RADIATION-CHEMICAL AND THERMAL GRAFTING OF THIN FILMS FOR FUNCTIONAL PVDF MEMBRANE

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Introduction: proton exchange membranes for solid-state fuel cells must meet certain requirements: first high proton conductivity, chemical stability, the ability to work at elevated temperatures.

Currently used perftorsilanami membrane "Nafion" (DuPont,USA) meets these requirements, however, are limited in temperature (temperature range is limited to 90 ° C), in addition to their commercial price is quite high [2].The work is devoted to the study of processes of radiation-chemical and thermal modification of PVDF to form in it proton-conducting properties there.

Materials: PVDF, PTFE 2M 20 microns, styrene, toluene.

Experiment: Studies were conducted with samples of PVDF irradiated by helium ions with an energy of 28 MeV and PVDF samples not irradiated with ions. All irradiation was performed at an extracted into the air ion beam accelerator R-7M PTI TPU. The original polymer film of PVDF with a thickness of 20 microns were cut with a diameter of 60 mm and was placed in a special holder from which the air is then pumped out of the container was assailed grafting solution of styrene with toluene in the ratio 1:1. Solution previously was barbotirovany nitrogen. Before filling the containers with a solution of conducted research on the impact of throughput rate of nitrogen through the solution and determined the minimum amount of residual oxygen prior barbotirovany nitrogen, to exclude the undesirable presence of oxygen. Additionally undertook such an analysis with argon. These gases are actively displace oxygen from the solution. Figure 1 shows the dependence of oxygen content from time bubbling.

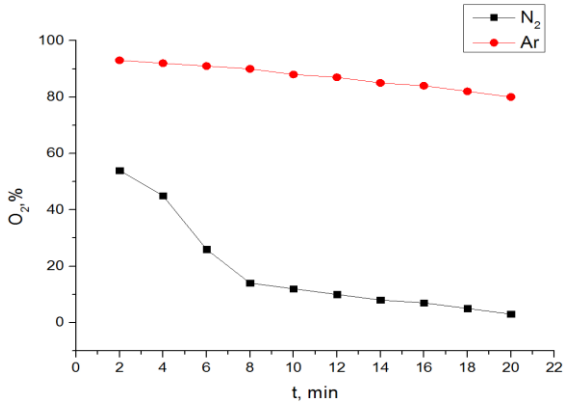

Figure 1. The influence of time bubbling of argon and nitrogen on the oxygen concentration in the grafting solution

Bubbling gases was conducted for 20 minutes. Substitution of oxygen with nitrogen in the solution is faster than with argon. Because the density of argon is less than that of nitrogen, respectively its content in the air is less and the removal of oxygen is necessary to spend a large amount. As a result, nitrogen in contact with the air absorbs the oxygen from it, thus melts, forming a solution of oxygen in nitrogen.

The containers are then irradiated with sample ions was placed in an oven and cured at a temperature of 600C for 8 hours. Another part of the non-irradiated sample, placed in the same container with vaccination solution was incubated at 900C for 20 hours. During irradiation in the polymeric matrix and form free radicals, followed by thermal effects in the presence of styrene solution occurs prishivka to the polymer skeleton of the matrix side suspensions,

which have attached sulfonation sulpho -SO3H. . After inoculation depressurized containers, polymer samples were washed thoroughly to remove surface residues of styrene and gravimetric measurements [1].

Results and discussion: overall, the development of ideas about selective and "long-range" effects in the early stages radiaion-chemical transformations of macromolecules is not only of fundamental scientific interest, but also is the basis for the formulation of new principles of radiation stabilisation and radiation modification of polymer systems. We can talk about the approaches that use relatively low doses and low concentrations of additives or chemically modified units entered in a certain position. Table 1 presents the results of gravimetric studies.

Table 1. The results of the comparison of radiation-chemical and thermal polymerization gravimetric method

Radiation-chemical polymerization				Thermal polymerization			
№	The mass Exodu. PVDF, g	Weight after irradiation, g	The grafting yield,%	№	The mass Exodus. PVDF,g	Mass vaccination PVDF, g	The grafting yield,%
1	0,204	0,252	23,5	1	0,215	0,218	1,4
2	0,249	0,277	11	2	0,219	0,220	0,5

Conclusion: studies have shown that the degree of grafting of styrene monomer to a PVDF thin films is significantly higher than in the case of thermal grafting without irradiation. During irradiation formed a sufficient number of free radicals which occurs side prishivkoy styrene. In the case of thermal graft, you may need significantly more time for the formation of free radicals. Further studies will be devoted to the sulfonation of samples of PVDF grafted with styrene to give them a proton-conducting properties and the synthesis of proton-conducting functional membrane.

REFERENCES

1. Abdrashitov E. F., Bokun H. V., Kritsky D. A., Sanginov E. A., Ponomarev A. N., Dobrovolsky Yu. a. Synthesis and transport properties of proton conducting membranes based on the polyvinylidene fluoride films entered and sulfonated polystyrene //Russian journal of electrochemistry, 2011, Vol 47, no 4.-P. 411-419
2. Golovkov, V. M., Mrachkovsky Y., Sochorova V. V. Study of the kinetics of radiation grafting of styrene to the PTFE-2M when it is irradiated with helium ions, " Izv.Universities. "Physics".-2013.-11/

EFFECT MACHINING OF BATCH ON LINEAR PARTICLE SIZES

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Powder metallurgy occupies a special place among various metal processing techniques in modern industry, as well as it contributes to the solution of many important problems in the manufacture of products and materials. One of the main problems in this industry is the production of metal powders [1].

In the report the effect of mechanical activation on the starting components will is reviewed and dependence of the particle size parameters of mechanical activation expected to reveal.

Self-propagating high-temperature synthesis (SHS) is a part of powder metallurgy allowing to synthesize different substances with the specified parameters. SHS is motion process of the a chemical reaction wave upon the mixture of starting components to form a solid final product. This method has several advantages, but one of the main