

FLUOROPLASTIC-4D (4Д)
SPECIFICATIONS
GOST 14906-77
(Abstract)

1 Introduction

The standard refers to fluoroplastic-4D (4Д), which is a product of tetrafluoroethylene polymerization obtained in an aqueous medium under pressure in the presence of initiator and emulsifier.

Fluoroplastic-4D (4Д) has high dielectric indices and is resistive to highly active corrosive environments. The operating temperature of articles made of fluoroplastic-4D (4Д) can vary from minus 60 to plus 250 °C.

2 Technical Requirements

2.1 Fluoroplastic-4D (4Д) shall be produced as per the present standard based on the process regulations approved in accordance with the established procedure.

Quality data of fluoroplastic-4D (4Д) shall comply with the standard values and requirements given in Table 1.

Table 1

Parameter	Standard value	Test methods
1 Exterior view	Fine loose powder of white color	Item 4.2.2
2 Grain size distribution in powder, %, fraction over 2 mm in size, maximum fraction under 0.25 mm in size, maximum	2 10	Item 4.3
3 Weight ratio of moisture content, %, maximum	0.02	Item 4.4

2.2 Reference values of fluoroplastic-4D (4Д) are given in Appendix A.

3 Safety Requirements

3.1 At temperatures from minus 60 to plus 250 °C, fluoroplastic-4D (4Д) is not explosion hazardous, nonflammable, and has no effect on the human system in case of direct contact.

Spontaneous ignition temperature in the layer is 520 °C. Ignition temperature in the layer is not observed until spontaneous ignition temperature.

3.2 When fluoroplastic-4D (4Д) is heated above 250 °C, volatile products of thermal-oxidative destruction can be emitted, containing hydrogen fluoride, perfluoroisobutene, carbon monoxide, tetrafluoroethylene.

3.3 If maximum allowable concentrations are exceeded, hydrogen fluoride and perfluoroisobutene irritate mucous membrane of the respiratory tract and cause inflammatory processes of respiratory organs, and high concentrations may cause pulmonary edema.

Carbon monoxide causes asphyxiation due to carboxyhemoglobin formation and affects the central nervous system.

Inhalation of fine particles of the polymer itself, as well as of volatile products emitted from fluoroplastic-4D (4Д) during heating, causes “polymer fume fever” syndrome, resembling metal fume fever (high temperature, the shakes, irritation of the upper respiratory tract, cough, labored breathing).

Tetrafluoroethylene causes affection of the nervous system, liver, and kidneys.

Harmful substances emitted during fluoroplastic-4D (4Д) decomposition have cumulative properties.

3.4 Maximum allowable concentrations in the air of production floor area, mg/m³:

Hydrogen fluoride	0.05	– 1 st class of hazard
Perfluoroisobutene	0.1	– 1 st class of hazard
Carbon monoxide	20.0	– 4 th class of hazard
Fluoroplastic-4	10.0	– 3 rd class of hazard
Tetrafluoroethylene	30.0	– 4 th class of hazard

3.5 Handling of fluoroplastic-4D (4Д) shall be done in production floor areas provided with supply and exhaust ventilation. The equipment shall have local exhaust ventilation.

3.6 Open-type heating devices (electric hot plates) or devices with surfaces heated above 250 °C shall be switched on in exhaust hoods only, with local exhaust ventilation switched off.

3.7 Smoking in production floor areas is prohibited, as fluoroplastic dust getting onto a burning cigarette will burn with generation of toxic products.

3.8 When working with fluoroplastic-4D (4Д), accumulation of static charges is possible.

To reduce accumulation of static charges, relative humidity in production floor areas shall be 50 % minimum. For protection against static electricity effects, metal structures shall be grounded.

3.9 In case of emergencies, work shall be done wearing gas masks.

The intervals of sanitary and chemical safety checks of the working air are established by sanitary supervision authorities.

Fluoroplastic-4D (4Д) waste is subject to recycling. Non-recyclable fluoroplastic-4D (4Д) waste shall be buried at specially allocated sites.

4 Acceptance Rules

4.1 Fluoroplastic material is accepted in batches. A batch is an amount of fluoroplastic-4D (4Д) with weight of 100 kg minimum, obtained from one polymerization process, representing one grade, and accompanied by one quality document.

The document shall give the following information:

manufacturer's name or trademark;

product description and grade;

batch number and quantity of production units in batch;

net weight;

manufacture date;

results of tests performed or confirmation of fluoroplastic-4D (4Д) quality compliance with the requirements of the present standard;

designation of the present standard.

4.2 To control quality of fluoroplastic-4D (4Д), 10 % of production units shall be taken from a batch, but no less than three units.

4.3 If unacceptable test results are obtained for as many as a single parameter, repeated tests of the parameter using a double amount of production units taken from the same batch shall be carried out.

4.4 The parameters given in Table 1 shall be checked periodically but not less frequently than once a quarter, on at least five batches.

The weight ratio of moisture shall be determined periodically on each tenth batch of the polymer.

5 Test Methods

5.1 Sampling

Snap samples of fluoroplastic-4D (4Д) are taken with a sampling instrument, joined together, and mixed thoroughly. An average sample with the weight of at least (500 ± 50) g is taken from the integrated sample and placed into a clean dry tightly-closing polyethylene or glass container. Container with integrated sample shall have an attached label indicating:

- manufacturer's name;
- product description and grade;
- batch number;
- date of sampling.

5.2 Prior to testing, specimens shall be conditioned in the air at a temperature of (23 ± 2) °C for at least 3 hours; relative humidity is not specified.

5.3 The appearance of fluoroplastic-4D (4Д) is determined visually, without the without use of magnifiers.

5.4 Determination of Grain Size Distribution

To determine grain size distribution, use a set of sieves with mesh size of 2; 0.25 mm and a tray.

Prior to testing, keep the powder at a temperature within plus 5 to plus 18 °C for 6 hours. Each sieve and tray shall be wiped with alcohol beforehand, dried in the air, and weighed with the maximum error of 0.1 g.

Pour 100 g of fluoroplastic-4D (4Д) weighed with the maximum error of 0.1 g onto the upper sieve. Perform powder sifting manually by moving the set of sieves left and right for 3 min.

After that, weigh the sieves and tray with polymer residue again with the maximum error of 0.1 g.

It is allowed to perform sifting with the help of vibration machine with oscillation amplitude of (30 ± 5) mm and frequency of (4 ± 1) oscillations per second.

Calculate weight ratio of residue after sifting on each sieve and in tray X, %, using the following formula:

where m – weight quantity before sifting, g;

m_1 – weight of residue on sieve and in tray after sifting, g.

An arithmetic average value of three parallel measurements with the maximum permissible difference between them not exceeding 0.5 % shall be assumed as a test result, with confidence factor $P = 0.95$.

5.5 Determination of Moisture Weight Ratio

Determination of the weight ratio of moisture is performed by drying with the help of an infrared lamp of IKZ (ИКЗ) type (infrared radiation lamp of mirror type).

Weigh (5 ± 1) g of fluoroplastic-4D (4Д) in a beaker pre-dried to a constant weight. Record the weighing results with an accuracy to the second decimal digit.

Install the lamp vertically under ventilation draft. The distance between lamp low point and table surface shall be (65 ± 5) mm. To minimize heat losses, a metal screen lined with asbestos fabric shall be installed around the lamp.

Switch the lamp on 5 min before the test.

Place a beaker with weight quantity in the area of light circle for 30 min. Then cool down in exiccator to the room temperature, perform weighing, record the weighing result in grams with an accuracy to the fourth decimal digit, and place under the lamp again for 10 min.

Repeat the last operations (heating for 10 min, cooling-down to room temperature for at least 30 min, and weighing) until obtaining a constant weight.

Calculate moisture weight ratio X_1 , %, using the following formula:

$$X_1 = \frac{[(m - m_1)] \cdot 100}{m},$$

where m – weight quantity before drying, g;

m_1 – weight quantity after drying, g.

An arithmetic average value of two parallel measurements with the maximum permissible difference between them not exceeding 0.005 % shall be assumed as a test result, with confidence factor $P = 0.95$.

5 Packing, Transportation and Storage

5.1 Fluoroplastic-4D (4Д) is packaged into cardboard boxes or metal cans with the maximum height of 450 mm. When pouring fluoroplastic-4D (4Д) into a metal or cardboard container having no protective coating, a polyethylene liner bag of larger size than the container shall be placed into the latter. The container cover shall be tightly closed. The liner bag shall be sealed by one of the following methods: welded, soldered, bound with cord or threads, or sealed with the help of adhesive tape. During packaging, fluoroplastic-4D (4Д) shall not be compacted.

Boxes or cans are packaged in wooden crates. The consumer and shipping containers shall be filled taking into account the maximum use of container loading capacity.

Gross weight of the crate shall not exceed 60 kg. The wooden crates are grouped into unitized load blocks.

A unitized load block is composed, mechanically or manually, on flat pallets sized 800×1200 or 1000×1200 mm and shall not exceed the dimensions of $840 \times 1240 \times 135$ mm or $1040 \times 1240 \times 1350$ mm, respectively.

A block is braced in two points with disposable bindings. steel packing band with thickness of at least 0.5 mm or steel wire of dia. 4 – 6 mm.

The ends of steel band shall be linked by means of a steel cramp, which is cut and bent at the edges, same as the band.

Wire bindings shall consist of two strands of 6 mm dia. wire or three strands of 4 mm dia. wire, and shall be tightened.

The weight of a unitized load block shall not exceed 1 t.

5.2 The consumer container shall bear a glued or otherwise attached label or tag indicating:

- manufacturer's name or trademark;
- product description and grade;
- batch number;
- gross weight and net weight;
- manufacture date;
- designation of the present standard.

5.3 Shipping marking shall be applied on the cargo packages, indicating the basic informative and additional inscriptions and handling signs: "Keep dry", "This side up, no tipping", "Fragile, handle with care!". Additional designations applied on containers shall indicate:

- product description and grade;
- batch number;
- designation of the present standard.

Marking for shipping containers shall be made on cardboard tags enclosed in polyethylene film, plywood or metal tags with stenciled paintwork; the tags shall be arranged on one of the crate sides. The tag shall be attached to container with screws or wire.

5.4. Fluoroplastic-4D (4Д), packaged as per item 5.1, can be transported by any means of transport in covered transport vehicles in accordance with the shipping rules applicable for a given means of transport.

5.5 Fluoroplastic-4D (4Д), packaged as per item 5.1, shall be stored in a clean dry room at a distance of minimum 1 m from heating systems.

5.6 Fluoroplastic-4D (4Д) is transported by rail in covered cars in less-than-truckload lots.

6 Manufacturer's Warranty

The manufacturer shall guarantee compliance of fluoroplastic-4D (4Д) with the requirements of the present standard, provided that transportation and storage conditions stipulated in the standard are observed.

Shelf life of fluoroplastic-4D (4Д) is two years from the manufacture date.

Appendix A
(reference)

Reference Values of Fluoroplastic-4D (4Д)

Parameter	Standard value
Crystalline grains melting point, °C	327 ± 1
Glass transition temperature of noncrystalline regions, °C	Minus 120 ± 1
Maximum working temperature during operation, °C	260
Minimum working temperature during operation, °C	Minus 269
Decomposition temperature, °C	Above 415
Temperature of the maximum crystallization rate, °C	310 – 315
Bulk density, kg/m ³	500 ± 50
Thermal conductivity, J·K/ms (kcal/g·°C/mh)	$0.2 \cdot 10^{-5}$ ($0.2 \cdot 10^{-5}$)
Specific heat capacity, J/kg·K (cal/g·°C)	$1.04 \cdot 10^3$ (0.25)
Water absorption over 24 hours, %	0.00
Flexural modulus: at 20 °C: Pa (kgf/cm ²) at 60 °C: Pa (kgf/cm ²)	 $(441 - 834) \cdot 10^6$ (4 500 – 8 500) $(137 - 274) \cdot 10^6$ (14 000 – 28 000)
Impact viscosity J/m ² (kgf·cm/cm ²)	10.2 (100)

Parameter	Standard value
Brinell hardness, Pa kgf/mm ²	(29.4 – 39.2)·10 ⁶ (3 – 4)
Surface resistivity, Ω	≥10 ¹⁷
Dielectric strength at 2 mm thickness: kV/m kV/mm	25·10 ³ – 27·10 ³ 25 – 27
Dielectric capacitance at frequency: 50 Hz 10 ³ Hz 5·10 ⁸ Hz 10 ¹⁰ Hz	2.0 – 2.1 2.0 – 2.1 2.0 – 2.1 2.0 – 2.1
Parameter	Standard value
Dielectric loss tangent at frequency: 50 Hz 10 ³ Hz 5·10 ⁸ Hz 10 ¹⁰ Hz	0.0002 0.0002 0.0003 0.0002
Arc resistance, s	250
Flammability	Non-combustible
Maximum allowable concentration of fluorophosgene, mg/m ³	0.5 – 2 nd class of hazard