%] column.
- d) In the case that glass composition contains a complex compound (ex. BaTiO₃) as raw material, after calculation rows of its single compounds (ex. BaO and TiO₂) are added in the list and asterisks appear in the cells of the ratio.

7) [Correct] button

When it is necessary to correct the glass composition after the calculation (the proportional adjustment and unit conversion), click the [Correct] button. A warning message "Converted data not with Main Unit will be cleared. OK?" appears, and when the [Yes] button is clicked, the components in the [Component] column remain and values as the [Main Unit] appear in the [Ratio] column, and the other values disappear. When the user selects at% for the [Main Unit], or converts the [Main Unit] from mol% to at% after clicking the [Calc] button, the elements in the [Component] column and the values as at% in the [Ratio] column appear after clicking the [Correct] button.

8) Glass System

Glass System is an indispensable item. Three systems at a maximum can be specified from the [Select Glass System] dialog box. Specification using the [Keyword] field in the dialog box is also available. The first system constitutes a part of the Glass Number. Refer to 6. 2 (2) (B) 2).

9) Sol-Gel Material

It is possible to select up to 10 materials from the list in the [Select Sol-Gel Material] dialog box. Specification using the [Keyword] field in the dialog box is also available. After entering any material, the term "Sol-Gel" is automatically added in the [Appearance, Feature & Process] column.

10) Glass-Forming Region Data / [Δ None] pulldown menu

Glass-Forming Region data can be registered in two manners. When the State is not Melt, and the sum of ratios of the 2 or 3 components is 99.99~100.01%, the user can register the data for the Glass Forming-Region.

a) Marks on Ternary Diagram

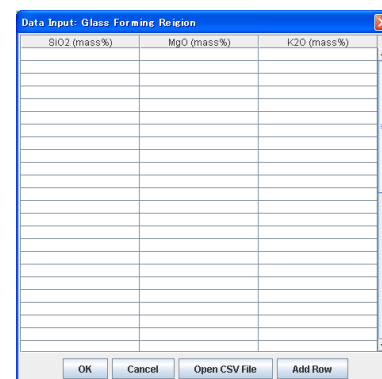
These marks are shown on ternary diagrams to indicate the glass-forming region.

○: Glass composition at which completely transparent glass is obtained.

×: Non-vitrified composition (At least a little part consisting of the non-glass exists in the

sample.)

After selecting (at least 2 or 3) components in the [Component] column and entering ratios of the components, select [Point Data] in the [Δ None] pulldown menu, and the [Select 3 components] dialog box opens. Check 2 or 3 components in the dialog box, and the [Δ Mark] pulldown menu appears in the right-hand side. Then select [O: Glass] or [$\times$: Non-vitrified] as the mark in the ternary diagram for the specified composition.



b) Curve on Ternary Diagram

The glass-forming region also can be shown by a curve.

After entering 3 components in the [Component] column, select [Curve Data] in the [Δ None] pulldown menu, and the [Select 3 components] dialog box opens. Check 3 components in the dialog box, and the [Data Input: Glass-Forming Region] dialog box appears. Enter x1, x2, x3 of 3-component compositions for the curve in the ternary diagram.

[Data Input: Glass-Forming Region] dialog box

The curve data can be entered also from CSV file prepared by clicking [Open CSV File] button in the window. Refer to 4. Curve data for glass-forming region of Chapter 6.

11) Filler / Crystal / Substrate

When Composite is selected in the [State] pulldown menu, the [Filler] column appears to enter conditions of Filler; when Glass-Ceramics is selected, the [Crystal] column appears; and when Thin Film is selected, the [Substrate] column appears.

a) Material of Filler, Crystal, or Substrate

Select a material in the [Select Component], [Select Crystal], or [Select Substrate] dialog box, which opens by double-clicking the left light-blue cell in each column. Specification using the [Keyword] field in the dialog box is also available.

b) Ratio of Filler or Crystal

Enter values in mass% in the white cell. When vol% is used, this fact should be noted in the [Note] column.

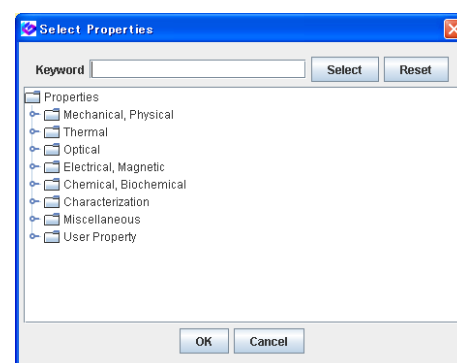
c) Shape of Filler or Crystal

Select a shape in the [Select Shape] dialog box, which opens by double-clicking the right light-blue cell. Specification using the [Keyword] field in the dialog box is also available.

<Property>

1) Specified

Property items can be specified using the [Select Properties] dialog box opened by clicking on a blue cell in the Specified column. Specification using the [Keyword] field in the dialog box is also available. 1199 property items at a maximum can be set. After a User Defined Property is registered (refer to 6.5), the property item is listed in the [User Property] folder of the [Select Properties] dialog box. Then, the user can register data for the User Property. When no User Defined Property is registered, the [User Property] folder does not appear.



[Select Properties] dialog box

Note: Regarding Diffusion ID, there are Diffusion Coefficient D_0 , but no Diffusion Coefficient D in the Property ID list. When a source has data of only D , not D_0 or Activation Energy E_a of Diffusion, register a value of D instead of D_0 , and enter a memo (ex. "D, 300C") in the [Condition] column.

2) Unit System

The user can select one of 5 Unit Systems, Common, SI, CGS, PSI, and Other by using the pulldown menu. The default is Common, and it can be changed in the [Preference] dialog box. Refer to 5.1 ID List of Property Database in Chapter 6.

3) Input Type

Numerical values are normally entered as linear values, but other types such as log, ln (natural log) and inverse (reciprocal) are also available. The type can be selected by using the pulldown menu. By the [Save] operation, all values are converted to linear values and stored.

4) Unit Description

When a unit system is chosen from among Common, SI, CGS and, the unit for each property is shown in the [Unit Desc] column automatically. Refer to 5.1 ID List of Property Database in Chapter 6.

5) Free Unit

When “Other” is chosen as the property unit system, the actual unit can be freely entered in the [Free Unit] column. If the input unit is one of the registered units in the system, it is converted to one of the 4 unit systems automatically.

6) Value

Enter the property values in the cell with asterisk of the [Value] column. Figures up to 15 significant digits can be registered. The values can be inputted in decimal style or E (exponent) style. A value of $1\text{E}-4$ or less, or $1\text{E}7$ or more is registered in E style. When a value is inputted in E style and the integral exponent is -3 to 6, it is registered in decimal style. When an exponent is in decimal style, the value is calculated to a figure with 4 significant digits and an integral exponent. Ex. Inputted value: $1.2468\text{E}-10.56$. By clicking the [Enter] key, the figure is converted to $3.434\text{E}-11$. Decimal points of numerical value should be period (.), not comma (,).

7) Condition

Note conditions such as the measurement condition. When a property value exceeds significant four digits, note the value in this [Condition] column. 100 letters (bites) can be entered here at a maximum.

8) Image Name

XY data for figures of some properties can be registered here. The applicable properties are 5 items; Thermal Expansion Curve (α -T Curve), UV/IR Transmisssion Spectrum, UV/IR Absorption Spectrum, UV/IR Reflectance Spectrum, and Emissivity Spectrum. Refer to 3. “Table Data” of Chapter 6. When one of the properties is selected in the [Specified] column, the cell of the same row in the [Image Name] collum changes from grey to light-blue color. By double-clicking the light-blue cell, the [Data Input: Figure Data] dialog box opens. The user can enter the title, labels of X and Y axes (X: parameter such as temperature, wave length, Y: property value), minimum and maximum values for each axis, and XY data for a figure.

CSV data, which are stored in the form described in 3. “Table Data” of Chapter 6 in the user’s computer, can be imported by clicking the [Open CSV File] button. The registered figure is shown by selecting the [Figure] pulldown menu in the [Detail Data of Property] window.

The dialog box titled "Data Input: Figure Data" has a blue title bar. Inside, there are input fields for "Title", "X: label", "Y: label", "min", and "max". Below these fields is a table with two columns, "X" and "Y", and multiple rows for data entry. At the bottom of the dialog are four buttons: "Save", "Cancel", "Open CSV File", and "Add Row".

[Data Input: Figure Data] dialog box

Note: The temperature given for a property ID allows that within a ± 20 °C range.

Example: [Density 100 °C] includes densities in the range 80 to 120 °C.

When the temperature is not 100 °C, note the temperature in the [Condition] column.

Note: The entry rules for special characters, etc. are as follows.

a) Greek characters: $\alpha \rightarrow A$, $\beta \rightarrow B$, $\gamma \rightarrow G$, $\varepsilon \rightarrow E$, $\lambda \rightarrow L$, and $\chi \rightarrow X$

b) Roman numerals: I $\rightarrow$ 1, II $\rightarrow$ 2, and III $\rightarrow$ 3

c) Superscripts and subscripts: Å $\rightarrow$ A, °C $\rightarrow$ C, and SiO₂ $\rightarrow$ SiO2

(C) Other buttons

1) [Copy Data] button

A new glass dataset (record) is prepared using a copy of the existing stored data. Click the [Copy Data] button in the [Data Input] window with a new Glass ID, and the [Copy Data] dialog box opens. When a Glass ID for a copy is entered and the [OK] button is clicked, the data of the Glass ID appear in a red color. For composition, the components and the ratios appear in the [Component] column and the [Ratio] column, respectively, and in the [Input Ratio] column its values appear. The corrected letters change from red to black. When the [Save] button is clicked, the color of the all data changes to black.

2) [Save] button

Click to save the inputted data of the window.

3) [Reset] button

Click to clear all the entered data before saving.

4) [Lot No.] button

Click to transfer to the other Lot. No. by using the [Select Lot No.] dialog box.

5) [Show/ Hyde Typical Property] pulldown menu of Tools on the menu bar

When there is a property value with the Typical Data in the inputted data, if the user clicks the 'Hyde Typical Property' in the pulldown menu of the Tools, and then clicks the [Save] button, the Typical Data do not appear in the list of the [Data Input] window after clicking the [YES] button in the [Check of Registration] 'Data will be updated. OK?' button. If the user then clicks the [Previous Record] button or the [Next Record] button, and goes back to the [Data Input] window, the Typical Data do not appear similarly. In reverse, when the user likes to show the Typical Data, click the 'Show Typical Property' in the pulldown menu. For previously saved data, this selection of the pulldown menu is reflected in the reopened window.

6) ◀ [Previous Record] button

Click to transfer to the previous record in the same Lot. No.

7) ▶ [Next Record] button

Click to transfer to the next record in the same Lot. No. When the record in display is the newest, a window for a new record opens.

6.3 [Data List] window

A list of registered glass data by the user is shown. Batch entry of data can be conducted from this window. The registered data can also be deleted in this window.

(1) Window configuration

Delete	No.	Lot No.	Glass No.	Data Source	Year	Data Source Number	SiO ₂	B ₂ O ₃	Al ₂ O ₃	K ₂ O
☐	1	002	GU05-800017	User Data	2011	U008	27.83	30.94	10.31	30.92
☐	2	002	GU09-800020	User Data	2011	U008	29.36	30.29	10.09	30.26
☐	3	002	GU05-800025	User Data	2011	U010	33.33	44.45	11.11	11.11

[Data List] window

(2) Details

(A) Search Condition

1) [Lot No.] pulldown menu

Select a lot from a list of the existing lots.

2) Glass ID

Specify a range of Glass IDs with 6-digit number (ex. 800001-800100). When a Glass ID is entered in one of two cells, only the glass is searched

3) [Component Unit] pulldown menu

Select a component unit from mass%, mol%, at%, or Input Ratio. When the user converts the component unit, click the [Search] button after selecting the unit in the pulldown menu.

4) [Search] button

Click to search under the specified condition in the [Search Condition] column, and the searched glasses are listed in the table.

5) [Reset] button.

Click to clear the specified condition to the initial state. The searched list is not cleared.

(B) Data List

The data list table contains No. in the list, Lot No., Glass No., Data Source, Year, Data Source Number, Components, and Properties of the searched glasses.

1) Component

Up to 10 components, data of which are searched, are shown by default. By clicking the [Component] button and check the checkboxes of components, up to 39 components (19 oxides with each different element) can be shown.

2) Property

Up to 10 properties, data of which are searched, are shown by default. By clicking the [Property] button and check the checkboxes of properties, up to 199 properties can be shown.

3) [Delete] checkbox

Check to specify as glasses to delete.

(C) Add Items

The information shown in the list is limited, however other data items may be added by using the following buttons.

1) [Information] button

Using the checkboxes in the [Select Information] dialog box opened by clicking the [Information] button, the following data of the searched glasses can be shown or hidden in the list: Data Source, Year and Number of Data Source, Author, Glass State, Glass System, Shape, Feature & Process, Usage, Sol-Gel Material, Thermal Treatment, Note. The [Select All] button makes ON of the checkboxes for all the items, and the [Clear All] button makes OFF for all the items.

2) [Component] button

Using the checkboxes in the [Select Component] dialog box opened by clicking the [Component] button, the [Component] columns of the searched glasses can be shown or hidden in the list. The [Select All] button makes ON of the checkboxes for all the components, and the [Clear All] button makes OFF for all the components. Clicking the [Expand All] button opens the all items of components, the [Collapse All] button returns to the initial state.

3) [Property] button

Using the checkboxes in the [Select Property] dialog box opened by clicking the [Property] button, the [Property] columns of the searched glasses can be shown or hidden in the list. In the [Select Property] dialog box, the Unit System of the selected properties can be selected. To delete a property item in the list, click the [Delete] key in the computer after clicking a numerical cell for the item.

(D) Delete glass data

1) [Delete] button

Click to delete the rows for which the deletion checkbox in the left side of the table is checked. The deleted data are unable to recover. By checking the [Select All] checkbox above the [Delete] button, the checkboxes of the all glasses can be checked. Then by unchecking the [Select All] checkbox, the checkboxes of the all glasses can be unchecked.

2) [Data Source List] button

Click to delete unnecessary Data Source, which has no data (0 in the right columns).

(E) Transfer to the [Data Input] window

1) [Edit] button

After clicking a glass row in the list, click the [Edit] button, and the [Data Input] window of the selected glass opens. Here the author can confirm all the registered data of the selected glass, and can renew the data.

2) [New Data] button

By clicking the [New Data] button, the [Data input] window for a new data opens. The Glass ID of the window is the next No. of the largest No. registered.

(F) Batch entry of new glass data

Many datasets in the same form of a spreadsheet (ex. Microsoft Excel sheet) can be registered by the batch entry processing. However several items cannot be register in this procedure. Such items are Operator, Gold Data, User Glass, Character, Operator's Memo, Memo, and Condition of Property in the [Data Input] window. After the batch entry, Character becomes Batch as default (the Character of the model glass does not change), for Memo the description of the model dataset is rested when the Data Source is the same, and the other items are blank. 10 authors at a maximum can be entered by punctuating. 150 letters (bites) at a maximum including commas can be inputted. On the [Data Input] window, the authors are shown one by one in each row. 39 components and 199 properties at a maximum can be registered. Accordingly lacked informations should be corrected and saved in each [Data Input] window.

<Procedure>

1) Input a model data

Input a model glass dataset in the [Data Input] window and save it.

2) Display the model data in the list

In the [Data List] window, enter the Glass ID of the model glass in the [Search Condition] column and

click the [Search] button. A row of the model data appears in the list. Select [Component Unit] for the batch entry, and by clicking the [Search] button the component values in the list are converted.

3) Add items

Add items of components, properties, etc. to register in the list, and hide unnecessary items such as Typical Data. For hiding the Typical Data, in the [Select Property] dialog box delete the leftside check of the item, and click the [OK] button.

4) Make CSV file

By Clicking the  [Export] icon, the [Save] dialog box opens. Enter a file name, select the save folder, and click the [Save] button. The default file name is “userdata.csv.” When a save folder is set as the [Default Folder] in the [Preference] dialog box, the default folder appears in the [Save] dialog box.

5) Open CSV file

Start up the user's spreadsheet software (ex. Microsoft Excel) and open the CSV file.

TJ GLASS	TJ GLASSINF	TJ GLASSINFO	TJ GLASS	TJ GLASSINF	TJ COM	TJ COM	TJ CO	TJ COM	TJ PROP	TJ PROP	TJ PROPERTY	PROP FIG	2017	01
Lot No.	Glass No.	Data Source	Year	Data Source No	SiO2	Al2O3	CaO	Na2O	Density at	Expansion	Refract Index	587.6nm d		
2	GU02-800003	900<!>User Data	2010	U002	65	12	11	12	2.45	7.54	1.52			

Example: An opened CSV file in the Excel Sheet

The 3rd row is the model data. Enter new data from the 4th row.

6) Enter data

Enter data or paste a table data before prepared below the model data in the same format, save the file, and close the software. Data Source “900<!>User Data” of the 3rd column should not be changed. For Usage, etc. input ‘ID No <!’>. Ex. Display: 310<!’>. Addition of items which is not in the model data is unable. The user can register figures with maximum 2 decimal places for component ratios, and figures up to 11 significant digits for property values.

7) Import CSV file

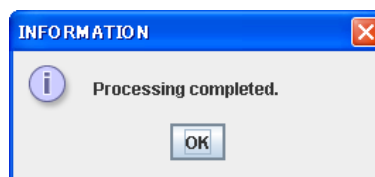
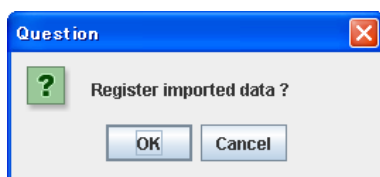
Clicking the  [Import] icon in the [Data List] window opens the [Import Result] dialog box. By clicking the [OK] button in the dialog box after checking, the data of CSV file appear in the list.



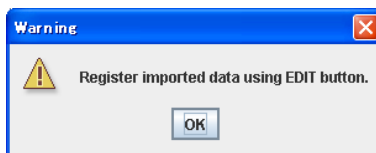
8) Save the data

The [Question] dialog box (Register imported data?) appears. In the case of batch registration, click the [OK] button, and also the [OK] button of the [Information] dialog box (Processing completed), which appears subsequently. By this procedure the proportional divide calculation of the total contents of the components to 100%, and the convert calculation to the other units, and the registration of the Typical Data are performed. When the registered property includes the Typical Data, the corresponding Typical Data appear in the list of the [Data List] window.

[Import Result] dialog box



In the case of registration one by one, click the [Cancel] button in the [Question] dialog box, and click the [OK] button of the [Warning] dialog box (Register imported data using EDIT button), which appears subsequently. Then operate the procedure below.



Select the 1st added row of the glass data, and click the [Edit] button. Enter additional data and correct if necessary in the [Data Input] window, and click the [Save] button. By saving, the component contents are calculated, and the Typical Data, etc. are also registered, which appear in the [Data List] window. Execute the same procedure for the other added data one by one. The save procedure is necessary for all the datasets, even if the addition is not necessary. Also after the batch registration, the users can perform any addition and correction of data one by one in the same manner by using the [Edit] button.

6.4 [Lot Data Operation] dialog boxes

Backup, recovery, and deletion of the user data for each Lot can be executed Lot by Lot in these dialog boxes opened by clicking the [Lot Data Operation] button in the [User Data Menu] window.

(1) Details

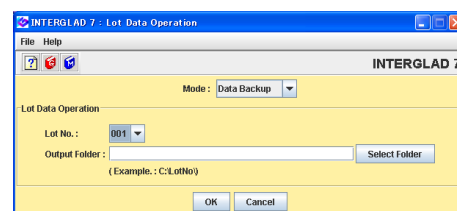
(A) [Mode] pulldown menu

Select an operation mode from among “Data Backup,” “Data Recovery,” and “Data Deletion.”

(B) Each operation

1) Data Backup

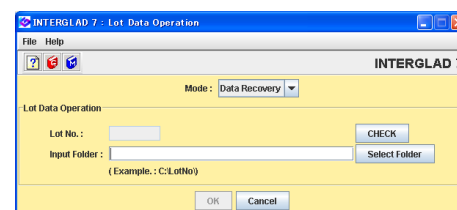
- Select Lot No. of the data for backup in the [Lot No.] pulldown menu. The subjected mdb file is that which is selected in the [Preference] dialog box.
- Click the [Select Folder] button, select a backup folder in the [Save] dialog box opened, and click the [Save] button.
- Lot No. of the data for backup appears in the [Output Folder] column. After the confirmation, click the [OK] button.
- When the [Information] dialog box, “Processing completed” is opened, click the [OK] button in the dialog box.



Data Backup

2) Data Recovery

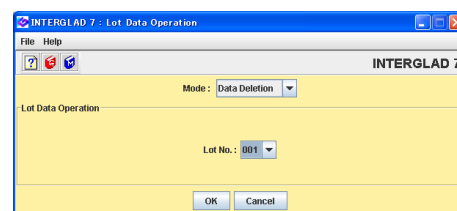
- By clicking the [Select Folder] button, the [Open] dialog box opens. In this dialog box select the folder for recovery stored in the user's computer, and click the [Open] button.
- In the [Input Folder] column the folder name for recovery appears.
- By clicking the [Check] button, Lot No. appears in the [Lot No.] column.
- After the confirmation, click the [OK] button.
- When there is the same Lot No. in the INTERGLAD system, a [Question] dialog “Data (Lot No.: xxx) will be overwritten by input data” appears. Note that the data are registered in the mdb file selected in the [Preference] dialog box. By clicking the [Yes] button, the operation is executed.
- When the [Information] dialog box, “Processing completed” is opened, click the [OK] button in the dialog box.



Data Recovery

3) Data Deletion

- Select Lot No. of the data for deletion in the [Lot No.] pulldown menu, and click the [OK] button.
- The [Question] dialog box “Deleted data are unable to recover.OK?” appears. By clicking the [Yes] button, the operation is executed.
- When the [Information] dialog box, “Processing completed” is opened, click the [OK] button in the dialog box.



Data Deletion

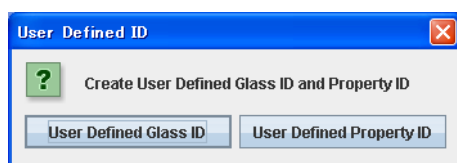
[Lot Data Operation] dialog boxes

6.5 [User Defined ID] window

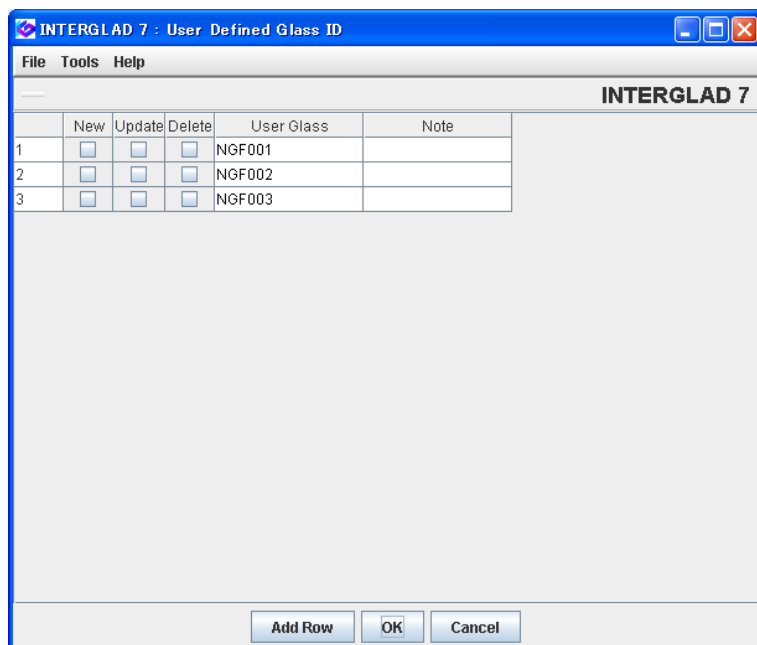
The user can define new Glass ID and new Property ID here. The data registered with User Defined IDs can be used in the Property Search. These data cannot be utilized in the Analysis and the Prediction at the present time.

(1) Window configuration

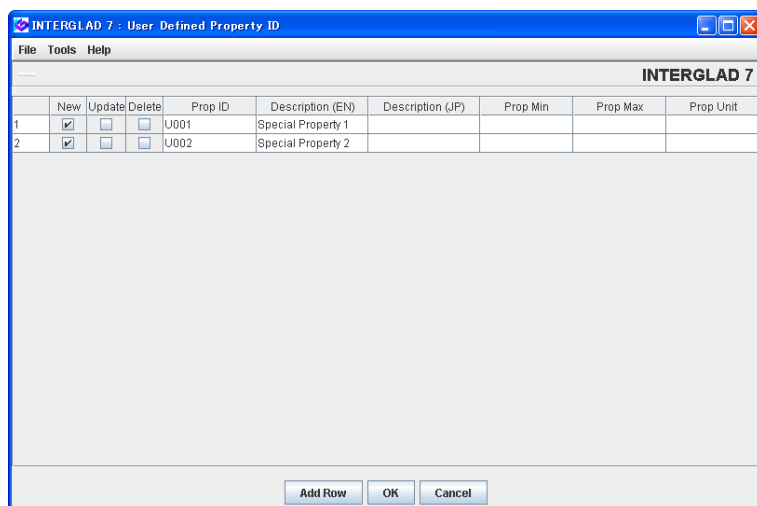
By clicking the [User Defined ID] button in the [Main] window, the [User Defined ID] dialog box opens, and the [User Defined Glass ID] window or the [User Defined Property ID] window opens by selecting the buttons.



[User Defined ID] dialog box



[User Defined Glass ID] window



[User Defined Property ID] window

(2) Details

(A) [User Defined Glass ID] window

User Defined Glass ID can be registered, corrected, and deleted here.

- By clicking the [User Defined Glass ID] button, the [User Defined Glass ID] window opens.
- A new row for registration is added by clicking the [Add Row] button.
- Enter a name of Glass ID in the [User Glass] column. The limit of the entry is 25 letters. Notes can be entered in the [Note] column.
- For registration, check in the [New] checkbox, and click the [OK] button.
- When the [Information] dialog box, “Processing completed” is opened, click the [OK] button in the dialog box.
- For correction, check in the [Update] column, for deletion check in the [Delete] column, and click the [OK] button.

The registered Glass ID is specified as an input item in the [Select Commercial and User Glass] dialog box opened from the [User Glass] column of the [Data Input] window. And the ID is specified as a search item in the [Select Commercial and User Glass] dialog box opened from the [Commercial (User) Glass] column in the [Search Property Data/ Detail] window.

(B) [User Defined Property ID] window

User Defined Property ID can be registered, corrected, and deleted here.

- By clicking the [User Defined Property ID] button, the [User Defined Property ID] window opens.
- A new row for registration is added by clicking the [Add Row] button.
- Enter a code, “U+three figures” (ex. U001), and a name, etc. in the [Description (EN)] column. The limit of the entry is 40 letters.
- The minimum value, the maximum value, and the unit of the property may be entered in the [Prop Min], [Prop Max], and [Prop Unit] columns respectively. However, the minimum and maximum values do not have any effect in the [Data Input] window and in the [Search Property Data] window. The [Description (JP)] column is for a name in Japanese.
- For registration, check in the [New] checkbox, and click the [OK] button.
- When the [Information] “Processing completed” dialog box is opened, click the [OK] button in the dialog box.
- Check in the [Update] column for correction, check in the [Delete] column for deletion, and click the [OK] button.

The registered Property ID is shown and specified in the ‘User Property’ list of the [Select Properties] dialog box opened from the ‘Specified’ column of the [Property] column in the [Data Input] window, in the [Search Property Data] window and in the [Search for Regression Analysis] window. The data of the

registered Property ID can be used for the Ternary Plot, XY Plot, Element Analysis and Regression Analysis. To show the registered Property ID in the [Data Input] window, close the INTERGLAD system and reopen it. To show the registered Property ID in the [Search Property Data] window, the user need not close the INTERGLAD system once.