## Lawrence Berkeley National Laboratory

# International Glazing Database:
# Data File Format

Version 2.0

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# 1 INTRODUCTION

This document is part of a set of documents that needs to be referenced when submitting data for the International lazing Database. The set of documents comprises of the following documents:

- IGDB data submission procedure → describes in general terms the procedure that needs to be followed for submitting new data to the IGDB
- IGDB data file format (this document) → describes the exact format for submitting data to the IGDB
- IGDB data submission form → required form for data submission

# 2 DEFINITIONS / GLOSSARY

## 2.1 DEFINITION OF FRONT AND BACK SIDE

Throughout this document references are made to the front side and the back side of the glazing product, such as 'front reflectance' and 'back reflectance'.

The front side is defined as the side of the glazing normally facing exterior. This surface is also often referred to as surface 1 when the glazing is a stand-alone layer.

The back side is defined as the side of the glazing normally facing interior This surface is also often referred to as surface 2 when the glazing is a stand-alone layer. By convention, the spectral data and other information is presented so that the glazing is orientated in its 'usual' fashion.

The following schemes are usually equivalent:

- front ↔ outside ↔ surface 1
- back ↔ inside ↔ surface 2

## 2.2 DEFINITION OF PHYSICAL PROPERTIES

| Quantity | Symbol | Unit | Remarks |
|---|---|---|---|
| Wavelength | λ | *nanometers* or *micrometers* | In the data file micrometers is abbreviated to *microns* in order to stay backwards compatible with Window4.1. |
| Thickness | d | *mm* or *inch (in)* | |
| Conductivity | k | $W \cdot m^{-1} \cdot K^{-1}$ or $Btu_{th} \cdot hr^{-1} \cdot ft^{-1} \cdot F^{-1}$ | |
| IR transmittance | TIR | - | |
| Emissivity | ε | - | Thermal hemispherical surface emissivity |
| Reflectance | R | - | The ratio of reflected power to incident power on the sample at normal incidence |
| Transmittance | T | - | The ratio of transmitted power to incident power on the sample at normal incidence |

## 2.3 FORMAT OF NUMBERS

- Fractional numbers in the data file use a point ( . ) as the decimal separator.
- All values shall preferably be given in 3 significant digits (examples: 0.302 or 0.094)
- Do not use scientific notation (such as 3E—2)

## 2.4 SYSTEMS OF UNITS

- All data shall be submitted in SI units or IP units, see Table 1 (the unit system that is used is part of the header information).

*Table 1 – System of Units.*

| Quantity | SI units | IP units |
|---|---|---|
| Thickness | mm | inch (in) |
| Conductivity | $W \cdot m^{-1} \cdot K^{-1}$ | $Btu_{th} \cdot hr^{-1} \cdot ft^{-1} \cdot F^{-1}$ |

Upon inclusion in the database, all data submitted in IP units will be converted to SI units using the following conversion factors taken from ASTM SI 10 (1997):

- From IP to SI, multiply thickness with 0.025 4
- From IP to SI, multiply conductivity with 1.730 735

# 3 HEADER DATA FORMAT

## 3.1 INTRODUCTION

The header in the text file consists of two parts. The first part contains the information that is used by both *WINDOW4.1* and *OPTICS5*:

- **Units, Wavelength Units**
- **Thickness**
- **Conductivity**
- **IR Transmittance**
- **Emissivity, front back**

The format of each line *in this part* is typically given by:

{ Keyword } Value

Note that each line consists of one or more keywords between curly brackets, followed by the values belonging to these keywords. These lines must be included *in the order shown* (but may have other lines in between them).

The second part contains the new information that can be provided and that is used by *WINDOW5* and *OPTICS5*. The information in the second part may be given in any order and may contain the following fields:

- **Type**
- **Hidden**
- **Product Name**
- **Manufacturer**
- **NFRC ID**
- **Acceptance**
- **Material**
- **Coating Name**
- **Coated Side**
- **Substrate Filename**
- **Appearance**
- **Structure**
- **Interlayer Appearance**
- **Interlayer Product Name**
- **Interlayer Code**
- **Interlayer Nominal Thickness**
- **Interlayer Material**

The format of *these* lines is usually given by

{ Keyword: Value}

The definition of each of the header lines is given in @@@.

There are 6 different types of glazings for which data can be submitted. We will discuss each of these types in chapter 4.

### 3.2 EXAMPLES

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

# 4 GLAZING TYPES

## 4.1 MONOLITHIC

### 4.1.1 DEFINITION

A monolithic glazing is an uncoated slab of homogeneous material such as clear float glass or an uncoated suspended film. This may be a free standing layer or a substrate or component in another glazing (e.g. a component of a laminate).

### 4.1.2 HEADER

The header of a monolithic glazing should have the following lines (**bold font** is always required, normal font is optional). The exact definition of each line is given in chapter 4.

```
{ Units, Wavelength Units }
{ Thickness }
{ Conductivity }
{ IR Transmittance }
{ Emissivity, front back }
{ }
{ Product Name: }
{ Manufacturer: }
{ Type: Monolithic }
{ Material: }
{ Appearance: }
{ Acceptance: }
{ NFRC ID: }
{ Hidden: }
```

### 4.1.3 REMARKS

Some of the optional lines are highly recommended, see chapter 4.

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

## 4.2 COATED

### 4.2.1 DEFINITION

A coated glazing is a monolilthic substrate with a thin-film coating deposited on it. This includes coated rigid substrates (glass, polymer) and also coated suspended films.

### 4.2.2 HEADER

The header of a coated glazing should have the following lines (**bold font** is always required, normal font is optional). The exact definition of each line is given in chapter 4.

```
{ Units, Wavelength Units }
{ Thickness }
{ Conductivity }
{ IR Transmittance }
{ Emissivity, front back }
{ }
{ Product Name: }
{ Manufacturer: }
{ Type: Coated }
{ Coating Name: }
{ Coated Side: }
{ Substrate Filename: }
{ Appearance: }
{ Acceptance: }
{ NFRC ID: }
{ Hidden: }
```

### 4.2.3 REMARKS

Some of the optional lines are highly recommended, see chapter 4.

If a laminate has a coating on the outer surface(s) or an embedded coating it is still referred to as a type Laminate in the IGDB, not as a glazing type Coated.

By supplying the `Coating Name` and the `Substrate Filename` you will provide a lot more flexibility for this product in Optics, such as:

- Optics users can apply the coating to another substrate, can change the substrate of this coated glazing or can apply another coating to the uncoated side of this glazing.
- Optics users can create laminates with this coated glazing

Examples of data files can be found on the internet on the IGDB homepage; go to:

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and click on

Data Submission Documentation and Examples

## 4.3 APPLIED FILM

### 4.3.1 DEFINITION

An applied film glazing is an adhesive backed film applied to a Monolithic substrate.

### 4.3.2 HEADER

The header of an applied film glazing should have the following lines (**bold font** is always required, normal font is optional). The exact definition of each line is given in chapter 4.

```
{ Units, Wavelength Units }
{ Thickness }
{ Conductivity }
{ IR Transmittance }
{ Emissivity, front back }
{ }
{ Product Name: }
{ Manufacturer: }
{ Type: Applied Film }
{ Coating Name: }
{ Coated Side: }
{ Substrate Filename: }
{ Appearance: }
{ Acceptance: }
{ NFRC ID: }
{ Hidden: }
```

### 4.3.3 REMARKS

Some of the optional lines are highly recommended, see chapter 4.

By supplying the `Coating Name` and the `Substrate Filename` you will provide a lot more flexibility for this product in Optics, such as:

- Optics users can apply the film to another substrate, can change the film of this applied film glazing.
- Optics users can create laminates with this applied film glazing.

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

## 4.4 FILM

### 4.4.1 DEFINITION

A film glazing is an adhesive backed film meant to be applied to a substrate.

### 4.4.2 REMARKS

The glazing type "film" cannot be submitted anymore to the IGDB. Instead, you should measure and submit data of your film, applied to a clear substrate and you should submit the measured data of the clear substrate (or use an existing clear substrate in the IGDB). For the substrate you should use a very thin, low iron clear monolithic glazing to get the best results.

This way Optics users can still apply the film to any other substrate.

The reason for requesting Applied Film data instead of Film data is because it is very difficult to get consistent measurements of Films alone. By measuring Applied Films and calculating the film properties by 'subtracting' the substrate properties the results for the Film will be much more consistent and reliable.

## 4.5 LAMINATE

### 4.5.1 DEFINITION

A glazing layer consisting of several Components joined together by adhesive Interlayers.

### 4.5.2 HEADER

The header of a laminate should have the following lines (**bold font** is always required, normal font is optional). The exact definition of each line is given in chapter 4.

```
{ Units, Wavelength Units }
{ Thickness }
{ Conductivity }
{ IR Transmittance }
{ Emissivity, front back }
{ }
{ Product Name: }
{ Manufacturer: }
{ Type: Laminate }
{ Coating Name: }
{ Coated Side: }
{ Appearance: }
{ Structure: }
{ Acceptance: }
{ NFRC ID: }
{ Hidden: }
```

### 4.5.3 STRUCTURE LINE

The exact format of the structure line (See paragraph 4.14) sounds rather complicated, but becomes much clearer by the following example:

Example:

Suppose a laminate consists (from the external to the internal side) out of 3 components (each can be found in the database):

1. A clear glazing called CLEAR3.LOF, with a thickness of 3 mm
2. A PVB layer called AZURBLUE.DUP, with a thickness of 0.76 mm
3. A coated glazing called ACTIV2.LOF, with a thickness of 2.24 mm (coating on air side, not PVB side)

In this case the structure field will be:

{ Structure: CLEAR3LOF;3;False+AZURBLUE.DUP;0.76;FALSE+ACTIV2.LOF;2.24;True }

Note that ACTIV2.LOF (which is listed in the database as coated on the front side) must be referred to as flipped in this laminate, since the coating is now facing the back side.
Note also that the second component in the structure (the interlayer) is referring to the reference laminate of this interlayer, which can be determined using the interlayer database in Optics.

4.5.4 REMARKS

Some of the optional lines are highly recommended, see chapter 4.

If a laminate has a coating on the outer surface(s) or an embedded coating it is still referred to as a type Laminate in the IGDB, not as a glazing type Coated.

By supplying the `Structure` you will provide a lot more flexibility for this product in Optics, such as:

- Optics users can change the structure of this laminate to create new laminates.
- Optics users can add coatings or films to the outer surfaces of the laminate.

The glazing type Laminate is also used when submitting interlayer data or embedded coating information ,see paragraphs 4.6 and 4.7

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

## 4.6 INTERLAYER

### 4.6.1 DEFINITION

An Interlayer is an adhesive layer used to join components in a Laminate.

### 4.6.2 INTRODUCTION

The optical properties of laminate interlayers cannot be measured directly, instead they are calculated from the spectral properties of a 'reference laminate' which consists of the interlayer laminated between two glass layers of known optical properties. To submit data for an interlayer, both the spectral optical properties of the reference laminate, and the glass layers used in the reference laminate should be submitted. Optics uses a special algorithm to determine the interlayer properties from these sets of data. For each spectral data file the rules given in this document should be followed.

For the outer layers of the reference laminate, one could *in principle* use two different glazings. If so, the spectral optical properties of both glazings should be measured and submitted with the reference laminate. Here it is assumed that both outer layers are the same glazing, so that only one additional set of data is required. We strongly recommend the use of low-iron glass of a minimum thickness required to fabricate good quality laminate samples. This will give the best quality results for the calculated properties of the interlayer.

### 4.6.3 MEASUREMENTS

Step 1: Measure the properties of the sheet of low-iron glass that is going to be used to construct the outer layers of the laminate:

- Measure the thickness as exactly as possible
- Measure the spectral data of the glass

Step 2: Construct a laminate with the interlayer between two sheets of the measured glass and measure the properties of the laminate:

- Measure the thickness as exactly as possible
- Measure the spectral data of the laminate

Step 3: Submit data, both for the clear glass outer layer as well as for the laminate. The structure information of the interlayer of the laminate should refer to itself, see example below.

Note: For different interlayer thicknesses, different laminates should be measured.

4.6.4 HEADER

Suppose you have measured a low-iron glass, with thickness d = 2.23 mm and made a spectral data file of the data (Clear_2.TST). The header of this file should look like this (some optional fields are omitted):

```
{ Units, Wavelength Units } SI Microns
{ Thickness } 2.230
{ Conductivity } 0.900
{ IR Transmittance } TIR=0
{ Emissivity, front back } Emis= 0.84 0.84
{ }
{ Product Name: Clear Float }
{ Manufacturer: Testing Systems Techno Inc. }
{ Type: Monolithic }
{ Material: Glass }
{ Appearance: Clear }
```

Then you constructed the reference laminate, with the interlayer and the outer layers you just measured. You measure the thickness of the reference laminate to be d = 4.86, and measured the spectral optical properties of the laminate and made a spectral data file of the data (Laminate.TST). The nominal thickness of the interlayer is 30 mil (0.762 mm) - you can use the nominal thickness value in the structure string. Note that the second component of the structure string for the reference laminate should refer to itself (i.e. the name of the reference laminate).

The header of this file should look like this:

```
{ Units, Wavelength Units } SI Microns
{ Thickness } 4.86
{ Conductivity } 0.624
{ IR Transmittance } TIR=0
{ Emissivity, front back } Emis= 0.84 0.84
{ }
{ Product Name: Laminate with a nice PVB interlayer }
{ Manufacturer: Testing Systems Techno Inc. }
{ Type: Laminate }
{ Appearance: Clear }
{ Structure: Clear_2.TST;2.23;False+Laminate.TST;0.762;False+Clear_2.TST;2.23;False }
{ Interlayer Appearance: Clear }
{ Interlayer Product Name: Your Interlayer Name }
{ Interlayer Code: 12345 }
{ Interlayer Nominal Thickness: 30 }
{ Interlayer Material: PVB }
```

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

## 4.7 EMBEDDED COATING

### 4.7.1 DEFINITION

An embedded coating is a coating positioned in a Laminate so that the coating is adjacent to an interlayer.

### 4.7.2 INTRODUCTION

The same coating has different properties in an embedded position (next to an interlayer) as opposed to a position where it faces an air or gas environment. An additional 'reference laminate' layer must be stored in the IGDB to allow Optics to correctly determine the properties of a coating in an embedded position. When you supply this data for a specific coating, Optics users will be able to use it in an embedded position.

### 4.7.3 MEASUREMENTS

Four sets of measured data are required to determine the properties of embedded coatings:

1. *Monolithic A*: A clear, thin, monolithic, low-iron glass substrate
2. *Coated A*: The coating applied to the substrate *Monolithic A*
3. *Laminate A:* A reference laminate with a clear interlayer but without embedded coating
4. *Laminate B:* A reference laminate with a clear interlayer and the embedded coating on one side adjacent to the interlayer.

If you want to submit embedded coating data, please contact the IGDB administration for further assistance.

### 4.7.4 HEADER

Examples of data files can be found on the internet on the IGDB homepage; go to:

http://windows.lbl.gov/materials/IGDB/default.htm

and click on

Data Submission Documentation and Examples

# 5 HEADER DATA REFERENCE

## 5.1 UNITS, WAVELENGTH UNITS

Definition: System of units used for thickness and conductivity and system of units used for wavelengths.

Used: For all glazing types

Required: Yes

Format: Text

Value: Pick from list below

Remarks: Units must be chosen from:

*SI*
*IP*

Wavelength Units must be chosen from:

*Nanometers*
*Microns*

Examples:

```
{ Units, Wavelength Units } SI Microns
{ Units, Wavelength Units } IP Microns
{ Units, Wavelength Units } SI Nanometers
```

## 5.2 THICKNESS

Definition: The exact measured thickness of the entire glazing layer in mm for SI units, inches for IP units.

Used: For all glazing types

Required: Yes

Format: Number

Value: Greater than 0.0

Remarks: Shall be the exact measured thickness of the sample that was used to measure the spectral data, not the nominal thickness.

Examples:

```
{ Thickness } 2.997
{ Thickness } 0.500
```

### 5.3 CONDUCTIVITY

Definition: Thermal conductivity of the glazing
in $W \cdot m^{-1} \cdot K^{-1}$ for SI Units, $Btu \cdot hr^{-1} \cdot ft^{-1} \cdot F^{-1}$ for IP Units

Used: For all glazing types

Required: Yes

Format: Number

Value: Greater than 0.0

Remarks: In order to get NFRC accreditation, in the case of generic materials such as glass, the conductivity must be taken from NFRC 101:2001 (2002).

For regular float glass the value tabulated in NFRC 101:2001 is taken from EN 12524:2000 (2000) and is equal to 1.000 $W \cdot m^{-1} \cdot K^{-1}$.

For high density PET (polyethylene/polyethene) the value tabulated in NFRC 101:2001 is taken from EN 12524:2000 and is equal to 0.500 $\cdot m^{-1} \cdot K^{-1}$.

For low density PET (polyethylene/polyethene) the value tabulated in NFRC 101:2001 is taken from EN 12524:2000 and is equal to 0.330 $\cdot m^{-1} \cdot K^{-1}$.

For PVB (polyvinyl butyral) the value tabulated in NFRC 101:2001 is equal to 0.212 $W \cdot m^{-1} \cdot K^{-1}$.

For all other materials we refer to NFRC 101:2001 or EN 12524:2000.

The conductivity value of laminates must be calculated with the following formula, when the conductivity and thickness of each layer are known:

$$k_{lam} = \frac{d_{lam}}{\sum_i d_i / k_i} \quad or \quad k_{lam} = \frac{\sum_i d_i}{\sum_i d_i / k_i}$$

where

| | |
|---|---|
| $k_{lam}$ | is the thermal conductivity of the laminate |
| $k_i$ | is the thermal conductivity of the i-th layer |
| $d_{lam}$ | is the thickness of the laminate |
| $d_i$ | is the thickness of the i-th layer |
| $\sum$ | means the sum of |

Examples:

```
{ Conductivity } 1.000
{ Conductivity } 0.200
```

### 5.4 IR TRANSMITTANCE

Definition: The thermal infrared transmittance of the glazing

Used: For all glazing types

Required: No, this line may be omitted when:
- the IR transmittance is zero.

Format: Number

Value: Between 0.0 and 1.0

Remarks: All glass based layers have a TIR of zero. Only very thin uncoated polymers have a non-zero TIR.

Examples:

```
{ IR Transmittance } TIR=0
{ IR Transmittance } TIR=0.100
```

### 5.5 EMISSIVITY, FRONT BACK

Definition: The thermal hemispherical emittance/emissivity of the front and back surfaces of the glazing.

Used: For all glazing types

Required: Should only be used for monolithic samples with predefined emissivities (e.g.. glass=0.84)

Format: Number

Value: Between zero and one

Remarks: When the specified surface is uncoated a generic emissivity value is highly recommended.

For regular float glass a value of 0.840 should be used. This value is tabulated in NFRC 101:2001 and EN 12524:2000. For most other generic materials a value of 0.900 is specified in these standards.

When the specified surface is coated sufficient spectral data in the IR region must be provided to determine the emissivity value from the measured spectral data.

In many cases one of the surfaces is coated and the other surface is uncoated. In that case sufficient IR spectral data must be provided (for both surfaces) **and** the value for the uncoated surface must be given in the header. The value in the header for the coated side will be automatically overwritten by the value calculated from the spectral data upon submission in the database.

Examples:

```
{ Emissivity, front back } Emis=0.840 0.840
{ Emissivity, front back } Emis=0.900 0.900
```

### 5.6 PRODUCT NAME

Definition: The trade name of your product

Used: For all glazing types

Required: No, but this line is highly recommended in order for users to quickly identify and locate this product.

Format: Text, maximum 50 characters

Value: Free to choose

Remarks: Do not include other information (like thickness, color, etc) than just the product name. Other fields, e.g. Thickness & Appearance shall be used to store thickness, color, etc.
The trade name does not need to be unique – for example, all glazings of the same product type but different thickness shall have the same product name.
This value is displayed for information only.

Examples:

```
{ Product Name: Activ™ on Clear }
{ Product Name: Your Product Name }
```

### 5.7 MANUFACTURER

Definition: The name of your company

Used: For all glazing types

Required: Yes

Format: Text, maximum 50 characters.

Value: Free to choose

Remarks: The name shall be exactly the same for all submitted data files. This is to avoid products from the same manufacturer to be listed under two different (but nearly identical) manufacturer names, such as "ABC inc." & "ABC Inc." I you are a new data submitter, you can choose the name with the first data submission.

Examples:

```
{ Manufacturer: Pilkington North America }
{ Manufacturer: DuPont }
```

### 5.8 TYPE

Definition: Type of glazing (e.g. monolithic, coated, laminate, etc.)

Used: For all glazing types

Required: Yes

Format: Text

Value: Pick value from list below

Remarks: The glazing type shall be picked from the following list

*Monolithic*
*Coated*
*Film*
*Applied Film*
*Laminate*

For Interlayers you should use the type Laminate and refer to the exact rules for submitting interlayer data. For more information about the glazing types, see chapter 4.

Examples:

```
{ Type: Coated }
{ Type: Laminate }
```

### 5.9 MATERIAL

Definition: Material that this product consists of

Used: Only for glazing type Monolithic

Required: Yes

Format: Text

Value: Pick value from list below

Remarks: This field is used for *Monolithic* glazing products only and shall be picked from the following list. *If* you do supply this value for other glazing types it should always be equal to *N/A*.

*Glass*
*PVB*
*Polycarbonate*
*Acrylic*
*PET*
*N/A*

If the material does not appear in this list, choose N/A.

Examples:

```
{ Material: Glass }
{ Material: N/A }
```

### 5.10 COATING NAME

Definition: Name (may be trade name or internal designation) of coating deposited on this glazing layer.

Used: For type Coated, Applied Film and Laminates

Required: No, but highly recommended. If you cannot supply or prefer not to supply the coating name of a coated product, the value for this field in the database will be set to *Unknown*. This will limit the functionality regarding your product when used in Optics.

Format: Text, less than 50 characters

Value:

| | |
|---|---|
| Coated | coating name (of coating on substrate) |
| Applied Film | coating name (of coating on film) |
| Laminate, coated on outer surface(s) | coating name (of coating on laminate) |
| Laminate, uncoated on outer surfaces | set value to *N/A* |

Remarks:
- Use the same coating name for all glazing layers which share the same coating.
- Products with different coatings on the front and back side cannot be handled yet in Optics. Please contact us if you want to submit data for such a product on how to fill in this information.
- A list of the current coating names and the products to which they are applied can be examined by using the program Optics5: Select the coated products, the coating names are given in the field called 'Coating'.
- For laminates: If the laminate is uncoated set value to 'N/A'. If the laminate is coated, but you don't want to supply the coating name, set the value to 'Unknown'.

Examples:

```
{ Coating Name: Activ™ }
{ Coating Name: N/A }
```

### 5.11 COATED SIDE

Definition: For *Coated* type glazings: indicates which surfaces are coated, if any.
For *Applied Film* type glazings: indicates the surface the film is applied to.
For *Laminate* type glazings: indicates which surfaces are coated, if any.

Used: For type Coated, Applied Film and Laminate

Required: Yes

Value:

| | |
|---|---|
| Coated: | pick value from list below |
| Applied Film: | pick value from list below |
| Laminate, coated on outer surface(s): | set value to *Neither* |
| Laminate, uncoated on outer surface(s): | pick value from list below |

Format: Text

Remarks: - Pick the correct value from the following list:

*Front*
*Back*
*Both*
*Neither*

- Products with <u>different</u> coatings on the front and back side cannot be handled yet in Optics. Please contact us if you want to submit data for such a product

Examples:

```
{ Coated Side: Front }
{ Coated Side: Neither }
```

### 5.12 SUBSTRATE FILENAME

Definition: Filename of *Monolithic* glazing layer which is the substrate of the current coated or applied film glazing.

Used: For type Coated, Applied Film only

Required: No, if you cannot supply or wish not to supply the substrate filename, the value for this field will be set to *Unknown*. However, this will limit the functionality of Optics regarding your product: this coating or film cannot be applied to another glazing product.

Format: Text, less than 50 characters

Value:

| | |
|---|---|
| Monolithic: | set value to *N/A* |
| Coated: | substrate filename |
| Applied Film: | substrate filename |
| Laminate: | set value to *N/A* |

Remarks: The substrate filename must be referring to a *Monolithic* glazing product.
A list of possible substrate file names can be examined by using the program Optics5: Select the *Monolithic* products, the file names are given in the field called 'FileName'.

Examples:

```
{ Substrate Filename: CLEAR2.LOF }
{ Substrate Filename: N/A }
```

### 5.13 APPEARANCE

Definition: Terms related to product appearance indicating color etc – do not include information on usage or product name

Used: For all glazing types

Required: No

Format: Text, less than 255 characters

Value: Free to choose.

Remarks: Displayed for information only.

Examples:

```
{ Appearance: Clear }
{ Appearance: Blue-Green }
```

### 5.14 STRUCTURE

Definition: Internal structure of Laminate, described by a list of components, their orientation and thickness.

Used: For type Laminate (and Interlayer and Embedded Coating) only[1]

Required: No, if you cannot supply or prefer not to supply the structure of the laminate, this will limit the functionality of Optics regarding your product.
When submitting interlayer data this line always required, see paragraphs 4.5 and 4.6.

Format: List of elements describing each laminate component, each element separated by the plus sign (+).
Each element consists of **Filename ; Thickness ; Flipped** (separated by semicolons).
**Filename**: text
**Thickness**: number greater than 0.0 (This value should be given in millimeters !! even when all other values are given in IP units).
**Flipped**: must be either *True* or *False*, indicating whether the orientation of this component in this laminate has been flipped (regarding its orientation in the database).

Value: Text line according to above described format.

Remarks:

[1] And types Interlayer and Embedded Coating which use type Laminate as a 'carrier' for submitting data.

### 5.15 INTERLAYER APPEARANCE

Definition: Terms related to product appearance indicating color etc of the Interlayer – do not include information on usage or product name

Used: For Interlayer data only

Required: No

Format: Text, less than 50 characters

Value: Free to choose.

Remarks: Displayed for information only.

Examples:

```
{ Interlayer Appearance: Clear }
{ Interlayer Appearance: Blue-Green }
```

### 5.16 INTERLAYER PRODUCT NAME

Definition: The trade name of the interlayer

Used: For Interlayer data only

Required: No, but highly recommended

Format: Text, maximum 50 characters

Value: Free to choose

Remarks: Do not include other information (like thickness, color, etc) than just the product name. Other fields, e.g. Interlayer Appearance shall be used to store color, etc.

The trade name does not need to be unique – for example, all interlayers of the same product type but different thickness can have the same product name. This value is displayed for information only.

Examples:

```
{ Interlayer Product Name: Butacite }
{ Interlayer Product Name: Your Product Name }
```

### 5.17 INTERLAYER CODE

Definition: The code of the interlayer. Some manufacturers use an (internal) code to designate interlayers.

Used: For Interlayer data only

Required: No

Format: Text, maximum 25 characters

Value: Free to choose

Remarks: This can be an internal code used by your company or a coding scheme used in external communications

Examples:

```
{ Interlayer Code: 123-456 }
{ Interlayer Code: NC1010 }
```

### 5.18 INTERLAYER NOMINAL THICKNESS

Definition: The nominal thickness of the interlayer in mils.

Used: For Interlayer data only

Required: Yes

Format: Number

Value: Larger than 0.

Remarks:

Examples:

```
{ Interlayer Nominal Thickness: 15 }
{ Interlayer Nominal Thickness: 90 }
```

### 5.19 INTERLAYER MATERIAL

Definition: Material of the interlayer

Used: For Interlayer data only

Required: Yes

Format: Text

Value: Pick value from the following list:

*PVB*
*Unknown*

If the interlayer material does not appear in this list, choose Unknown.

Examples:

```
{ Interlayer Material: PVB }
{ Interlayer Material: Unknown }
```

### 5.20 ACCEPTANCE

Definition: Request for acceptance by a standardization body

Used: For all glazing types

Required: No, this field may be omitted if you do not request acceptance of the measured data by a standardization body.

Format: Token

Value: #

Remarks: At this moment you can only request *NFRC acceptance* by adding the line in the example in the header of the data file.

Example:

```
{ Acceptance: # }
```

### 5.21 NFRC ID

Definition: Request for a specific NFRC ID number

Used: For all glazing types

Required: Yes, this field should be filled with ID number, selected from the manufacturer's assigned rage of ID numbers.

Format: Number

Value: In accordance with NFRC assigned blocks

Remarks: In case the file should also be 'hidden' a NFRC ID value of 0 (zero) will be assigned to the product.
An overview of the currently assigned blocks of NFRC ID numbers can be found through the IGDB homepage:

http://windows.lbl.gov/materials/IGDB/default.htm

Examples:

```
{ NFRC ID: 1234 }
{ NFRC ID: 9876 }
```

### 5.22 HIDDEN

Definition: Request for hiding this product in the database, making it invisible for everybody (except for Optics to use it as a reference for other glazings)

Used: For all glazing types

Required: No, this field is usually omitted except when you request to hide a specific glazing.

Format: String

Value: Pick value from the following two:

*True*
*False*

Remarks:

Example:

```
{ Hidden: True }
```

### 5.23 USES

This field is no longer in use, but may be reinstated later.

### 5.24 AVAILABILITY

This field is no longer in use, but may be reinstated later.

## 6 SPECTRAL DATA FORMAT

The following rules shall be taken into account for the spectral data:

- The measured data shall start at a wavelength of 300 nanometers (or 0.3 microns)
- The measured data shall end at a wavelength of at least 2 500 nanometers (2.5 microns) or at a wavelength of at least 25 000 nanometers (25 microns)
- The spectral data shall be given in 4 columns, 4 values on each line, separated by a space, a tab or a comma, representing in the following order:

  Wavelength Transmittance Front Reflectance Back Reflectance

- In order to calculate accurate spectral averages according to current US and international standards, there is a maximum wavelength interval needed in each part of the solar spectrum[2]:

| Wavelength Range | Maximum Wavelength Interval |
|---|---|
| 300-2500nm | 5nm |
| 2500-5000nm | - no requirement - |
| 5000-25000nm+ | 1000nm |

As an example, spectral measurements can be made at the following wavelengths: 300 nm, 305 nm, 310 nm … or 300 nm, 302 nm, 304 nm, … → OK

but measurements at the following wavelengths are not sufficient: 300 nm, 315 nm, 330 nm … or 300 nm, 302 nm, 310 nm, … → NOT OK

- If no IR spectral data is supplied (no measured data above 2500 nanometer), the header shall contain a value for the emittance values and TIR.
- All data shall be physically correct:
  - All transmittance, emittance and reflectance values shall be between 0 and 1.
  - For each wavelength transmittance plus reflectance shall be less than 1[3].

[2] These requirements are different to those in the WINDOW 4.1 manual – the new data intervals are necessary to ensure compliance with standards that have been published since the WINDOW 4.1 manual was written. Also, data submitted for peer review should not have been processed by the SPECPACK program. This program eliminates data that is linear between other data points within a certain tolerance and may cause the data to violate the spacing requirements

- The maximum number of wavelengths in the spectral data set is 1000. This limit is imposed by the import routines used in Optics.

[3] Interference patterns in thin films measurements may cause a violation of this requirement. Other violation causes can be due to measurement noise. In such situations, please contact the IGDB administration on the most appropriate way to prepare the data.

## 7 REFERENCES

IEEE/ASTM SI 10 (1997) - Standard for Use of the International System of Units (SI): The Modern Metric System, ASTM**:** 70 p.

NFRC 101:2001 (2002) - Procedure for Determining Thermo-Physical Properties of Materials for Use in NFRC-Approved Software Programs

EN 12524:2000 - Building materials and products. Hygrothermal properties. Tabulated design values