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DRYING OF GRANULATED THERMOLABILE PLASTICS IN A VIBROROTATING LAYER

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Features of drying and storing of thermoplastics were determined on an installation of industrial dimensions.

At present the technology of molding plastic products, with ever more stringent requirements as to the quality of the products, poses the problem of thorough dehydration (to hundredths of a percent) of the raw material before molding. Initial experiments with thorough dehydration of thermoplastics showed that it is very promising to use for this purpose apparatus with a vibrorotating layer [1]. After intensive mixing in combination with evacuation, certain peculiarities of the drying of these materials arise. Some of these peculiarities will be examined in the present work.

A diagram of the installation is shown in Fig. 1. The inner diameter of the chamber is 0.5 m, its height is 0.7 m. The material was fluidized by the rotation of the rotor consist-

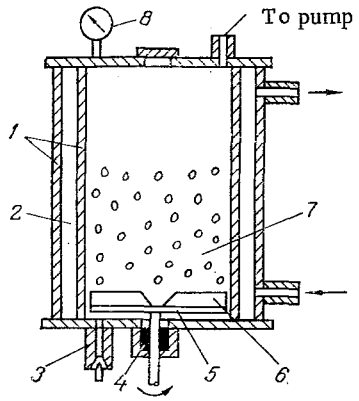

Fig. 1. Diagram of the experimental installation: 1) chamber with double walls; 2) water; 3) flow regulator; 4) vacuum seal; 5) disk; 6) blades; 7) material; 8) manometer.

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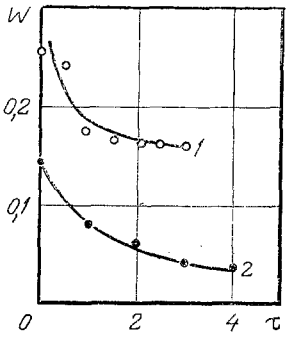

Fig. 2. Drying of granulated thermolabile plastics at n = 6 rps, t = 95°C: 1) ABS plastic (47 kg; P = 10^5 Pa); 2) polycarbonate (40 kg; P = $0.38 \cdot 10^5$ Pa). W, %; τ, h.

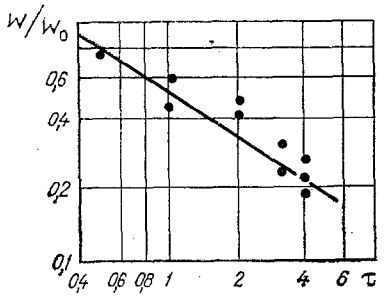

Fig. 3

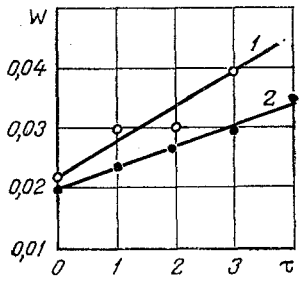

Fig. 4

Fig. 3. Kinetics of the drying of polycarbonate (40 kg) at n = 6 rps; t = 95°C; P = $0.35 \cdot 10^5$ Pa (a = 0.55; C = 0.61).

Fig. 4. Storage of polycarbonate in a bunker at t = 60-80°C; P = 10^5 Pa: 1) with periodic release of material (about 3 kg every 15 min); 2) without release of material.

ing of a disk on which were mounted two inclined blades 0.1 × 0.2 m in size, making an angle of 30° with the plane of the disk. The material was heated by the mutual friction of the particles as well as by their friction with the rotor and the chamber. The temperature of the material was stabilized by suitably adjusting the throughflow of water in the jacket.

To determine the moisture content from the instant of starting the installation at specified intervals of time, samples of the material were put into sample boxes with ground-in stoppers which were placed in an desiccator with calcium chloride; this prevented moistening of the samples of the material during storage. The moisture content of the sample of the material was determined during their finish drying in a vacuum drier. To prevent removal of highly volatile components of the material itself, except moisture, on account of decomposition of the material, the temperature in the drier during finish drying was 85-95°C, which is in agreement with the data on thermostability [2]. To remove the moisture completely, the time of finish drying was 6 h (which is more than was recommended in [3, 4]) at a pressure of $0.02 \cdot 10^5$ Pa. The weight of a sample in the sample bottle was 30 g (thickness of the layer 10^{-2} m). As a result, in weighing with an accuracy of ±0.5 mg, the moisture content was determined with an accuracy of ±0.004% (absolute value).

The investigations were carried out with ABS plastic (cylindrical particles $2.6 \cdot 10^{-3}$-m diameter and $3.2 \cdot 10^{-3}$-m long) and polycarbonate ($2.2 \cdot 10^{-3}$ and $3.2 \cdot 10^{-3}$ m, respectively). Experiments (Fig. 2) showed that drying of these materials was effected in a regime of decreasing speed from the first instants on, in analogy with the vacuum drying of cellulose materials [5]. This is lucidly shown in Fig. 3, where the drying process is represented in double logarithmic anamorphosis by a straight line of the type

$$W/W_0 = a\tau^{-C}.$$

The coefficients of this dependence were determined by the least-squares method. The experimental results indicated that the duration of the drying is affected chiefly by the degree of vacuuming and by the rotary speed of the rotor.

We also determined the storage conditions of the dried material. For this the material was removed from the drier by a vacuum loader and charged into a heated bunker (60-80°C) whose size was the same as that of the drier. To prevent agglutination of the material in the bunker, it was stirred by a stirrer having a speed on the order of 1 rpm. To simulate conditions of real operation, material was released (by periodically opening a door in the lower part of the bunker).

A number of experiments showed that some moistening of the material was observed (Fig. 4). Therefore, if the quality is to be guaranteed, the material has either to be dried more than necessary, which impairs the total productivity of the equipment, or else the bunker has to be evacuated.

NOTATION

W, moisture content; a, C, drying coefficients; τ, time; t, temperature of the layer; P, pressure in the chamber; n, rotary speed of the rotor. Indices: 0, initial.

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ELECTROMETRIC METHODS OF INVESTIGATING CRYOGENIC PHASE TRANSFORMATIONS OF LIQUID MOISTURE IN BUILDING MATERIALS

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The article explains the basic concepts of the electrometric methods of investigating cryogenic phase transformations of liquid moisture in building materials.

In the experimental investigation of cryogenic phase transformations of liquid moisture in materials with capillary pores and in disperse materials, several methods are currently in use: 1) the calorimetric method, which is based on measuring the heat effect due to the temperature of the phase transition [1]; 2) the dilatometric method, based on measuring the total volume of the liquid and solid phases of the pore moisture in its phase transformations [2]; 3) the method connected with the measurement of the thermal characteristics [3], etc.

Without examining in detail the advantages and shortcomings of the different methods, we want to point out only one common substantial shortcoming of all of them — experimental investigations are carried out with small specimens. This makes it impossible to investigate phase transformations of the moisture in local volumes of large fragments imitating building structures, or directly in actual building structures. In addition to that, and equally important, the investigation of the kinetics of phase transitions by the above methods encounters a number of methodological difficulties.

The electrometric investigation methods [4] are free of these shortcomings, and in addition to that they have a number of obvious advantages owing to the physical principles on which they are based. With these methods, the measured characteristic is any electrical pa-

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