CONCLUSIONS

The introduction of fiberglass somewhat increases the swelling of polypropylene in acidic media, but due to the preservation of a high level of mechanical properties, it permits one to increase the operational lifetime of parts and to reduce warping.

From the test results, glass-filled polypropylene of the Komponor grade is recommended for introduction for operation in the aggressive media of man-made fibre manufacturing.

LITERATURE CITED

1. Polymer Encyclopedia [in Russian], Sovetskaya Entsiklopediya, Vol. 3, Moscow (1977).
2. G. L. Koren'kov, E. P. Nikulina, et al., Khim. Prom-st' za Rubezhom, No. 1, 89 (1982).
3. A. Neiman (ed.), Materials of the Future [Russian translation from German], Khimiya, Leningrad (1985).
4. Yu. A. Mulin, Yu. A. Panshin, and N. A. Bugorkova, Protective Coatings and Linings Based on Thermoplastics [in Russian], Khimiya, Leningrad (1984).

DETERMINATION OF HEAT OF DESORPTION OF MOISTURE IN DRYING POLYACRYLONITRILE FIBRES

É. A. Mal'vinov, I. N. Andreeva, L. S. Gulyaev, A. T. Serkov, and V. P. Kim

UDC 677.494.745.32.021.125.7

It is well known that in moist hydrocellulose fibres the water can be in free or bound form [1, p. 109], the bound water being retained by capillary and solvation forces. In hydrophilic fibres, the latter stage of water bonding with the fibre is practically absent; therefore there can be only free and capillary water in such moist fibres.

It was previously shown [2, 3, p. 100] in the case of viscose textile yarn that the thermogravimetric analysis method gives satisfactory results in determining the heats of desorption of free and bound water. In these same researches it was found that, at a denser structure, for example, from fibres of regenerated cellulose obtained from viscoses containing 12% by wt. of α-cellulose, the heat of desorption from the capillaries is approximately 15% greater than the heat of desorption for fibres prepared from viscoses containing 6% by wt. of α-cellulose. Thus, this form of analysis gives an indirect characterization of the overall structural density of hydrocellulose fibres.

Knowledge of the heat of desorption of moisture from fibres of other types presents undoubted interest. As objects of study we took polyacrylonitrile (PAN) fibres spun from polyacrylonitrile in a thiocyanate bath. The procedure in preparing specimens for the experiment, and also the experiment, which was carried out on a derivatograph from the Hungarian company MOM, have been previously described [2]. Graphical and mathematical treatment of the experimental data were carried out by the procedure of [4].

Treatment of the experimental data revealed that in drying PAN fibre (see Table 1), with respect to heat of desorption, the water can be arbitrarily divided into two fractions: a first one with a heat of 2.48 MJ/kg; and the second, with a heat of 5.59 MJ/kg of evaporated moisture. The heat of desorption of the first fraction corresponds to the value for the heat of a phase transformation of water, which is, for the investigated temperature range (from 20 to 60°C) 2.403 MJ/kg of evaporated moisture [5, p. 548], that is, with a deviation of no more than 3.3%. Thus, the method used for determining the heat of desorption has an accuracy sufficient for technical purposes. The heat of desorption of the second water fraction (5.59 MJ/kg of evaporated moisture) is 2.3 times as great as the heat of desorption of free water. For further analysis we use the results of [2]. According

Translated from Khimicheskie Volokna, No. 3, pp. 51-52, May-June, 1989. Original article submitted July 7, 1988.

0015-0541/89/2103-0253 $12.50

TABLE 1. Comparison of the Heats of Desorption of PAN Fibres

Item	Freshly spun tow		Partially dewatered tow	
	first fraction	second fraction	first fraction	second fraction
Interval of variation in moisture content, %	122.0-31.2	31.1-1.1	12.1-11.0	11.0-0.3
Interval of variation in temperature, °C	20-60	60-80	20-55	54-70
Specific energy of desorption, MJ/kg	2.48	5.59	2.48	5.59

to the information in this work, in evaporating second fraction water (capillary water), the heat of desorption for regenerated cellulose was from 3.26 to 4.74 MJ/kg of evaporated moisture. For our case, the energy of desorption is greater, which may be explained by a denser structure of the PAN fibres.

Attention is attracted by the fact that evaporation of capillary moisture begins even before evaporation of the free water is ended. This same phenomenon is observed in drying hydrocellulose [2].

CONCLUSIONS

The presence of two forms of moisture in polyacrylonitrile fibre has been shown by thermogravimetric analysis: free water and capillary water.

Values for the heat of desorption of the free and capillary moisture have been determined: these are, respectively, 2.48 and 5.59 MJ/kg of evaporated moisture, respectively.

LITERATURE CITED

1. A. B. Pakshver, B. N. Mel'nikov, V. A. Usenko, et al., in: Properties and Special Processing Features of Man-Made Fibres (A. B. Pakshver, ed.) [in Russian], Khimiya, Moscow (1975).
2. L. S. Gulyaev, I. N. Andreeva, and É. A. Mal'vinov, Khim. Volokna, No. 4, 43-44 (1987).
3. E. A. Mal'vinov, I. N. Andreeva, G. G. Finger, et al., A Study of the Heat of Desorption of Cellulose Fibres and Yarns Prepared from Viscoses with an Elevated Polymer Content, in: Coll. of Scientific Works of the VNIIVproekt, "Ways of Improving the Quality of Hydrocellulose Fibres," [in Russian], Mytishchi (1987), pp. 100-105.
4. L. S. Gulyaev, Author's abstract of Candidate's dissertation, LTA (1980).
5. K. F. Pavlov, P. G. Romankov, and A. A. Noskov, Examples and Problems in a Course on Chemical Engineering Processes and Apparatus [in Russian], Khimiya, Moscow (1987).