reasons: subsidence occurs in two different environments with very different densities; the value of the gravitational settling velocity in the air is greatly affected by turbulent flows.

Conclusions

1. There is currently no means of determining the speed of gravitational settling of particles of industrial emissions in atmospheric turbulent flows. The average velocity of gravitational settling of particulate emissions of coal thermal power station (99,6 cm/s), it is up to six times higher than that of the aluminum plant emission's particle (15 cm/s). These results are consistent with the known composition of the particulate emissions of these types of productions.
2. The rate of gravitational settling, determined by known methods, cannot be used in describing the dispersion of pollutants from a point source of pollution in the turbulent atmosphere.

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Radio-chemical of fluorine-containing polymer "TEFLON-2M" for giving proton conducting properties

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Annotation. *The experimental study of the kinetics of styrene monomer accumulation in polyvinylidenefluoride films with radiation-chemical grafting of styrene monomer is presented. It is proved that the degree of grafting depends on the absorbed dose of helium ions, temperature and composition of the grafting solution.*

Introduction

Intensive research is being conducted to establish a commercially available functional proton conducting membranes. Important role in the biological processes, such as ATP synthesis, plays controllable proton transport. Proton-proton transport through the polymer membrane is also used in hydrogen fuel cells.

The objective of this study was to investigate the formation of the proton conductivity in the fluorine-containing polymer PTFE-2 M using radiation-chemical modification.

The starting material is a polymer film Teflon -2M of thickness - 20 microns. Samples of circular diameter –(80 mm) have been washed in toluene solution for 1.5 hours in the ultrasonic bath and then dried in the oven for three hours at 50^0C.

Prior to irradiation by helium ions, the samples were placed in the containers which were evacuated (the design of the containers is given in details in [2]). Part of the containers was filled with argon and the other half was filled with the solution of styrene monomer and toluene in the ratio of 1:1.

Several samples were packed in polyethylene bags of thickness 10 microns.

Irradiation

Irradiation of the samples was carried out on the accelerator R- 7M TPU Ioffe Institute by the beam of helium ions with energy of 27 MeV. Container with a special device was attached to the disk, which was rotated at a speed of 50 rev / min. Grafting was carried out in the first experiment bythe direct irradiation of the polymer and the styrene monomer and in the second experiment by the grafting on "post- effect". By the direct process irradiation of samples by helium ions was realized in the presence of solution of styrene and toluene.

The scheme of radiation treatment on PVDF films in the vaccine solution is shown in Figure 1. Absorbed dose (Д) was calculated from the total current probe with slats cyclotron. More precisely, the number of ions incident on the sample was determined by the model of "witness" of polyethyleneterephthalate (PET), which during their radiation was placed behind the test sample of PVDF . PET sample after irradiation with ions, was etched in the hot NaOH (6N). The number of ions passing through the sample was determined by calculating the number of tracks of helium ions in the film. Figure 2 shows a micrograph of the surface of the PET film after irradiation by helium ions and etching.

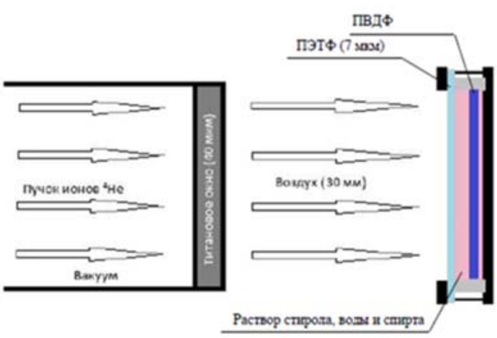


Fig.1 . The scheme of radiation- chemical grafting of PVDF

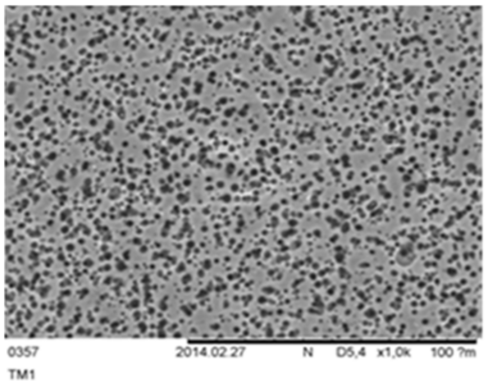
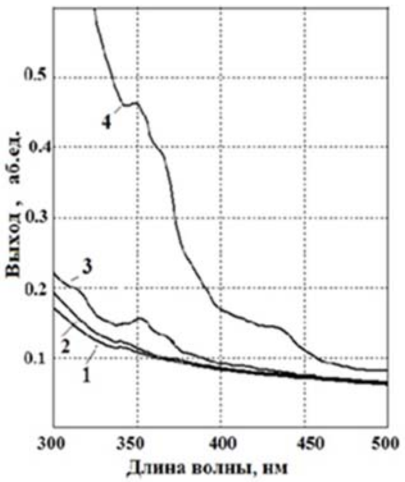


Fig. 2. Tracks of helium ions in the PET film after etching in NaOH

UV- and IR-spectroscopy

Degree of grafting of styrene monomer is dependent on the amount of free radicals formed in the samples due to breaking of covalent bonds.

For qualitative confirmation that appearance of free radicals depends on the absorbed dose studies using UV spectroscopywere done. In the wavelength range of 300-500 nm was a direct dependence of the amplitude of the radiation dose (Figure 2). Curves 2, 3 and 4 correspond to radiation doses - 0.5;1 and 2, 5 respectively. Fig . 4 presents the results of IR spectroscopy study. Spectrum with the highest amplitude corresponds to a dose - 2MGr.



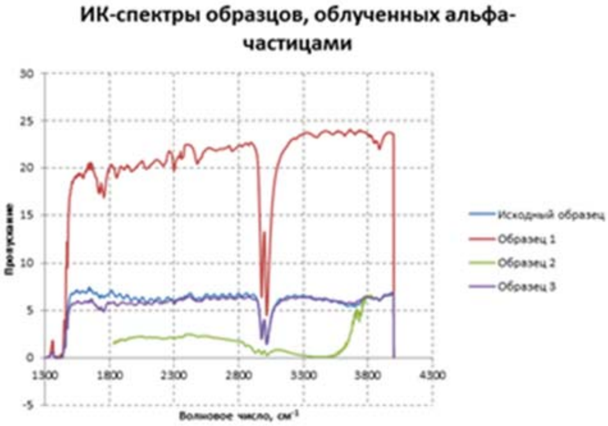


Fig. 3. UV spectra
1 - Source PVDF 2-0,5mGy
3-1 mGy 4-2MGr .

Fig. 4. IR spectra

Electron paramagnetic resonance method

Figure 5 shows the results of measurements of free radicals in irradiated and non-irradiated PVDF films. Straight horizontal line in the electron paramagnetic resonance (EPR) spectrum indicates the absence of radicals in the system and any deviation indicates the presence of radicals.

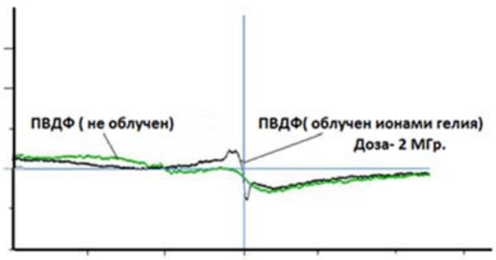


Fig. 5. EPR spectra

The film sample before irradiation (PVDF) is characterized by the residual content of radicals , which are shown in the EPR spectrum in the form of small deviations from a horizontal line - a broad unresolved line (Figure 1, green line).

In a sample of PVDF film after irradiation in addition to a broad line (residual radicals) appears distinct peak hydrocarbon radicals with g-factor 2.0095 and the concentration of 3,5*10exp16 spin/g (Figure 6, black line).

Grafting of styrene monomer

All samples were removed from the containers and packages and placed into a quartz flask, from which the air was evacuated and then the grafting solution was poured under pressure.

Dried argon was passed through the grafting solution to remove oxygen. Argon was bubbled through the solution for 40 minutes. Additionally, in the free space in the flask (samples and solution) argon under pressure was injected. The flask was placed in an ultrasonic bath at t = 60^0C for 8 hours.

Determining the degree of grafting

The degree of grafting of monomer was determined by gravimetric method. Ungrafted monomer was removed from the sample surface by rinsing in deionized water , and then toluene (for 24 hours) and again in deionized water at t = 50^{0}C . The samples were dried in an oven at t = 40^{0}C for three hours and weighed. The degree of grafting was calculated using the formula:

$$R_g = \frac{W_f - W_i}{W_i} \cdot 100\% \qquad (1),$$

Where W_f and W_i are samples weights before and after grafting, respectively.

Results and discussion

In the direct method of grafting monomer styrene wasirradiated together with pre-swollen polymer film. Grafted styrene was distributed uniformly on the substrate surface, the samples were heated by irradiation to ~ 70^{0}C, but since the irradiation time even at the highest dose of 2.5 MGy was 3 minutes, grafting has penetrated by several nanometers. Then, for the styrene molecules to diffuse through the whole thickness of the film samples were heated in the grafting solution. Grafting on "position effect" of the samples was carried out by irradiating PVDF in air and argon, i.e. without contact with the monomer. After irradiation, the films were placed in the grafting solution and were heated together with samples irradiated by the direct method. Figure 6 shows the dependence of the degree of grafting on the ion dose and the environment in which the sample was irradiated.

During irradiation, due to the high ionization ability of helium ions, covalent bonds are broken to form free radicals. Increasing the dose of irradiation led to a dramatic increase in free radicals in the PVDF-based polymer, which was confirmed by UV spectroscopy. In the wavelength region of 300-500 nm spectral amplitude increased by 50 % at 3,5MGy dose compared with a dose of 2 MGy .

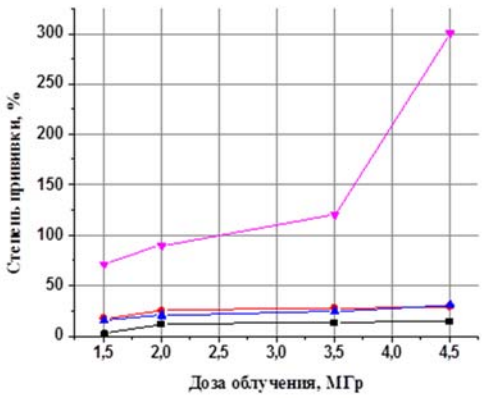


Fig. 6. The dependence of the degree of grafting of styrene to the PVDF film on the dose of irradiation and the medium

Fig. 7. Sample PVDF Rg -200%

The figure shows that the degree of grafting also increasedsignificantly. It should be noted that direct grafting method results in free radicals are being formed in the monomer of styrene. Irradiation of the air leads to the formation of hydroperoxide or peroxide radicals groups that can react solely with the monomers at high temperatures and onlythen initiate the formation of free radicals and grafting monomer. Variations in the degrees of grafting in the air and in the argon can be explained by this factor. With increasing radiation dose in the grafting solution > MG- 4 and subsequent chemical treatment the samples increased greatly in volume (Figure 7) , the degree of grafting reached 300 % and the samples just crumbled . Studies have shown that the best results are obtained by the direct grafting method. At doses in the range of 3-3.5 MG- radiation grafting takes place several times faster than at the doses of << 3 MGy.

Studies have been undertaken to modify the composition of the reaction mixture. A certain amount of water was added to the grafting solution. The results were not worse than in the present experiment, however, the rate of grafting decreased, and the time of grafting was~ 58 hours. Fig. 8 shows photomicrographs of transverse sections of proton exchange membrane formed after grafting and sulfonation in chlorosulfonic acid.

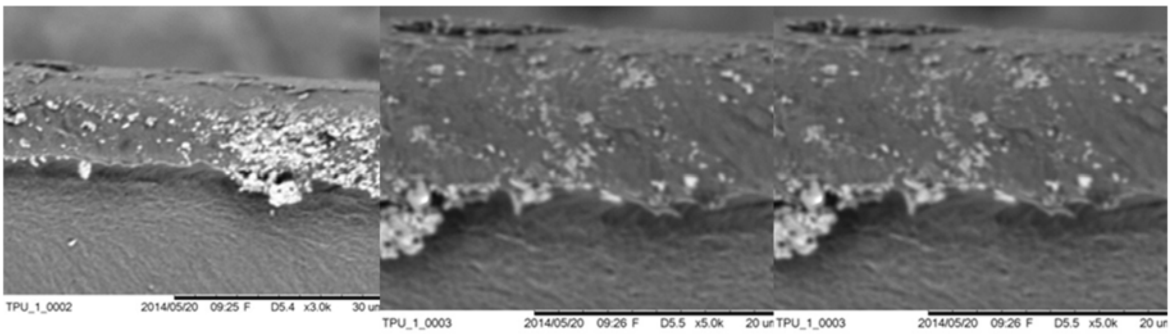


Fig. 8. Fragments micrographs of samples of PVDF after grafting and sulfonation

At the top of the photos are the remains of not-grafted styrene and oblique thread at the bottom of the picture are grafted sulfonic acid groups. In conclusion, it should be noted that the results presented in this report allow us to consider the radiation- chemical grafting by irradiation with helium ions as a basic possibility of obtaining maximum grafting of styrene monomer in the fluoropolymer PVDF samples with thicknesses from 10 to 180 microns. Thus fixed styrene monomer in the polymer that is the dopant, in the subsequent sulfonation imparts proton conducting properties on the polymer matrix. It should also be noted that by changing the energy of ion irradiation, we can create a controlled in depth and thickness layer with free radicals.

Studies were carried out with financial support in the framework of the state task of the Russian Ministry for 2014-2016 years on number 1750.

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Heart condition imaging with the help of hardware and software complex based on the cardiographic equipment on nanosensors

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Modern functional diagnostics provides the most variable instrumental methods of examination both invasive and noninvasive. The most widespread and available methods of heart examination is electrocardiography (ECG). In spite of prior use in cardiology it is also successfully used for examination of patients with diseases of lungs, kidneys, liver, endocrine glands, and blood system and also in pediatrics, geriatrics, oncology, sports medicine, etc. Using ECG it is possible to detect heart rate and as a result to identify any heart rhythms disturbances; to detect the disturbances of heart electrical conduction which may lead to decrease of its pumping ability and even to its complete cessation; to detect defects or damages of heart muscle caused by chronic or acute disease.

In spite of availability and informational content under real conditions ECG records are affected by internal and external disturbances which disrupt the given informational fragments and as a result cause additional problems in the process of generation of ECG analysis and interpretation computer systems. Even the solution of supposedly absolutely simple problem of ECG division into separate cardiac cycles (RR intervals) requires using quite difficult detection algorithms of QRS-complexes.

Voltage is significantly influenced by correct recording technique and also the distance from explorative electrode to current source. The size of ECG waves is inversely related to