

Application Number:E.2.1 (Manufacture)

Fluororesin Products for Manufacturing Processes of Various Fluoride Gases

Lining tank (PTFE), lining piping (PTFE, PFA), lining valve (PTFE, PFA), insertion tube (PTFE, PFA), gasket (PTFE), bellows (PTFE, PFA)

Flexible hose (PTFE, PFA), pliable hose (PTFE, PFA)

· PFAS used in the products is PTFE and PFA, which are polymer materials, and there is no concern about exposure, leakage, or environmental release of eluates.

(Reference: SDS of PTFE in Daikin Industries, SDS of PFA in Daikin Industries)

· This product is to be used under the following conditions.

Subject to use: Wetted parts of piping systems in various fluoride gas manufacturing processes

Fluid to be used: anhydrous hydrogen fluoride, hydrofluoric acid

Usage Environment: RT to 150°C

Use Conditions: Not to be affected by fluids in the use environment and no leakage.

No elution of metal ions in chemicals

Required to meet the above specification conditions, and no perfect alternative product is considered to be available at this time,

(Reference: Plastic Data Handbook, VALQUA Handbook Technical Section, Kogyo Chosakai Publishing Co., Ltd.)

· As mentioned above, the presence of fluororesin product is essential for chemicals used in manufacturing processes of various fluoride gases.

· We propose a regulatory exemption for the above reasons.

## Attachment 1: PTFE Safty Date Sheet



### Safety data sheet

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Printing date 06.02.2023

Version number 1

Revision: 06.02.2023

#### SECTION 1: Identification of the substance/mixture and of the company/undertaking

##### 1.1 Product identifier

**Trade name:** POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393

**Article number:** M

##### 1.2 Relevant identified uses of the substance or mixture and uses advised against:

No further relevant information available.

##### 1.3 Details of the supplier of the safety data sheet

###### Manufacturer/Supplier:

DAIKIN INDUSTRIES, LTD. CHEMICALS DIVISION:

OSAKA UMEDA TWIN TOWERS SOUTH, 1-13-1 Umeda, Kita-ku, Osaka-shi, Osaka, 530-0001, Japan

Phone: [REDACTED] Fax: [REDACTED]

**Further information obtainable from:** <http://www.daikin.com/>

##### 1.4 Emergency telephone number:

Japan:

China: [REDACTED] +86-21-34151689

South Korea:

Americas: CHEMTREC [REDACTED] (Outside US/Canada: [REDACTED])

Europe: +49-211-179 225-0

#### SECTION 2: Hazard identification

##### 2.1 Classification of the substance or mixture

**Classification according to Regulation (EC) No 1272/2008**

The substance is not classified, according to the CLP regulation.

##### 2.2 Label elements

**Labelling according to Regulation (EC) No 1272/2008:** Not applicable

**Signal word:** Not applicable

#### SECTION 3: Composition/information on ingredients

##### Information on ingredients:

CAS: 9002-84-0 Polytetrafluoroethylene

100%

#### SECTION 4: First aid measures

##### 4.1 Description of first aid measures

**General information:** Seek medical treatment.

**After inhalation:** In case of inhaling decomposed gases: supply fresh air and consult a doctor in case of complaints.

###### After skin contact:

Immediately wash with water and soap and rinse thoroughly.

After contact with the molten product, cool rapidly with cold water.

Do not pull solidified product off the skin.

###### After eye contact:

Rinse opened eye for several minutes under running water.

Consult an ophthalmologist in case of complaints.

**After swallowing:** If symptoms persist consult a doctor.

**4.2 Most important symptoms and effects, both acute and chronic:** No further relevant information available.

**4.3 Indication of any immediate medical attention and special treatment needed:**

No further relevant information available.

#### SECTION 5: Firefighting measures

##### 5.1 Extinguishing media

**Suitable extinguishing agents:** Use fire extinguishing methods suitable for surrounding conditions.

**For safety reasons unsuitable extinguishing agents:** No further information available.

##### 5.2 Special hazards arising from the substance or mixture:

Formation of toxic gases is possible during heating or in case of fire.



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Trade name: **POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393**

### 5.3 Advice for firefighters:

#### Protective equipment:

Wear self-contained breathing apparatus and protective suit.

Do not inhale explosion gases or combustion gases.

### SECTION 6: Accidental release measures

#### 6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation before entering the area.

Keep out unauthorized persons.

Wear appropriate protective devices (See Section 8 Exposure Controls/Personal Protection).

Avoid contact with eyes and skin.

Do not swallow the product.

6.2 Environmental precautions: Do not allow product to reach sewage system or any water course.

6.3 Methods and material for containment and cleaning up: Pick up mechanically.

#### 6.4 Reference to other sections:

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

### SECTION 7: Handling and storage

#### 7.1 Precautions for safe handling:

Ensure good ventilation/exhaustion at the workplace.

Extractors are required on all machines used for thermal processing or powder handling processes.

Do not handle until all safety precautions have been read and understood.

Information about fire - and explosion protection: Keep ignition sources away - Do not smoke.

#### 7.2 Conditions for safe storage, including any incompatibilities:

##### Storage

Requirements to be met by storerooms and receptacles: Store in a cool and dry location.

Information about storage in one common storage facility:

Store away from oxidising agents.

See section 10 for information on incompatible materials.

#### Further information about storage conditions:

Protect from heat and direct sunlight.

Store containers in a well ventilated area.

7.3 Specific end use(s): No further relevant information available.

### SECTION 8: Exposure controls/personal protection

8.1 Control parameters No further information available.

Ingredients with limit values that require monitoring at the workplace: Not required.

#### 8.2 Exposure controls

Individual protection measures, such as personal protective equipment

##### General protective and hygienic measures:

Wash hands before breaks and at the end of work.

Do not eat or drink while working.

Keep away from tobacco products.

##### Respiratory protection:

Use respiratory protective device with filters for organic and acid gas (or airline respirators in some cases), if the product is heated above 260 °C and toxic gas is formed.

Dust respirator, simplified dust respirator

##### Hand protection



Protective gloves

Material of gloves: Rubber



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### Eye/face protection



Safety glasses

Body protection: Protective work clothing

## \* SECTION 9: Physical and chemical properties

### 9.1 Information on basic physical and chemical properties

#### General Information

|                                                          |                                   |
|----------------------------------------------------------|-----------------------------------|
| Physical state                                           | Powder                            |
| Colour:                                                  | Milky-white                       |
| Odour:                                                   | Odourless                         |
| Melting point/freezing point:                            | 320-330 °C                        |
| Boiling point or initial boiling point and boiling range | Undetermined.                     |
| Flammability                                             | Product is not flammable.         |
| Lower and upper explosion limit                          |                                   |
| Lower explosive limit:                                   | No further information available. |
| Upper explosive limit:                                   | Not determined.                   |
| Flash point:                                             | Not applicable.                   |
| Decomposition temperature:                               | 480-490 °C (1%TG)                 |
| pH                                                       | Not applicable.                   |
| Viscosity:                                               |                                   |
| Kinematic viscosity                                      | No further information available. |
| Solubility                                               |                                   |
| water:                                                   | Insoluble.                        |
| Partition coefficient n-octanol/water (log value)        | No further information available. |
| Vapour pressure:                                         | Not applicable.                   |
| Density and/or relative density                          |                                   |
| Density:                                                 | Not determined.                   |
| Relative density                                         | 2.1-2.2                           |
| Vapour density                                           | No further information available. |
| Particle characteristics                                 | No further information available. |

### 9.2 Other information:

|                            |                               |
|----------------------------|-------------------------------|
| Form:                      | Powder                        |
| Auto-ignition temperature: | Product is not self-igniting. |

#### Information with regard to physical hazard classes

|                                                     |                |
|-----------------------------------------------------|----------------|
| Explosives                                          | Not applicable |
| Flammable gases                                     | Not applicable |
| Aerosols                                            | Not applicable |
| Oxidising gases                                     | Not applicable |
| Gases under pressure                                | Not applicable |
| Flammable liquids                                   | Not applicable |
| Flammable solids                                    | Not applicable |
| Self-reactive substances and mixtures               | Not applicable |
| Pyrophoric liquids                                  | Not applicable |
| Pyrophoric solids                                   | Not applicable |
| Self-heating substances and mixtures                | Not applicable |
| Substances and mixtures, which emit flammable gases |                |
| in contact with water                               | Not applicable |
| Oxidising liquids                                   | Not applicable |
| Oxidising solids                                    | Not applicable |
| Organic peroxides                                   | Not applicable |
| Corrosive to metals                                 | Not applicable |
| Desensitised explosives                             | Not applicable |



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Revision: 06.02.2023

Trade name: **POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393**

### SECTION 10: Stability and reactivity

**10.1 Reactivity** No further relevant information available.

**10.2 Chemical stability**

**Thermal decomposition / conditions to be avoided:**

Even at the temperatures reached during the normal hot processing of fluoropolymers, fume that presents a potential health hazard may be generated.

To avoid thermal decomposition do not overheat.

**10.3 Possibility of hazardous reactions:** No dangerous reactions known under normal conditions of use.

**10.4 Conditions to avoid:** Keep away from heat, sparks, flame, high temperature.

**10.5 Incompatible materials:**

Metal powder (e.g. Al, Mg) and fluorine oxidizer. There is a danger of chemical reactions that could cause fire or explosion when the product is heated with them.

**10.6 Hazardous decomposition products:**

As for decomposition products, particulate matters and extremely toxic/corrosive fumes may be generated (HF, carbonyl fluoride, monomers, perfluoroisobutylene).

Decomposition products differ depending on the temperature and conditions.

### SECTION 11: Toxicological information

**11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008**

**Acute toxicity** no data

**LD/LC50 values relevant for classification:** No further information available.

**Skin corrosion/irritation** No further information available.

**Serious eye damage/irritation** No further information available.

**after inhalation:** No further information available.

**Respiratory or skin sensitisation** Based on available data, the classification criteria are not met.

**Germ cell mutagenicity** Based on available data, the classification criteria are not met.

**Carcinogenicity** Based on available data, the classification criteria are not met.

**Reproductive toxicity** Based on available data, the classification criteria are not met.

**STOT-single exposure** Based on available data, the classification criteria are not met.

**STOT-repeated exposure** Based on available data, the classification criteria are not met.

**Aspiration hazard** Based on available data, the classification criteria are not met.

**Other information (about experimental toxicology):** No further information available.

**Subacute to chronic toxicity** No further information available.

**Additional toxicological information:**

General effects:

Fumes generated during burning may cause "polymer fume fever" (flu-like symptoms such as fever, chill, cough).

This may last for a whole day and night.

Fumes are not absorbed in skin. No sensitizing effect known.

Effects of hydrogen fluoride:

Low concentration of hydrogen fluoride may cause feeling of dyspnea, cough, irritation in eyes, nose, throat, fever, chill for 1-2 days.

After that, dyspnea, cyanosis and pulmonary edema may be seen.

High concentration of hydrogen fluoride damages liver and kidney.

Effects of carbonyl fluoride:

Skin: Irritation or eruption

Eye: Ulcer in cornea, conjunctiva

Respiratory system: Irritation

Lung: Temporary symptoms such as cough, pain, dyspnea

Persons who have experienced lung diseases are vulnerable to toxicity caused by excessive exposure to pyrolysis products

**11.2 Information on other hazards**

**Endocrine disrupting properties**

Substance is not listed.



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Version number 1

Revision: 06.02.2023

Trade name: POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393

### \* SECTION 12: Ecological information

#### 12.1 Toxicity

*Aquatic toxicity:* No further relevant information available.

*12.2 Persistence and degradability:* The product is thought to be non-biodegradable.

*Other information:* The product is slightly biodegradable.

*12.3 Bioaccumulative potential:* No further relevant information available.

*12.4 Mobility in soil:* No further relevant information available.

#### 12.5 Results of PBT and vPvB assessment

*PBT:* No further relevant information available.

*vPvB:* No further relevant information available.

*12.6 Endocrine disrupting properties* The product does not contain substances with endocrine disrupting properties.

*12.7 Other adverse effects:* No further relevant information available.

### SECTION 13: Disposal considerations

#### 13.1 Waste treatment methods

##### Recommendation:

Landfill disposal is recommended.

In case of incineration, the temperature must be higher than 800 °C.

Treat exhaust gas such as HF in a suitable way.

Disposal must be made according to official regulations.

##### Uncleaned packaging

Recommendation: Disposal must be made according to official regulations.

### \* SECTION 14: Transport information

#### 14.1 UN number or ID number

ADR, ADN, IMDG, IATA Not applicable

#### 14.2 UN proper shipping name:

ADR, ADN, IMDG, IATA Not applicable

#### 14.3 Transport hazard class(es):

ADR, ADN, IMDG, IATA Not applicable

##### Class:

14.4 Packing group: Not applicable

##### ADR, IMDG, IATA

14.5 Environmental hazards: Not applicable

##### Marine pollutant:

14.6 Special precautions for user: No

14.7 Maritime transport in bulk according to IMO instruments Not applicable.

Transport/Additional information: Avoid direct sunlight. Make sure of no damage, corrosion, leaks on the receptacles.

Take necessary measures for preventing cargo shift.

UN "Model Regulation": Not applicable

### \* SECTION 15: Regulatory information

#### 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

No further relevant information available.

**Labelling according to Regulation (EC) No 1272/2008** Not applicable

**Hazard pictograms** Not applicable

**Signal word** Not applicable

**Hazard statements** Not applicable

**National regulations** No further information available.

**15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.



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### SECTION 16: Other information

The product is for the industrial use only. We do not guarantee the safety in case the product is used for the other purposes. When using the product for health-care application or food/feed application, consult us in advance. This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

**Department issuing SDS:** EHS Department

**Contact:** <http://www.daikin.com/>

#### Abbreviations and acronyms:

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)

ICAO: International Civil Aviation Organisation

ICAO-TI: Technical Instructions by the "International Civil Aviation Organisation" (ICAO)

ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

GHS: Globally Harmonised System of Classification and Labelling of Chemicals

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

PBT: Persistent, Bioaccumulative and Toxic

vPvB: very Persistent and very Bioaccumulative

**\* Data compared to the previous version altered.**

## Attachment 2: PFA Safety Date Sheet



### Safety data sheet

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Printing date 06.02.2023

Version number 1

Revision: 06.02.2023

#### \* SECTION 1: Identification of the substance/mixture and of the company/undertaking

##### 1.1 Product identifier

**Trade name:** NEOFロン PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

**Article number:** AP2 STD

##### 1.2 Relevant identified uses of the substance or mixture and uses advised against:

No further relevant information available.

##### 1.3 Details of the supplier of the safety data sheet

###### Manufacturer/Supplier:

DAIKIN INDUSTRIES, LTD. CHEMICALS DIVISION:

OSAKA UMEDA TWIN TOWERS SOUTH, 1-13-1 Umeda, Kita-ku, Osaka-shi, Osaka, 530-0001, Japan

Phone: [REDACTED] Fax: [REDACTED]

Further information obtainable from: <http://www.daikin.com/>

##### 1.4 Emergency telephone number:

Japan:

China: [REDACTED], +86-21-34151689

South Korea:

Americas: CHEMTREC [REDACTED] (Outside US/Canada: [REDACTED])

Europe: +49-211-179 225-0

#### SECTION 2: Hazard identification

##### 2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008

The product is not classified, according to the CLP regulation.

##### 2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008: Not applicable

Signal word: Not applicable

#### SECTION 3: Composition/information on ingredients

##### Information on ingredients:

CAS: 26655-00-5 Perfluoro(alkoxy alkane)

100%

Additional information: For the wording of the listed hazard phrases refer to section 16.

#### SECTION 4: First aid measures

##### 4.1 Description of first aid measures

**General information:** Seek medical treatment.

**After inhalation:** In case of inhaling decomposed gases: supply fresh air and consult a doctor in case of complaints.

**After skin contact:**

Immediately wash with water and soap and rinse thoroughly.

After contact with the molten product, cool rapidly with cold water.

Do not pull solidified product off the skin.

Consult a doctor in case of complaints.

**After eye contact:**

Rinse opened eye for several minutes under running water.

Consult an ophthalmologist in case of complaints.

**After swallowing:** If symptoms persist consult a doctor.

**4.2 Most important symptoms and effects, both acute and chronic:** No further relevant information available.

**4.3 Indication of any immediate medical attention and special treatment needed:**

No further relevant information available.

#### SECTION 5: Firefighting measures

##### 5.1 Extinguishing media

**Suitable extinguishing agents:** Use fire extinguishing methods suitable for surrounding conditions.

**For safety reasons unsuitable extinguishing agents:** No further information available.

##### 5.2 Special hazards arising from the substance or mixture:

Formation of toxic gases is possible during heating or in case of fire.



## Safety data sheet

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Version number 1

Revision: 06.02.2023

Trade name: NEOFロン PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

### 5.3 Advice for firefighters:

#### Protective equipment:

Wear self-contained breathing apparatus and protective suit.

Do not inhale explosion gases or combustion gases.

### SECTION 6: Accidental release measures

#### 6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation before entering the area.

Keep out unauthorized persons.

Wear appropriate protective devices (See Section 8 Exposure Controls/Personal Protection).

Avoid contact with eyes and skin.

Do not swallow the product.

6.2 Environmental precautions: Do not allow product to reach sewage system or any water course.

6.3 Methods and material for containment and cleaning up: Pick up mechanically.

#### 6.4 Reference to other sections:

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

### SECTION 7: Handling and storage

#### 7.1 Precautions for safe handling:

Ensure good ventilation/exhaustion at the workplace.

Extractors are required on all machines used for thermal processing or powder handling processes.

Do not handle until all safety precautions have been read and understood.

Information about fire - and explosion protection: Keep ignition sources away - Do not smoke.

#### 7.2 Conditions for safe storage, including any incompatibilities:

##### Storage

Requirements to be met by storerooms and receptacles: Store in a cool and dry location.

Information about storage in one common storage facility:

See section 10 for information on incompatible materials.

#### Further information about storage conditions:

Protect from heat and direct sunlight.

Store containers in a well ventilated area.

7.3 Specific end use(s): No further relevant information available.

### SECTION 8: Exposure controls/personal protection

8.1 Control parameters No further information available.

#### Ingredients with limit values that require monitoring at the workplace:

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

#### 8.2 Exposure controls

Appropriate engineering controls No further data; see item 7.

Individual protection measures, such as personal protective equipment

##### General protective and hygienic measures:

Wash hands before breaks and at the end of work.

Do not eat or drink while working.

Keep away from tobacco products.

##### Respiratory protection:

Use respiratory protective device with filters for organic and acid gas (or airline respirators in some cases), if the product is heated above 260 °C and toxic gas is formed.

Dust respirator, simplified dust respirator

##### Hand protection



Protective gloves

Material of gloves: Rubber



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Trade name: NEOFロン PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

### Eye/face protection



Safety glasses

Body protection: Protective work clothing

### \* SECTION 9: Physical and chemical properties

#### 9.1 Information on basic physical and chemical properties

##### General Information

|                                                          |                                   |
|----------------------------------------------------------|-----------------------------------|
| Physical state                                           | Powder                            |
| Colour:                                                  | Whitish                           |
| Odour:                                                   | Odourless                         |
| Odour threshold:                                         | Not determined.                   |
| Melting point/freezing point:                            | 300 °C                            |
| Boiling point or initial boiling point and boiling range | Undetermined.                     |
| Flammability                                             | Not determined.                   |
| Lower and upper explosion limit                          |                                   |
| Lower explosive limit:                                   | No further information available. |
| Upper explosive limit:                                   | Not determined.                   |
| Flash point:                                             | Not applicable.                   |
| Decomposition temperature:                               | No further information available. |
| pH                                                       | Not applicable.                   |
| Viscosity:                                               |                                   |
| Kinematic viscosity                                      | Not applicable.                   |
| Dynamic:                                                 | Not applicable.                   |
| Solubility                                               |                                   |
| water:                                                   | Not miscible or difficult to mix. |
| Partition coefficient n-octanol/water (log value)        | No further information available. |
| Vapour pressure:                                         | No further information available. |
| Density and/or relative density                          |                                   |
| Density at 25 °C:                                        | 2.1-2.2 g/cm <sup>3</sup>         |
| Relative density                                         | Not determined.                   |
| Vapour density                                           | Not applicable.                   |
| Particle characteristics                                 | No further information available. |

#### 9.2 Other information:

|                            |                                               |
|----------------------------|-----------------------------------------------|
| Form:                      | Pellets                                       |
| Auto-ignition temperature: | Product is not self-igniting.                 |
| Explosive properties:      | Product does not present an explosion hazard. |
| Evaporation rate           | Not applicable.                               |

#### Information with regard to physical hazard classes

|                                                     |                |
|-----------------------------------------------------|----------------|
| Explosives                                          | Not applicable |
| Flammable gases                                     | Not applicable |
| Aerosols                                            | Not applicable |
| Oxidising gases                                     | Not applicable |
| Gases under pressure                                | Not applicable |
| Flammable liquids                                   | Not applicable |
| Flammable solids                                    | Not applicable |
| Self-reactive substances and mixtures               | Not applicable |
| Pyrophoric liquids                                  | Not applicable |
| Pyrophoric solids                                   | Not applicable |
| Self-heating substances and mixtures                | Not applicable |
| Substances and mixtures, which emit flammable gases |                |
| in contact with water                               | Not applicable |
| Oxidising liquids                                   | Not applicable |
| Oxidising solids                                    | Not applicable |



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Trade name: NEOFロン PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

|                         |                |
|-------------------------|----------------|
| Organic peroxides       | Not applicable |
| Corrosive to metals     | Not applicable |
| Desensitised explosives | Not applicable |

### SECTION 10: Stability and reactivity

**10.1 Reactivity** No further relevant information available.

**10.2 Chemical stability**

**Thermal decomposition / conditions to be avoided:** To avoid thermal decomposition do not overheat.

**10.3 Possibility of hazardous reactions:** No dangerous reactions known under normal conditions of use.

**10.4 Conditions to avoid:** Keep away from heat, sparks, flame, high temperature.

**10.5 Incompatible materials:**

Metal powder (e.g. Al, Mg) and fluorine oxidizer. There is a danger of chemical reactions that could cause fire or explosion when the product is heated with them.

**10.6 Hazardous decomposition products:**

As for decomposition products, particulate matters and extremely toxic/corrosive fumes may be generated (HF, carbonyl fluoride, monomers, perfluoroisobutylene).

Decomposition products differ depending on the temperature and conditions.

### SECTION 11: Toxicological information

**11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008**

**Acute toxicity** Based on available data, the classification criteria are not met.

**LD/LC50 values relevant for classification:** No further information available.

**Skin corrosion/irritation** No further information available.

**Serious eye damage/irritation** No further information available.

**after inhalation:** No further information available.

**Respiratory or skin sensitisation** Based on available data, the classification criteria are not met.

**Germ cell mutagenicity** Based on available data, the classification criteria are not met.

**Carcinogenicity** Based on available data, the classification criteria are not met.

**Reproductive toxicity** Based on available data, the classification criteria are not met.

**STOT-single exposure** Based on available data, the classification criteria are not met.

**STOT-repeated exposure** Based on available data, the classification criteria are not met.

**Aspiration hazard** Based on available data, the classification criteria are not met.

**Other information (about experimental toxicology):** No further information available.

**Subacute to chronic toxicity** No further information available.

**Additional toxicological information:**

General effects:

Fumes generated during burning may cause "polymer fume fever" (flu-like symptoms such as fever, chill, cough).

This may last for a whole day and night.

Fumes are not absorbed in skin. No sensitizing effect known.

Effects of hydrogen fluoride:

Low concentration of hydrogen fluoride may cause feeling of dyspnea, cough, irritation in eyes, nose, throat, fever, chill for 1-2 days.

After that, dyspnea, cyanosis and pulmonary edema may be seen.

High concentration of hydrogen fluoride damages liver and kidney.

Effects of carbonyl fluoride:

Skin: Irritation or eruption

Eye: Ulcer in cornea, conjunctiva

Respiratory system: Irritation

Lung: Temporary symptoms such as cough, pain, dyspnea

Persons who have experienced lung diseases are vulnerable to toxicity caused by excessive exposure to pyrolysis products

**11.2 Information on other hazards**

**Endocrine disrupting properties**

None of the ingredients is listed.



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Trade name: NEOFLOX PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

### \* SECTION 12: Ecological information

#### 12.1 Toxicity

*Aquatic toxicity:* No further relevant information available.

*12.2 Persistence and degradability:* The product is thought to be non-biodegradable.

*Other information:* The product is insoluble in water and the biodegradation and ecotoxicity is expected to be low.

*12.3 Bioaccumulative potential:* No further relevant information available.

*12.4 Mobility in soil:* No further relevant information available.

#### 12.5 Results of PBT and vPvB assessment

*PBT:* No further relevant information available.

*vPvB:* No further relevant information available.

*12.6 Endocrine disrupting properties* For information on endocrine disrupting properties see section 11.

*12.7 Other adverse effects:*

*Ecotoxicological effects:* no data

### SECTION 13: Disposal considerations

#### 13.1 Waste treatment methods

##### Recommendation:

Landfill disposal is recommended.

In case of incineration, the temperature must be higher than 800 °C.

Treat exhaust gas such as HF in a suitable way.

Disposal must be made according to official regulations.

##### Uncleaned packaging

*Recommendation:* Disposal must be made according to official regulations.

### SECTION 14: Transport information

#### 14.1 UN number or ID number

ADR, ADN, IMDG, IATA Not applicable

#### 14.2 UN proper shipping name:

ADR, ADN, IMDG, IATA Not applicable

#### 14.3 Transport hazard class(es):

ADR, ADN, IMDG, IATA

Class: Not applicable

#### 14.4 Packing group:

ADR, IMDG, IATA Not applicable

#### 14.5 Environmental hazards:

Marine pollutant: No

14.6 Special precautions for user: Not applicable.

#### 14.7 Maritime transport in bulk according to IMO

instruments Not applicable.

*Transport/Additional information:* Avoid direct sunlight. Make sure of no damage, corrosion, leaks on the receptacles.

Take necessary measures for preventing cargo shift.

UN "Model Regulation": Not applicable

### SECTION 15: Regulatory information

#### 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

No further relevant information available.

*Labelling according to Regulation (EC) No 1272/2008* Not applicable

*Hazard pictograms* Not applicable

*Signal word* Not applicable

*Hazard statements* Not applicable

*National regulations* No further information available.

*15.2 Chemical safety assessment:* A Chemical Safety Assessment has not been carried out.



## Safety data sheet

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Version number 1

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**Trade name:** NEOFロン PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH, 221SH, 230SH, 231SH

### SECTION 16: Other information

*The product is for the industrial use only. We do not guarantee the safety in case the product is used for the other purposes. When using the product for health-care application or food/feed application, consult us in advance. This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.*

**Department issuing SDS:** EHS Department

**Contact:** <http://www.daikin.com/>

#### **Abbreviations and acronyms:**

ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

GHS: Globally Harmonised System of Classification and Labelling of Chemicals

LCSO: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

PBT: Persistent, Bioaccumulative and Toxic

vPoB: very Persistent and very Bioaccumulative

**\* Data compared to the previous version altered.**

# Attachment 3: Chemical resistance of various resins

194 1 Basic data

## (176) Chemical Resistance of Various Plastics

◎ Superior: weight change < ±2% ○ Good: 2 to +14%, -2 to -3%

| Resin name              |                   | Vinyl chloride resin                                                                                     | Vinylidene chloride resin                                                                                       | Polyethylene (low density)                                                                     |
|-------------------------|-------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Test conditions         |                   | Stress-free condition by 1 month immersion test at 21°C and 60°C unless otherwise specifically mentioned | Stress-free condition by 1 month immersion test at 52°C for disc-shaped samples with 1/8" thick and 2" diameter | Stress-free condition by 1 month immersion test at 52°C for disc-shaped samples with 1/8" x 2" |
| Environmental agent     |                   |                                                                                                          |                                                                                                                 |                                                                                                |
| Environment             | 1 (High humidity) | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
|                         | 2 (Factory)       | ◎                                                                                                        | Discolored at high temperatures                                                                                 | ◎                                                                                              |
|                         | 3 (Ship)          | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
|                         | 4 (Countryside)   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
|                         | 5 (Salt spray)    | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Sulfuric acid           |                   | 10% 70°C : △, 30% Room temperature ◎, 98% Room temperature △                                             | 98% : △ Discolored, Hardened                                                                                    | Discolored                                                                                     |
| Nitric acid             |                   | ◎                                                                                                        | 65% : ○ Discolored, Hardened                                                                                    | Concentrated: Cracked                                                                          |
| Hydrochloric acid       |                   | Up to 35% : ◎                                                                                            | 35% : ○ Dark brown, Brittle                                                                                     | Slightly discolored                                                                            |
| Hydrofluoric acid       |                   | 50% 22°C : ◎, 60°C : ×                                                                                   | 48% : ○ Discolored, Hardened                                                                                    | Slightly discolored                                                                            |
| Chlorine                |                   | ◎                                                                                                        | Saturated : ◎                                                                                                   | Barely discolored                                                                              |
| Hydrogen sulfide        |                   | ◎                                                                                                        | Dry gas : ◎                                                                                                     | ◎                                                                                              |
| Sulfur dioxide          |                   | Dry gas : ◎, Wet gas : ○                                                                                 | ◎                                                                                                               | ◎                                                                                              |
| Arsenic acid            |                   | 80% : ◎                                                                                                  | Concentrated : ◎                                                                                                | Concentrated : ◎                                                                               |
| Boric acid              |                   | ◎                                                                                                        | ◎                                                                                                               | Saturated : ◎                                                                                  |
| Phosphoric acid         |                   | 70 to 80% : ○, 85% : ×                                                                                   | 85% : ×                                                                                                         | ◎                                                                                              |
| Potassium hydroxide     |                   | ◎                                                                                                        | ○ Discolored, Hardened                                                                                          | Slightly discolored                                                                            |
| Sodium hydroxide        |                   | ◎                                                                                                        | 50% : ○ Discolored, Hardened                                                                                    | Slightly discolored                                                                            |
| Ammonia                 |                   | Dry gas : ◎, Wet gas : ×                                                                                 | ×                                                                                                               | Slightly swollen                                                                               |
| Anhydrous ammonia       |                   | ◎                                                                                                        | Dark color                                                                                                      | ◎                                                                                              |
| Calcium hydroxide       |                   | ×                                                                                                        | ×                                                                                                               | Significantly brittle                                                                          |
| Water                   |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Sodium chloride         |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Ammonium nitrate        |                   | ◎                                                                                                        | Saturated: Slightly hardened                                                                                    | ◎                                                                                              |
| Sodium nitrate          |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Calcium carbonate       |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Magnesium carbonate     |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Calcium chloride        |                   | ◎                                                                                                        | 15% : Dark color, Hardened                                                                                      | ◎                                                                                              |
| Magnesium chloride      |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Magnesium nitrate       |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Magnesium sulfate       |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Zinc sulfate            |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Zinc chloride           |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Sodium hydrogen sulfate |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Hydrogen peroxide       |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Chromic acid            |                   | 10%, 22.2°C : ◎, 50% : ×                                                                                 | ◎                                                                                                               | 50% : ◎                                                                                        |
| Potassium dichromate    |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Acetic acid             |                   | 10, 80%, 22°C : ◎                                                                                        | Glacial acetic acid (Slightly brittle)                                                                          | Slightly swollen                                                                               |
| Acetic anhydride        |                   | Glacial acetic acid 22°C : ◎, 60°C : ×                                                                   | Softened                                                                                                        | Slightly swollen                                                                               |
| Sodium acetate          |                   | ◎                                                                                                        | ◎                                                                                                               | Slightly swollen                                                                               |
| Formic acid             |                   | 22°C : ◎, 60°C : ×                                                                                       | ○ : Hardened, Brittle                                                                                           | ◎                                                                                              |
| Maleic anhydride        |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Citric acid             |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Fatty acid              |                   | ◎                                                                                                        | ◎ Turned dark brown                                                                                             | ◎                                                                                              |
| Phthalic anhydride      |                   | —                                                                                                        | Softened                                                                                                        | Swollen, cracked                                                                               |
| Hydrocarbon             |                   | ×                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Alcohol                 |                   | <96%, 60°C : ◎                                                                                           | Slightly softened                                                                                               | ◎                                                                                              |
| Isopropyl alcohol       |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Butyl alcohol           |                   | ◎                                                                                                        | ×                                                                                                               | Slightly discolored and swollen                                                                |
| Glycerin                |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Glycol                  |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Ester                   |                   | ×                                                                                                        | Softened                                                                                                        | Slightly swollen                                                                               |
| Ethyl acetate           |                   | ×                                                                                                        | × Softened                                                                                                      | Slightly swollen                                                                               |
| Ethyl chloride          |                   | ×                                                                                                        | Room temperature : ×                                                                                            | Slightly swollen                                                                               |
| Ketone                  |                   | ×                                                                                                        | Softened                                                                                                        | Slightly swollen                                                                               |
| Acetaldehyde            |                   | ×                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Urea                    |                   | ◎                                                                                                        | Slightly discolored                                                                                             | ◎                                                                                              |
| Detergent               |                   | ◎                                                                                                        | —                                                                                                               | Soap solution : ◎                                                                              |
| Tar oil                 |                   | ◎                                                                                                        | ◎                                                                                                               | ◎                                                                                              |
| Rosin                   |                   | Wood rosin, Room temperature : ×                                                                         | Wood rosin, Room temperature : ×                                                                                | Wood rosin, Room temperature : ×                                                               |
| Chlorinated solvent     |                   | CCl <sub>4</sub> : ×                                                                                     | Slightly softened                                                                                               | Swollen                                                                                        |

Note: \* Use limit temperature is a maximum temperature at which the resin is usable.

This evaluation is by W.H. Adans

| Polypropylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Polystyrene (for general use)                                                                                                                                                                                                                                                                                             | ABS resin                                                                                                                                                                                                                                                                                                                                                      | AS resin                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test results obtained at room temperature unless otherwise specifically mentioned                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Immersed at 21°C for 7 days unless otherwise specifically mentioned                                                                                                                                                                                                                                                       | Immersed at 21°C for 7 days                                                                                                                                                                                                                                                                                                                                    | Immersed at 21°C for 7 days                                                                                                                                                                     |
| <p>2 to 10% 100°C : ○<br/>100% : ×<br/>Fume : ×, 50%<br/>60°C : ○<br/>30% 60°C : ○, 10% 100°C : ○<br/>38 to 40% 20°C : ○<br/>Dry gas : △, Wet gas : △, Liquid : ×<br/>Gas, 100°C : ○</p> <p>85% 100°C : ○</p> <p>30% 20°C : ○<br/>Liquid ○</p> <p>Total concentration<br/>Use limit temperature * : ○</p> <p>Total concentration,<br/>Use limit temperature * : ○</p> <p>—</p> <p>Total concentration, 90°C : ○</p> <p>—</p> <p>Total concentration, Room temperature to 60°C : ○<br/>Total concentration, Use limit temperature * : ○</p> <p>—</p> <p>30% 20°C : ○, 30%<br/>48.9°C : ×<br/>1%, 60°C : ○,<br/>10%, 60°C : ○</p> | <p>10, 50% : ○, Concentrated : ×<br/>20, 70% : ×<br/>10% : ○, 30% : △<br/>1% : △, 48% : ×<br/>×<br/>—</p> <p>—</p> <p>50% : ○<br/>10~30% : ○, Saturated : ○</p> <p>—</p> <p>Saturated : ○</p> <p>—</p> <p>Total concentration<br/>Use limit temperature * : ○</p> <p>—</p> <p>20% : ○</p> <p>○</p>                        | <p>10% : ○<br/>10% : Slightly affected</p> <p>10% : ○<br/>10% : ○, Concentrated : ×<br/>Anhydrous liquid : ×</p> <p>Slightly affected by dry and wet gases.<br/>Stained</p> <p>—</p> <p>Concentrated : ○<br/>10% : ○<br/>10% : ○<br/>Ammonia hydroxide ○<br/>Gas or liquid : ×</p> <p>10% : ○</p> <p>—</p> <p>6% Slightly affected<br/>Slight liquid stain</p> | <p>30% : ○<br/>—</p> <p>10% : ○<br/>10% : ○</p> <p>—</p> <p>Concentrated : ○<br/>10% : ○<br/>10% : ○</p> <p>—</p> <p>10% : ○</p> <p>—</p> <p>6% : ○</p> <p>○</p>                                |
| <p>100% Glacial acetic acid &lt;20°C : ○<br/>10% &lt;60°C : ○<br/>○<br/>Total concentration<br/>Use limit temperature * : ○<br/>100% : ○<br/>10%, 60°C : ○</p> <p>10%, 60°C : ○<br/>△<br/>△</p> <p>Benzene : ○<br/>Toluene : ×<br/>○</p> <p>—</p> <p>Butyl acetate : ×<br/>△ (Swollen)<br/>Room temperature : ×<br/>Acetone : ○<br/>○</p> <p>—</p> <p>Wood rosin, Room temperature : ×<br/>CCl<sub>4</sub> : ×</p>                                                                                                                                                                                                              | <p>5, 25% : ○<br/>Glacial acetic acid : ×<br/>○</p> <p>90% : △</p> <p>10% : ○, 20% : △<br/>○, 60°C : ×</p> <p>Benzene, Toluene, Xylene :<br/>Dissolved<br/>Ethanol : ○</p> <p>○</p> <p>Dissolved<br/>Dissolved</p> <p>Acetone : ×, MEK : Dissolved<br/>△*</p> <p>○</p> <p>CCl<sub>4</sub> : Dissolved<br/>Paralox : ×</p> | <p>5% : ○<br/>△*</p> <p>10% : ○</p> <p>—</p> <p>10% : ○</p> <p>10% : ○</p> <p>Toluene : Dissolved</p> <p>Slightly affected by methyl and<br/>95% ethanol</p> <p>○</p> <p>Generally dissolved</p> <p>—</p> <p>—</p>                                                                                                                                             | <p>5% : ○<br/>—</p> <p>10% : ○</p> <p>—</p> <p>10% : ○</p> <p>10% : ○</p> <p>Toluene : ×</p> <p>Methanol 95%<br/>Ethanol : ○</p> <p>○</p> <p>×</p> <p>×</p> <p>×</p> <p>×</p> <p>×</p> <p>△</p> |

| Resin name              |                                                                                   | Acrylic resin                                                             | Trifluorochloroethylene resin      | Tetrafluoroethylene resin                                                                                                                                                                                   |
|-------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental agent     | Test conditions                                                                   | Data obtained at room temperature unless otherwise specifically mentioned | Immersion test at room temperature | At room temperature unless otherwise specifically mentioned                                                                                                                                                 |
| Environment             | 1 (High humidity)<br>2 (Factory)<br>3 (Ship)<br>4 (Countryside)<br>5 (Salt spray) | ○<br>○<br>○<br>○<br>○                                                     | ○<br>○<br>○<br>○<br>○              | ○<br>○<br>○<br>○<br>○                                                                                                                                                                                       |
| Sulfuric acid           |                                                                                   | Weak acid (60%) : ○, Strong acid : ×                                      | ○                                  | 30%, 12 months, 71°C : No weight change ○<br>10% 24°C : No weight change<br>71°C : +0.1%                                                                                                                    |
| Nitric acid             |                                                                                   | 10% Room temperature : △, 10% 70°C : ×, 30% 70°C : ×                      | ○                                  | Room temperature, No weight change at 10% to 20% ○<br>≤60%, Room temperature to 100°C : ○<br>Dry gas, wet gas, liquid,<br>Use limit temperature * : ○                                                       |
| Hydrochloric acid       |                                                                                   | 38%, Room temperature : ○                                                 | ○                                  |                                                                                                                                                                                                             |
| Hydrofluoric acid       |                                                                                   | Weak acid (30%) : ○, Strong acid : ×                                      | ○                                  |                                                                                                                                                                                                             |
| Chlorine                |                                                                                   | Dry gas : ○, Wet gas : ×                                                  | ○                                  |                                                                                                                                                                                                             |
| Hydrogen sulfide        |                                                                                   | Dry gas : ○, Wet gas : ×                                                  | ○                                  |                                                                                                                                                                                                             |
| Sulfur dioxide          |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Arsenic acid            |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Boric acid              |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Phosphoric acid         |                                                                                   | 50% Room temperature : ○, 50% 70°C : △<br>75% Room temperature : ○        | ○                                  | Total concentration 200°C : ○<br>Total concentration<br>Room temperature to 150°C : ○<br>Total concentration, Room temperature to 150°C : ○<br>(No weight change)<br>Total concentration, Boiling point : ○ |
| Potassium hydroxide     |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Sodium hydroxide        |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Ammonia                 |                                                                                   | Aqueous solution : ○                                                      | ○                                  |                                                                                                                                                                                                             |
| Anhydrous ammonia       |                                                                                   | Yellowed                                                                  | ○                                  |                                                                                                                                                                                                             |
| Calcium hydroxide       |                                                                                   | ○                                                                         | ○                                  | Aqueous solution or lime milk,<br>100°C : ○                                                                                                                                                                 |
| Water                   |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Sodium chloride         |                                                                                   | ○                                                                         | ○                                  | Total concentration, use limit temperature * : ○                                                                                                                                                            |
| Ammonium nitrate        |                                                                                   | ○                                                                         | ○                                  | Total concentration, boiling point : ○                                                                                                                                                                      |
| Sodium nitrate          |                                                                                   | ○                                                                         | ○                                  | Total concentration, use limit temperature * : ○                                                                                                                                                            |
| Calcium carbonate       |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Magnesium carbonate     |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Calcium chloride        |                                                                                   | ○                                                                         | ○                                  | Total concentration, boiling point : ○                                                                                                                                                                      |
| Magnesium chloride      |                                                                                   | ○                                                                         | ○                                  | Total concentration, room temperature to boiling point : ○                                                                                                                                                  |
| Magnesium nitrate       |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Magnesium sulfate       |                                                                                   | ○                                                                         | ○                                  | Total concentration, room temperature to 150°C : ○                                                                                                                                                          |
| Zinc sulfate            |                                                                                   | ○                                                                         | ○                                  | Total concentration, use limit temperature * : ○                                                                                                                                                            |
| Zinc chloride           |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Sodium hydrogen sulfate |                                                                                   | ○                                                                         | ○                                  | Total concentration, use limit temperature * : ○                                                                                                                                                            |
| Hydrogen peroxide       |                                                                                   | Up to 50% : ○                                                             | ○                                  |                                                                                                                                                                                                             |
| Chromic acid            |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |
| Potassium dichromate    |                                                                                   | ×                                                                         | ○                                  | Total concentration, room temperature to boiling point : ○                                                                                                                                                  |
| Acetic acid             |                                                                                   | Weak acid 15% : △, Strong acid : ×                                        | ○                                  | Total concentration, room temperature to boiling point : ○<br>Boiling point : ○                                                                                                                             |
| Acetic anhydride        |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |
| Sodium acetate          |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Formic acid             |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Maleic anhydride        |                                                                                   | Weak acid 30% : ○, Strong acid : ×                                        | ○                                  | Total concentration, crude, pure, room temperature to boiling point : ○<br>Room temperature ~ 200°C : ○                                                                                                     |
| Citric acid             |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Fatty acid              |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Phthalic anhydride      |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Hydrocarbon             |                                                                                   | ×                                                                         | ○                                  | Benzene, 24°C, 12 months :<br>+0.3% : ○<br>95% ethyl alcohol 48.9°C,<br>12 months: no weight change                                                                                                         |
| Alcohol                 |                                                                                   | Ethyl alcohol 50% : ○<br>Methyl alcohol 60% : ○                           | ○                                  | ○*<br>Boiling point : ○<br>Pure or aqueous solution,<br>Use limit temperature * : ○                                                                                                                         |
| Isopropyl alcohol       |                                                                                   | Up to 50% : ○                                                             | ○                                  |                                                                                                                                                                                                             |
| Butyl alcohol           |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Glycerin                |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Glycol                  |                                                                                   | ○                                                                         | ○                                  |                                                                                                                                                                                                             |
| Ester                   |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |
| Ethyl acetate           |                                                                                   | ×                                                                         | ○                                  | 24°C, 12 months : +0.5%<br>Room temperature to boiling point : ○<br>Acetone, boiling point : ○                                                                                                              |
| Ethyl chloride          |                                                                                   | ×                                                                         | ○                                  | Total concentration, Room temperature to 100°C : ○                                                                                                                                                          |
| Ketone                  |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |
| Acetaldehyde            |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |
| Urea                    |                                                                                   | ○                                                                         | ○                                  | Soap solution : ○                                                                                                                                                                                           |
| Detergent               |                                                                                   | At low concentration ○ - ○                                                | ○                                  |                                                                                                                                                                                                             |
| Tar oil                 |                                                                                   | ○                                                                         | ○                                  | Wood rosin, Room temperature ~ 150°C : ○                                                                                                                                                                    |
| Rosin                   |                                                                                   | ○                                                                         | ○                                  | CCI <sub>4</sub> , 24°C, 12 months : +0.6%                                                                                                                                                                  |
| Chlorinated solvent     |                                                                                   | ×                                                                         | ○                                  |                                                                                                                                                                                                             |



| Resin name              |                                                                                   | Polyamide                               | Phenolic resin                                                                      | Phenoxy resin                                                              |
|-------------------------|-----------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Test conditions         |                                                                                   | Room temperature                        | Numerical value indicates weight increase after immersion at room temperature for 7 | Weight change in 7 days is indicated by (%) Temperature: room temperature  |
| Environmental agent     |                                                                                   |                                         |                                                                                     |                                                                            |
| Environment             | 1 (High humidity)<br>2 (Factory)<br>3 (Ship)<br>4 (Countryside)<br>5 (Salt spray) | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                   | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                                                               | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                                                      |
| Sulfuric acid           |                                                                                   | ×                                       | 30% : 0.98                                                                          | 38% : 0.21                                                                 |
| Nitric acid             |                                                                                   | ×                                       | 10% : 1.97                                                                          | Weight increase, dimension increase                                        |
| Hydrochloric acid       |                                                                                   | ×                                       | 10% : 1.49                                                                          | 10% : 0.25, Weight increase                                                |
| Hydrofluoric acid       |                                                                                   | ×                                       | ≤ 60%, Room temperature to 100°C : ⊙<br>(Carbon filling)                            | Concentrated: weight increase in 0.16<br>Dimension increase in 0% to 0.36% |
| Chlorine                |                                                                                   | ⊙                                       | Dry gas, wet gas, room temperature to 80°C : ⊙<br>(Carbon filling)                  | ×                                                                          |
| Hydrogen sulfide        |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Sulfur dioxide          |                                                                                   | ⊙                                       | No change at room temperature in 72 h : ⊙                                           | ⊙                                                                          |
| Arsenic acid            |                                                                                   | ⊙                                       | ⊙                                                                                   | ⊙                                                                          |
| Boric acid              |                                                                                   | △                                       | —                                                                                   | ⊙                                                                          |
| Phosphoric acid         |                                                                                   | △ - ×                                   | 1 to 85%, Room temperature to 100°C : ⊙                                             | ⊙                                                                          |
| Potassium hydroxide     |                                                                                   | ⊙                                       | ×                                                                                   | ⊙                                                                          |
| Sodium hydroxide        |                                                                                   | ⊙                                       | 1% : 0.85, 10% : 2.78                                                               | ⊙                                                                          |
| Ammonia                 |                                                                                   | ⊙                                       | —                                                                                   | —                                                                          |
| Anhydrous ammonia       |                                                                                   | ⊙                                       | 0% : No weight change                                                               | ⊙                                                                          |
| Calcium hydroxide       |                                                                                   | ×                                       | —                                                                                   | ⊙                                                                          |
| Water                   |                                                                                   | ⊙ (Dimension change occurred)           | 1.06                                                                                | ⊙ (Absorbed, dimension change occurred)                                    |
| Sodium chloride         |                                                                                   | ⊙                                       | Total concentration, use limit temperature * : ⊙                                    | ⊙                                                                          |
| Ammonium nitrate        |                                                                                   | ⊙                                       | ⊙                                                                                   | ⊙                                                                          |
| Sodium nitrate          |                                                                                   | ⊙                                       | Total concentration, use limit temperature * : ⊙                                    | ⊙                                                                          |
| Calcium carbonate       |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Magnesium carbonate     |                                                                                   | ⊙                                       | 5% : 1.04                                                                           | ⊙                                                                          |
| Calcium chloride        |                                                                                   | ⊙                                       | Total concentration, room temperature to 120°C : ⊙                                  | ⊙                                                                          |
| Magnesium chloride      |                                                                                   | ⊙                                       | Total concentration, room temperature to 95% : ⊙<br>(Glass-reinforced)              | ⊙                                                                          |
| Magnesium nitrate       |                                                                                   | ⊙                                       | Total concentration, use limit temperature * : ⊙                                    | ⊙                                                                          |
| Magnesium sulfate       |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Zinc sulfate            |                                                                                   | ⊙                                       | 5% : 1.05, 10% : 0.524                                                              | ⊙                                                                          |
| Zinc chloride           |                                                                                   | Dissolved at high temperature           | 3% : 1.04                                                                           | ⊙                                                                          |
| Sodium hydrogen sulfate |                                                                                   | △                                       | ×                                                                                   | 0.4, Dimension change                                                      |
| Hydrogen peroxide       |                                                                                   | ×                                       | —                                                                                   | ⊙                                                                          |
| Chromic acid            |                                                                                   | ×                                       | 90%, room temperature : △                                                           | ⊙                                                                          |
| Potassium dichromate    |                                                                                   | ×                                       | 5% : 0.98                                                                           | Swollen, dimension increased                                               |
| Acetic acid             |                                                                                   | ×                                       | —                                                                                   | ⊙                                                                          |
| Acetic anhydride        |                                                                                   | ×                                       | 25% room temperature : ⊙, 50% room temperature : ⊙                                  | —                                                                          |
| Sodium acetate          |                                                                                   | ⊙                                       | 90% room temperature : ⊙                                                            | ⊙                                                                          |
| Formic acid             |                                                                                   | ×                                       | —                                                                                   | ⊙                                                                          |
| Maleic anhydride        |                                                                                   | —                                       | 10% : 0.655                                                                         | ⊙                                                                          |
| Citric acid             |                                                                                   | △                                       | —                                                                                   | Stress cracking                                                            |
| Fatty acid              |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Phthalic anhydride      |                                                                                   | ⊙                                       | Toluene : 0.016                                                                     | ⊙                                                                          |
| Hydrocarbon             |                                                                                   | ⊙                                       | 95% ethanol : 0.041                                                                 | Toluene: Increase in 8.2<br>95% ethanol : 4.3                              |
| Alcohol                 |                                                                                   | ⊙ (Affected, dimension change occurred) | —                                                                                   | Stress cracking                                                            |
| Isopropyl alcohol       |                                                                                   | ⊙ (Affected)                            | ⊙                                                                                   | Stress cracking                                                            |
| Butyl alcohol           |                                                                                   | ⊙                                       | ⊙                                                                                   | Increase in 0.12                                                           |
| Glycerin                |                                                                                   | ⊙ (Affected)                            | ⊙                                                                                   | 0.03, Dimension change                                                     |
| Glycol                  |                                                                                   | ⊙ (Affected)                            | Butyl acetate : ⊙                                                                   | Swollen                                                                    |
| Ester                   |                                                                                   | ⊙                                       | Methyl acetate : ⊙                                                                  | Swollen                                                                    |
| Ethyl acetate           |                                                                                   | ⊙                                       | 0.8%                                                                                | ×                                                                          |
| Ethyl chloride          |                                                                                   | ⊙                                       | —                                                                                   | Swollen                                                                    |
| Ketone                  |                                                                                   | ⊙                                       | Acetone : 0.086                                                                     | Swollen                                                                    |
| Acetaldehyde            |                                                                                   | ⊙                                       | 40%, 60°C : ⊙                                                                       | —                                                                          |
| Urea                    |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Detergent               |                                                                                   | ⊙                                       | Soap solution : ⊙                                                                   | Increase in 0.26, Stress cracking                                          |
| Tar oil                 |                                                                                   | ⊙                                       | —                                                                                   | Stress cracking                                                            |
| Rosin                   |                                                                                   | ⊙                                       | —                                                                                   | ⊙                                                                          |
| Chlorinated solvent     |                                                                                   | ⊙                                       | CCl <sub>4</sub> : 0.006                                                            | CCl <sub>4</sub> : Increase in 0.09                                        |



| Resin name              |                                                                                   | Epoxy resin<br>(glass fiber-reinforced)                                                                                                                                                                                                     | Diallyl phthalate resin<br>(diallyl dilate resin)                                                      | Polyalomer<br>(ethylene-propylene copolymer)                                             |
|-------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Test conditions         |                                                                                   | Room temperature unless<br>otherwise specifically mentioned                                                                                                                                                                                 | Room temperature unless otherwise specifically mentioned,<br>Numerical value indicates weight change % | Numerical value obtained after immersion<br>at 23°C in 1 month indicates weight change % |
| Environmental agent     |                                                                                   |                                                                                                                                                                                                                                             |                                                                                                        |                                                                                          |
| Environment             | 1 (High humidity)<br>2 (Factory)<br>3 (Ship)<br>4 (Countryside)<br>5 (Salt spray) | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                                                                                                                                                                                                                       | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                                                                                  | ⊙<br>⊙<br>⊙<br>⊙<br>⊙                                                                    |
| Sulfuric acid           |                                                                                   | 10% : ⊙ (Low temperature) , ⊙ (High temperature)<br>70% : ⊙ (Low temperature) , × (High temperature)<br>5% : △ (Low temperature) , × (High temperature)<br>20% : × (Low and high temperatures)<br>Low temperature : ⊙, High temperature : △ | 30% : 0.48                                                                                             | 30% : +0.01                                                                              |
| Nitric acid             |                                                                                   | 10% : ⊙ (Low temperature) , × (High temperature)<br>5% : △ (Low temperature) , × (High temperature)<br>20% : × (Low and high temperatures)<br>Low temperature : ⊙, High temperature : △                                                     | 10% : +1.29                                                                                            | 70% : +0.7 Yellowed                                                                      |
| Hydrochloric acid       |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | 20%, 80°C : ×                                                                                          | 10% : +0.1                                                                               |
| Hydrofluoric acid       |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Chlorine                |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | —                                                                                                      | —                                                                                        |
| Hydrogen sulfide        |                                                                                   | ⊙                                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Sulfur dioxide          |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Arsenic acid            |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Boric acid              |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Phosphoric acid         |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | 50% Room temperature : ⊙, 50% 70°C : ⊙                                                                 | —                                                                                        |
| Potassium hydroxide     |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Sodium hydroxide        |                                                                                   | ≤50%, Room temperature to 80°C : ⊙                                                                                                                                                                                                          | 5% aqueous solution : ⊙,<br>Alcohol potash (warm) : ×<br>2.26%, 71.1°C : ⊙                             | 10% aqueous solution : +0.01%                                                            |
| Ammonia                 |                                                                                   | Ammonia hydroxide : ⊙                                                                                                                                                                                                                       | 1.2% aqueous solution : ⊙                                                                              | —                                                                                        |
| Anhydrous ammonia       |                                                                                   | Gas (low temperature) : ⊙,<br>Gas (high temperature) : △, liquid : ×<br>Wet : × (low and high temperatures)<br>Dry : ⊙ (low temperature) , × (high temperature)                                                                             | —                                                                                                      | —                                                                                        |
| Calcium hydroxide       |                                                                                   | ⊙                                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Water                   |                                                                                   | ⊙                                                                                                                                                                                                                                           | ⊙ (+0.9% in 1 month in distilled water)                                                                | ⊙                                                                                        |
| Sodium chloride         |                                                                                   | ⊙                                                                                                                                                                                                                                           | ⊙                                                                                                      | 10% aqueous solution : +0.02%                                                            |
| Ammonium nitrate        |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Sodium nitrate          |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | ⊙                                                                                                      | —                                                                                        |
| Calcium carbonate       |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Magnesium carbonate     |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Calcium chloride        |                                                                                   | ⊙                                                                                                                                                                                                                                           | ⊙                                                                                                      | 40% aqueous solution : +0.1%                                                             |
| Magnesium chloride      |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | ⊙                                                                                                      | —                                                                                        |
| Magnesium nitrate       |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | ⊙                                                                                                      | —                                                                                        |
| Magnesium sulfate       |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | ⊙                                                                                                      | —                                                                                        |
| Zinc sulfate            |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | ⊙                                                                                                      | —                                                                                        |
| Zinc chloride           |                                                                                   | Total concentration, use limit temperature * : ⊙                                                                                                                                                                                            | Total concentration, Use limit temperature * : ⊙                                                       | —                                                                                        |
| Sodium hydrogen sulfate |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Hydrogen peroxide       |                                                                                   | Low temperature : ⊙, High temperature : △                                                                                                                                                                                                   | +1.2% (71°C)                                                                                           | 30% : +0.1%                                                                              |
| Chromic acid            |                                                                                   | 10%, Room temperature : △                                                                                                                                                                                                                   | —                                                                                                      | —                                                                                        |
| Potassium dichromate    |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Acetic acid             |                                                                                   | 10% : ⊙ (Low temperature) , △ (High temperature)<br>75% : △ (Low temperature) , × (High temperature)                                                                                                                                        | ⊙                                                                                                      | 5% : +0.1%                                                                               |
| Acetic anhydride        |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | —                                                                                                      | —                                                                                        |
| Sodium acetate          |                                                                                   | 50% Low temperature : ⊙                                                                                                                                                                                                                     | —                                                                                                      | —                                                                                        |
| Formic acid             |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | —                                                                                                      | —                                                                                        |
| Maleic anhydride        |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | 3% : +1.2% (71°C)                                                                                      | 10% : +0.1%                                                                              |
| Citric acid             |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | —                                                                                                      | —                                                                                        |
| Fatty acid              |                                                                                   | Low temperature : ⊙, High temperature : ⊙                                                                                                                                                                                                   | —                                                                                                      | Oleic acid : 0.4 to 0.7%                                                                 |
| Phthalic anhydride      |                                                                                   | Low temperature : ⊙, High temperature : △                                                                                                                                                                                                   | 0.025% : ⊙                                                                                             | +1 to 20%                                                                                |
| Hydrocarbon             |                                                                                   | Low temperature : ⊙, High temperature : △                                                                                                                                                                                                   | +0.2% : ⊙                                                                                              | +0.1%                                                                                    |
| Alcohol                 |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Isopropyl alcohol       |                                                                                   | △                                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Butyl alcohol           |                                                                                   | △                                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Glycerin                |                                                                                   | Pure or aqueous solution,<br>Use limit temperature * : ⊙                                                                                                                                                                                    | —                                                                                                      | +0.1%                                                                                    |
| Glycol                  |                                                                                   | Methyl acetate, Butyl acetate : △                                                                                                                                                                                                           | ⊙                                                                                                      | +0.1%                                                                                    |
| Ester                   |                                                                                   | △                                                                                                                                                                                                                                           | ⊙                                                                                                      | +6 to 10%                                                                                |
| Ethyl acetate           |                                                                                   | △                                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Ethyl chloride          |                                                                                   | Low temperature : ⊙, High temperature : △                                                                                                                                                                                                   | Slightly swollen : △                                                                                   | 2 to 3%                                                                                  |
| Ketone                  |                                                                                   | ⊙                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Acetaldehyde            |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Urea                    |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Detergent               |                                                                                   | Soap solution : ⊙                                                                                                                                                                                                                           | ⊙                                                                                                      | —                                                                                        |
| Tar oil                 |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Rosin                   |                                                                                   | —                                                                                                                                                                                                                                           | —                                                                                                      | —                                                                                        |
| Chlorinated solvent     |                                                                                   | CCl <sub>4</sub> : ⊙                                                                                                                                                                                                                        | ⊙ - △                                                                                                  | +10 to 20%                                                                               |

[illegible]

(Yanagihara: plastics, 22(5), 53(1971))

## Attachment 4: Heat resistance of various resins

### 1.2.16 Heat resistance temperature

#### (90) Usable temperature of various plastics

##### 1) Long-term heat resistance temperature (90 days or more)

| Material                               | Long-term heat resistance temperature (90 days or more) (°C) | Material                        | Long-term heat resistance temperature (90 days or more) (°C) |
|----------------------------------------|--------------------------------------------------------------|---------------------------------|--------------------------------------------------------------|
| Phenolic resin (no filler)             | 120 to 130                                                   | Methacrylic resin               | 120 to 130                                                   |
| Unsaturated polyester resin (cast)     | 90                                                           | GP-polystyrene                  | 100                                                          |
| Allyl resin (cast)                     | 90                                                           | High pressure polyethylene film | 80                                                           |
| Epoxy resin                            | 95 to 100                                                    | Molded polyvinyl carbazole      | 120                                                          |
| Molded polyurethane                    | 110                                                          | Polytetrafluoroethylene film    | >250                                                         |
| Hard vinyl chloride resin              | 80 to 90                                                     | Poly trifluorochloroethylene    | >200                                                         |
| Soft vinyl chloride resin              | 60 to 70                                                     | Acetyl cellulose                | 80                                                           |
| Vinyl chloride vinyl acetate copolymer | 80                                                           | Ebonite (S = 20%, No filler)    | 100                                                          |

Degradation of high molecular materials, p. 237, CORONA PUBLISHING CO., LTD. (1958)

##### 2) Useful temperature

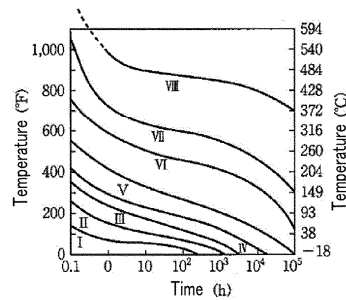
(Unit: °C)

| Material                  | Filler      | Replicated use | Continuous use | Material                     | Filler | Replicated use | Continuous use |
|---------------------------|-------------|----------------|----------------|------------------------------|--------|----------------|----------------|
| Polyester                 | Glass fiber | 135            | 105            | Polytetrafluoroethylene      |        | 260            | 230 to —268    |
| Epoxy resin               | Glass fiber | 150            | 120            | Poly trifluorochloroethylene |        | 230            | 200 to —196    |
| ABS resin                 |             | 80             | 70 to —20      | Polyvinylidene fluoride      |        |                | 150 to —184    |
| High density polyethylene |             | 120            | 105 to —20     | Chlorinated polyether        |        | 150            | 120            |
| Polyvinyl chloride I      |             | 75             | 65 to —40      | Polypropylene                |        | 150            | 120            |

(Gackebach : Chem. Eng. Progr., 59 (10), 96 (1963))

##### 3) Heat resistance classification

Time-temperature relationship diagram for 50% retention of mechanical properties under air heating



| Region | Polymer                      | Region | Polymer                                      |
|--------|------------------------------|--------|----------------------------------------------|
| I      | Methacrylic resin            | III    | Polychlorotrifluoroethylene                  |
|        | Acetyl cellulose             |        | Vinylidene fluoride resin (PVF)              |
|        | Nitrocellulose               | IV     | Alkyd resin                                  |
|        | Polyethylene (low density)   |        | Melamine resin                               |
|        | Polystyrene                  |        | Furfural resin                               |
|        | Vinyl acetate resin          |        | Polyphenylene oxide (PPO)                    |
|        | Polyvinyl alcohol            |        | Polysulfone                                  |
|        | Vinyl chloride resin         | V      | Thermosetting alkyl resin                    |
|        | AS resin (SAN)               |        | Diallyl dilate resin (DAP)                   |
|        | SBR                          |        | Epoxy resin                                  |
|        | Urea resin                   |        | Phenolic resin                               |
| II     | Polyacetal                   | VI     | Polyester                                    |
|        | ABS resin                    |        | Fluorine resin (PTFE)                        |
|        | Chlorinated polyether        | IV     | Polybenzimidazole (PBI)                      |
|        | Ethylene vinyl acetate resin |        | Polyphenylene                                |
|        | Furan resin                  |        | Silicone                                     |
|        | Polyamide (nylon)            | VII    | Polyamideimide                               |
|        | Polycarbonate                |        | Polyimide                                    |
|        | Polyethylene (high density)  | VIII   | Plastics made of future rigid linear polymer |
|        | Polyethylene terephthalate   |        |                                              |
|        | Polypropylene                |        |                                              |
|        | Vinylidene chloride resin    |        |                                              |
|        | Polyurethane                 |        |                                              |

(Oishi: plastics, 24(2), 50(1973))

## Attachment 5: Purity of fluororesin

### Elution test example of fluororesin

Eluate: concentrated nitric acid    Elution temperature: room temperature

Elution time: 1+6+7 (days)

Processing method: PIFE paste extrusion method

PFA-screw extrusion method

Analytical method: ICP-MS method or flameless atomic absorption spectrometry    Unit: ppb

| Element | PIFE  |        |        |       |        |        | PFA   |        |        |       |        |        |
|---------|-------|--------|--------|-------|--------|--------|-------|--------|--------|-------|--------|--------|
|         | No.1  |        |        | No.2  |        |        | No.1  |        |        | No.2  |        |        |
|         | 1 day | 6 days | 7 days | 1 day | 6 days | 7 days | 1 day | 6 days | 7 days | 1 day | 6 days | 7 days |
| Li      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Be      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Na      | <0.1  | <0.1   | 0.1    | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| Mg      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Al      | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| Ti      | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| V       | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Cr      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Mn      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Ni      | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| Co      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Cu      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Zn      | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| Ga      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Ge      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Sr      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Zr      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Nb      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Mo      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Ag      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Cd      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| In      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Sn      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Sb      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Ba      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Ta      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Tl      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Pb      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Bi      | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  | <0.05 | <0.05  | <0.05  |
| Fe      | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |
| Ca      | 0.2   | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | 0.1    | 0.1   | <0.1   | 0.1    |
| K       | <0.1  | <0.1   | 0.1    | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   | <0.1  | <0.1   | <0.1   |