Chapter 2. Outline

1. Contents and Functions

The international glass database INTERGLAD Ver. 7 is an information system that contains comprehensive data on approximately 340,000 types of glasses (including inorganic amorphous materials such as oxide glasses, non-oxide glasses, amorphous metals and glass-matrix composites, and oxide melts and non-vitrified oxides). It was designed for a variety of uses and purposes. Its main functions are four-fold:

1) Search for glass data,
2) Analysis of searched-for glass data,
3) Prediction of properties and the design of glass composition (composition optimization), and
4) Registration of user data and its utilization.

(1) Collected data

The INTERGLAD data set is mainly composed of glass compositions and properties drawn from five sources: data books, scientific journals, proceedings, patents, and company catalogues. Original data assembled by the NGF are also included.

Beginning with Ver. 5, the names of authors from scientific journals, data indicating glass-forming regions, and figures have been added to the collected data. Data on glass-forming regions in which only a single boundary exists have been also registered in Ver. 6. Information on precipitated crystals in glass-ceramics, raw materials for sol-gel processes, substrates of thin-film glasses, glass preparation methods, heat treatment conditions, and methods for determining properties have also been added.

Registrations of glass structural data were compiled for Ver. 7. Glass structural data include atomic information (atomic distance, bond angle), ring structure, coordination number, bridging oxygen information, oxidation number, basicity, etc. as analyzed by IR-UV spectroscopy, Raman spectroscopy, ESR, NMR, etc. With regard to the structural data, only the existence of most of the structural data was indicated with an asterisk (*) as characterization data in Ver. 6; however, other details including the numerical values were not present in this version. Ver. 7 is composed of a property and a structure database.

The latest data are posted on the Internet version twice a year, and posting errors that occur during the collection of INTERGLAD data from various sources are corrected immediately.

Registered Data in Ver. 7 (as of May 7, 2018)

Property Database 330,476 glasses

The number of glasses counted includes those whose composition, manufacturing process, or data source differs from that of other glasses.

Data Source		
Books	48,161 glasses (14.6%)	18 books
Journals	137,195 glasses (41.5%)	80 journals and others, mainly after 1970 Registered 2 years after publication
Proceedings, etc.	9,228 glasses (2.8%)	8 and others (including NGF's original data)
Patents	131,321 glasses (39.7%)	Japan, U.S., Europe patents after 1979 Registered in 2 years after disclosure
Catalogues	4,571 glasses (1.4%)	76 companies

Structure Database 10,691 glasses

Data Source	
Journals	10,593 glasses (99.1%)
Proceedings, etc.	98 glasses (0.9%)

Property Database + Structure Database total 341,167 glasses

(2) Search for glass data

The data and information required by users can be easily extracted using more than 2,600 keywords or ID's that are hierarchically arranged. Keywords or IDs of the property database are classified by State (General Glasses such as Glass, Glass-Ceramics, Composites; Melts; Non-vitrified; Not specified); Glass System (Oxide Glass such as Silica, Alkali Silicate, Alkaline-earth Silicate; Other Glasses); Appearance, Feature & Process; Usage (General; Energy, Nuclear, Radiation; Optics, Optoelectronics; Electronics, Electrical; Illumination; Architecture, Traffic, Industry; etc.); Data Source, Author, Composition, and Property (Mechanical, Physical; Thermal; Optical; Electrical, Magnetic; Chemical, Biochemical; etc.). In addition, the keywords or IDs of the structure database are likewise classified according to State, Glass System, Composition, Structure Information, Measurement Method, Data Source and Author. A search can be performed by setting at least one condition (keyword or glass No. except State). The search tools in Ver. 7 are more user-friendly. It is now possible to select a component using the periodic table or to select a component or property by inputting a keyword.

The search function can direct one to the following contents:

1) Data on commercial glasses that can be extracted from sources other than catalogues,

2) Detailed descriptions that are generally displayed in the Data List of Property (Structure),

3) Grouped data from a given data source that can be displayed in the same table,

4) Reciprocal referencing between the property database and structure database, which is possible for the searched Data List and the Detail Data,

5) Unit conversions as well as arithmetic operations for compositions and properties,

6) Comparison of values calculated using the additivity equations and fact data.

(3) Analysis of searched-for glass data

The data searched by a user can be visualized using an XY Plot, a Ternary Plot, and the Element Analysis. With Ver. 7, the interpolation of high temperature properties can be done with few data.

The analysis function accesses the following contents:

1) The relationships between two arbitrarily chosen variables from components, properties and structures can be plotted on XY charts.

2) XY Plots for property and structure can be shown when the Data List includes both property data and structure data.

3) High temperature property values for a glass at multiple temperatures can be plotted on XY charts as Temperature-Property Plots that include interpolated values.

4) Property and structure data can be displayed on a Ternary Plot of chemical composition.

5) The frequency of appearance for each glass element can be shown as Element Distribution for groups of glasses that have specified properties.

(4) Prediction of properties and design of glass composition (composition optimization)

INTERGLAD employs two approaches to the prediction of glass properties:

1) Additivity equations (51 equations for 14 properties): The property value of a glass having a specified chemical composition is calculated using an additivity equation selected from a list of equations assembled from papers published in scientific journals.

2) Multiple regression analysis: The relationship between the chemical composition and any given property of a glass can be derived by means of multiple regression analysis of the property values of searched-for glasses, and prediction becomes possible using the derived regression equation. Two types of equation, with and without a constant, are available.

A multiple regression analysis tool with multiple (quadratic or cubic) polynomials is also available in Ver. 7. Not just one-component terms but also two- and three-component terms can be used as explanatory variables. This is effective for predicting the properties of many glasses in composition ranges in which additivity is not observed. Values predicted through regression analysis can be compared with the measured values on an X-Y chart.

Glass compositions that fulfill all conditions of three properties can be searched for on the screen using trial and error. It is also possible to display a designed composition on a ternary plot and to compare positions within the glass-forming range. Interpolated property data can also be utilized for multiple regression analysis. New assistance dialogues now make prediction even easier.

(5) Registration of user data

Users of INTERGLAD can incorporate their own data in the INTERGLAD system and make full use of the integrated datasets. Batch entry of many data can be done using a simple import method. The user definitions of glass codes and property labels are free. User data are stored in one's PC. Because the data is not externalized, no security problems can arise, even when one's PC is connected to the Internet (for the Standard edition).

(6) Convenient Help system

INTERGLAD incorporates the following Help features so that anyone can readily operate the system:

1) Help balloons: Help balloons are attached to every key element on the screen,

2) User's manual: Full instructions on the use of INTERGLAD can be accessed on-screen (in preparation),

3) Explanations of terms: Various glass terms and their meanings are directly accessible on-screen as a Glossary,

4) Methods of measurement: Methods for measuring property values can also be accessed on-screen.

(7) Data reliability

The reliability of the data assembled in INTERGLAD is entirely dependent on the original data sources that were used: data books, scientific journals, patent applications, and catalogues. Based on the premise that erroneous data can be readily identified through the comparison of a number of data, the NGF did not examine each specific datum in INTERGLAD. However, obviously problematic data were deleted following the release of Ver. 6 through the use of a reliability estimation tool that was developed. In the future, all data will be rated on a scale ranging from low reliability to high reliability.

Every effort has been made to provide accurate data in INTERGLAD. However, the values, data, and information contained in this database cannot be guaranteed for accuracy or for freedom from errors or omissions. The use of INTERGLAD for any purpose is at the users' own risk, and we disclaim any liability for loss, claims, or damages resulting from its use.

2. Application Types

INTERGLAD Ver. 7 has 3 application types: a Standard edition, Internet edition, and CD Full Function edition (Table 1). The use of the Standard edition and Internet edition requires one to connect to the INTERGLAD server of the New Glass Forum. The CD Full Function edition does not require connection to Internet. This possibility was newly introduced in Ver. 7. The names of the program types in INTERGLAD Ver. 6 were changed in Ver. 7. Fig. 1 shows the system configuration of INTERGLAD Ver. 7.

Table 1 Application Types of INTERGLAD Ver. 7.

Application Type	System Installation	Internet Connection	Available[2] Database	Available Function[1]					User Type	Note
				Search	Analysis	Prediction /Design	User Data	File[3] Import/Export		
Standard	Required	Required	Server /Local /User	Yes	Yes	Yes	Yes	Yes	Annual Contract	Renewal of annual contract is required for continued use
Internet	Not required	Required	Server	Yes	Yes	Yes	No	No		
CD Full Function	Required	Not required	Local /User	Yes	Yes	Yes	Yes	Yes	One-time Purchase	Licensing period is one year

1 Structure Database does not have the functions of prediction/design and user data registration/utilization.

2 Available Database Server Database: Database stored in the INTERGLAD server of the New Glass Forum, available with the latest data any time.
Local Database: Database installed on computer from Web page or CD, renewed each year.
User Database: Database in which the user registered his/her own data, available for use along with the Server Database or the Local Database.

3 File Import/Export: Data- and image-saving for search conditions, search results, analysis results, prediction results, etc.

4 Type labels of Ver. 7 and Ver. 6

Ver. 7		Ver. 6
Standard Edition	⇔	Stand-alone full functional version (Stand-alone version)
Internet Edition	⇔	Internet Version (Applet Version)
CD Full Functional Edition	⇔	No
No	⇔	Stand-alone compact version (CD-ROM version)

(1) Standard edition

The program and database of the Standard edition are installed on the user's computer, and the Standard edition is then used by connecting to the Internet. Data from the server database that includes the most recently registered data, the local database installed on the hard disc of the computer, and the user database on which the user registers his/her own data can be all accessed. User authentication by a User ID and Password is required for start-up. Data from the server database are sent and received by HTTP. In slow-speed Internet environments, use of the local database is recommended. The correction of any program problems is carried out. The revised version is announced on the information page when start-up of INTERGLAD system and can be downloaded from the web page of INTERGLAD.

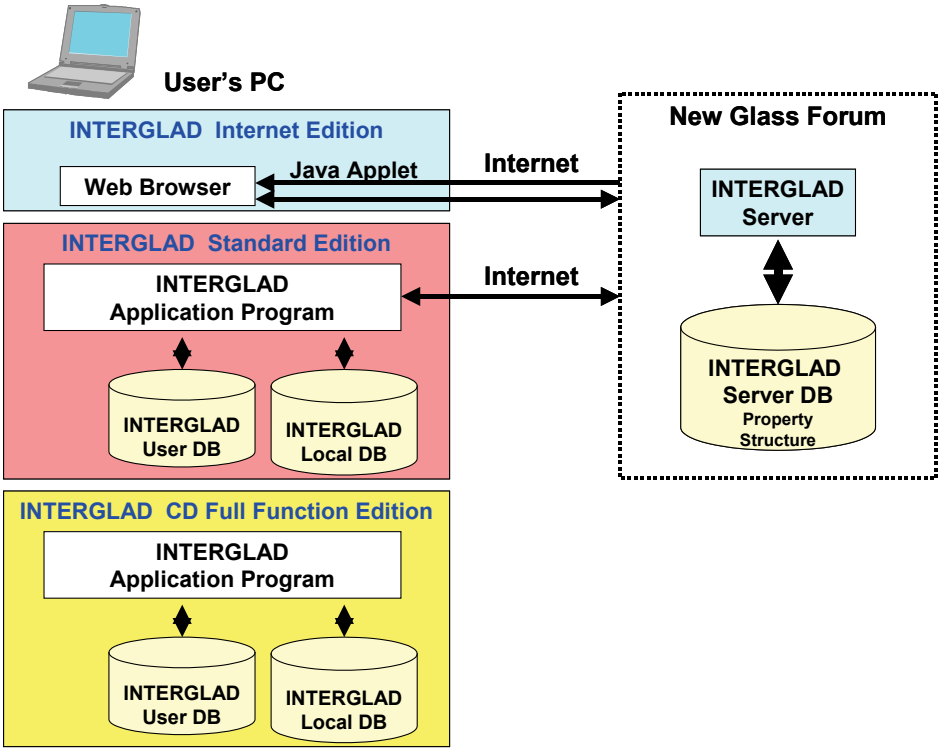

Fig. 1 Configuration of INTERGLAD Ver. 7.

(2) Internet edition

The Internet edition is used on a web browser that is connected to the Internet. Only data from the server database, including the most recently registered data can be accessed. The registration of user data and the ability to import/export files are not available. User authentication by a User ID and Password is required for start-up. Data from the server database are sent and received by HTTP. The server-side INTERGLAD program is automatically loaded into the cache of the user's computer as a Java Applet. In a low-speed Internet or high-security computer environment, the Internet edition may not provide full functionality. Program corrections are made from the server properly, and the latest programs and data are always available.

(3) CD Full Function edition

The program and database of the CD Full Function edition are installed on the user's computer. For start-up, input of a license key sent from the New Glass Forum is required. Data from the local database is installed on the hard disc of the computer, and the user's database can be accessed. Without connecting to the Internet, all the functions of INTERGLAD, including data analysis and prediction/design functions are available. The licensing period is one year. Usually the search speed is lower than that for the Standard edition.

3. User Types

INTERGLAD offers user access in two formats: (1) an annual contract, and (2) one-time purchase of the CD Full Function edition. The New Glass Forum recommends the annual contract, which gives access to both the Standard edition and the Internet edition that has the latest data and the fastest speed. Timely and rapid corrections of the program are made for both editions. For the CD Full Function edition, the licensing period is one year; the NGF recommends that users purchase a renewed upgrade version each year. The use fees can be found in Table 2.

Table 2 User Types and Fees for INTERGLAD Ver. 7.

JPY: Japanese Yen

User Type		for NGF Members	for Non-members	for Academics
Annual Contract	Initial Fee	50 000 JPY	60 000 JPY	0
	Annual Fee	100 000 JPY	120 000 JPY	50 000 JPY
One-time Purchase	Price of CD Full Function Edition	150 000 JPY	180 000 JPY	75 000 JPY

from January 2018

NGF Members: Corporate Members and Associate Members of the New Glass Forum. Non-members: Others besides NGF Members.
Academics are organizations or individuals of universities, colleges, or schools.
With an Annual Contract, the user downloads the INTERGLAD system of the Standard edition from the Web and installs it on his/her computer. To receive a CD of the Standard edition, an additional fee of 3000 JPY is required.
For ongoing renewal of the CD Full Function edition, the price becomes 120 000 JPY for NGF Members, 140 000 JPY for Non-members and 60 000 JPY for Academics from the 2nd year forward. An updated CD is delivered to the user with each renewal.
When an annual contract member also purchases the CD Full Function edition the price of the CD becomes 120 000 JPY for NGF Members and 140 000 JPY for Non-members.
For ongoing renewal of the CD Full Function edition by an annual contract member, the price of the CD becomes 110 000 JPY for NGF Member from the 2nd year forward.

4. User Requirements

(1) Hardware

a. Computer

AT-compatible computer operating Microsoft Windows Vista/7 /8 /10, or Apple Mac.

256 MB or more of RAM is indispensable (preferably 512 MB). 1.2 GHz and more of CPU speed is recommended.

b. Disk

Disk space required to contain software and database.

Java software : 170 MB

INTERGLAD system : 10 MB

Local database, User database: 500 MB

c. Display

Resolution: above 1024 × 768

d. CD Drive

Required for CD Full Function edition.

(2) Software

a. Operating System (OS)

Windows 32-bit and 64-bit (Vista/7 /8 /10), Mac OS X, Linux

In the case of Mac OS X or Linux, the server database is available for the Standard edition and the Internet edition, but the local database and user database are not available. The CD Full Function edition can be used only in the case of Windows.

b. Java software

Java software Ver. 6 or newer is required. Ver. 7 is recommended.

(Java Runtime Environment (JRE) 1.6.0 or newer)

c. Web browser

Required for the Internet edition.

Internet Explorer (9 or11)

Opera (4.x or newer)

Firefox (38 or newer)

(3) System installation and initial setting

To use the Standard edition or CD Full Function edition of INTERGLAD, installations of INTERGLAD system (with database) and Java to the user's PC are required. When Java has not installed in the PC, install Java Version 7. To use the full function of INTERGLAD, Java Version 7 is necessary. When the user installs only Java Version 8 or newer, he/she cannot perform conversion and registration of user data. In some cases the user have to stop the security soft temporarily or lower the security level to install the program or start-up.

When the user's PC is Windows 64-bit type, setting of ODBC data source etc. are required in some cases. For the details on Windows type and Java version, see "System Installation and Initial Setting" in Chapter 3 of the User's Manual.