CONCLUSIONS

The polyethyleneterephthalate dust particles which are formed as a result of abrasion of the flake during transportation are highly crystalline, low- and medium-molecular fractions of the polymer which contain an elevated amount of ash-type impurities.

An increase in the content of polyethylene terephthalate dust particles in the flake above 0.1% by wt. impairs the homogeneity of the polymer melt, reduces the stability of the spinning process, and reduces the uniformity in physicomechanical characteristics of the polymer yarns.

LITERATURE CITED


THERMODYNAMIC ACTIVITY OF SOME AQUEOUS-ORGANIC SOLUTIONS

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Quantitative data about the thermodynamic activity and activity coefficients of the components of solutions contain rich information about the partial properties of the solvent and of the dissolved substance in the solution. Thus, a study of the activity coefficients of components of a solution affords the possibility of judging about their thermodynamic affinity to one another and, depending on their specific values, affords the possibility of predicting the thermodynamic stability of the solution [1], which is very important in the practical utilization of solutions.

In studying the activity of water and aqueous salt solutions or some aqueous organic solutions which are intended for use as precipitating baths in the practice of making hydrocellulose fibres, it was found that the concentration dependences of the activity of water have a nonlinear character, with breaks in the curve. Breaks are clearly discerned for aqueous solutions of N-methylmorpholine N-oxide (MMO), sodium sulfate, calcium chloride, and diethylene glycol and have been interpreted as an indication of a considerable change in structure and properties of the mixed solvent at definite concentrations [2]. In this connection, a specific knowledge of the position of the breaks in the concentration dependence of the activity of water in aqueous-inorganic and aqueous-organic solutions will be particularly useful in selecting and optimizing the compositions of precipitating baths in spinning fibres.

From the foregoing, it was advisable to study in detail the concentration dependences of the activity of water and of other aqueous-organic solutions which are most frequently used as precipitants in fibre preparation. In conformity with this, in the present article we have chosen as the object of investigation solutions of dimethylacetamide (DMAc) and dimethylformamide (DMF) in water.

The procedure for determining the activity of water in solutions of DMAc and DMF corresponded to that which has been described in the literature [2]. We must indicate additionally that, for the investigated solutions, in distinction from solutions of salts for example, it is necessary to take into account the partial pressure of the vapor because of the definite volatility of the organic component. To do this, it is necessary either to determine experimentally the composition of the vapor, which is a rather complex procedure, or to adopt assumptions about the correctness of calculating the partial pressure of the...
Fig. 1. Dependence of water content of vapor on its content in DMF solutions. Continuous line is the literature data of [3].

organic component from its mole fraction in the solution. The difference between the experimentally determined total pressure above the solution and the calculated partial pressure of the organic component gives the partial pressure of water vapor, which permits one to obtain values for its activity. The permissibility of calculating the partial pressure of vapors of the investigated organic components from their mole fraction in the solution was preliminarily checked out on solutions of DMF. For these solutions the dependence of the composition of the vapor on the composition of the liquid has been published [3]. We reproduce this dependence in Fig. 1. Here also we have put the points which we obtained from data on determining the partial pressure of water vapor as described above, i.e., at the definite assumption which we made. As is evident from Fig. 1, at the assumption that we made, quite satisfactory results were obtained.

Results of determining the activity of water in solutions of DMAc or of DMF are shown in Fig. 2. It is to be noted that the character of the dependence of the activity of water on content of the organic component in the solution practically does not change on varying the temperature in the range 22-40°C. It is evident from Fig. 2 that the concentration dependences of the activity of water in solutions of DMAc and DMF are expressed by a single curve, which has clear breaks at concentrations of the organic component in the regions 40, 60, and ~85% by wt. Molar ratios of water to organic component of 7:1 (6:1 for DMF), 3:1, and 1:2 correspond to the position of the breaks. At these proportions of the components, the structure of aqueous solutions of DMAc or DMF apparently undergoes significant changes and their properties, including those of precipitating baths, also should change.

In this connection, it is interesting to turn to literature data about the effect of the composition of precipitation baths containing DMAc or DMF on structure formation and some properties of the fibres spun. As is well known, aqueous solutions of DMF are used as the precipitant in spinning fibres from polyacrylonitrile (PAN) and its copolymers. For these fibres, structure has been studied in detail by electron microscope procedures, as well as their ability to undergo maximum stretch as a function of the composition of the precipitation bath, where the DMF content was varied from 0 to 85% by wt. [4]. In the indicated research, it was noted that at a content in a precipitation bath of 40% water by wt. (60% DMF) a structure is formed which is characterized by huge radial hollows. A very uniform network structure is observed at a water content less than 20%, i.e., at a DMF concentration greater than 80%. Thereupon, in the first case, the fibre has a very thin membrane on its surface, while in the second, no such membrane is observed. Simultaneously, the authors stated that at a concentration of DMF greater than 80%, the ability of the freshly spun fibres to undergo maximum stretch rises sharply and there is a steep ascent on the curve which characterizes the dependence of maximum stretch on composition of the precipitation bath.

The data given and comparison of these with the results of Fig. 2 show that actually we are looking at a definite correlation between the positions of the breaks in the concentration dependence of the water activity of aqueous DMF solutions and the structure which is formed on precipitation of PAN with precipitants of the corresponding composition.

We may arrive at a similar conclusion by analyzing the results of a study of structure formation in poly-\(m\)-phenyleneisophthalamide (PMPIA) fibres as a function of the composition of the water-dimethylacetamide precipitating bath [5]. The author of [5], using electron microscopy and porometry to study structure, showed that in the DMAc concentration region up to 40%, the structure of the fibre is formed by a mechanism of so-called dropwise transfer of the precipitant. Such a very nonuni-