It has been shown that the investigated mixed fibres have low specific surface values (with respect to the inert sorbate). The experimental values of water vapor sorption for these are less than those calculated by an additive scheme, the greatest decrease being observed at a content of 10% by wt. of the second rigid-chain component (CA) in the mixture.

Ideas about interpolymer interactions which are displayed in extreme form at a definite composition of the mixed fibre (at a CA content of 10%) have been proposed to explain the nonadditive change in water vapor sorption by the mixed fibres.

LITERATURE CITED


PROPERTIES OF CHEMICALLY RESISTANT CARBON-REINFORCED PLASTICS


In the manufacture of artificial fibres, various highly aggressive media are used, just as in other regions of the chemical industry. Carbon fibres [1] and a number of carbon-reinforced plastics based on them [2] are promising materials for making equipment which contracts aggressive media; these make it possible to raise the reliability of operation of equipment, reduce costs for installation and repair work, and to improve ecological conditions of manufacturing and operation of constructions. A study of the behavior of these materials under thermal action affords an opportunity not only to determine the temperature ranges of their stability, and to separate out the chemical and physical processes which take place in various temperature regions, but also to judge about structural features of specimens [3] on which the properties of carbon-reinforced plastics depend in service.

In the present article we give results of a study of the properties of a hybrid carbon-reinforced plastic which can be used in making chemically resistant tubes, ejectors, and other technological equipment (Fig. 1). This carbon-reinforced plastic is a composite polymer material in which the lining (inner) and, if necessary, the protective (outer) layer include carbon fibres, and the constructional (middle) layer includes glass fibres or some other form of fibre. Cold-hardening phenolic resins are used as the binder.

Specimens of the carbon-reinforced plastic were made by the method of contact molding, on manual hydraulic presses without heating (pressure, 0.04 MPa). The fibrous filler ("Ural" T-22 carbon cloth, Technical Specification 6-06-I107-84) was soaked in a 15% alcohol-acetone solution of benzenesulfonic acid (BSA hardening catalyst), dried, and impregnated with the binder, after which it was pressed into plates. After 24 h, pressing out was performed, plus heat-treatment of the plates for 5 h at 150-160°C.

As the binder we used three grades of cold-hardening phenolic resin (SFZh-3042, SFZh-309, and SFZh-3032) which differed in storage life [4], molecular weight, and in viscosity, respectively - 125, 235, and 317 sec at 20°C (by VZ-4).

Fig. 1. Photograph of specimens of tubular elements made from hybrid carbon-reinforced plastic.

Fig. 2. DTA and TGA curves for starting carbon-reinforced plastics based on resins SFZh-3042 (1), SFZh-309 (2) and SFZh-3032 (3).

Treatment of the plastics with aggressive media was carried out for 500 sec. The aggressive media were boiling distilled water and plasticizing bath from viscose manufacturing (composition of the aqueous solution: H$_2$SO$_4$, 20-50 g/liter; ZnSO$_4$, 10-20 g/liter; Na$_2$SO$_4$, 60-80 g/liter; H$_2$S, 10-20 mg/liter; CS$_2$, 100-500 mg/liter; surface-active agents, 0.2 mg/liter; temperature, 95-98°C). We also studied specimens of tubular elements from a hybrid carbon-reinforced plastic — the original composite, and after 20 months and after 6 years of service. The experimental tubular elements were made by the wet winding method, using carbon tape of type "Ural T-24" (lining and protective layers), glass fabric TSF-(7a)-7s (constructional layer) and resin SFZh-309 with BSA. The tubular elements were operated under conditions of transporting through them a vapor-air medium — vapors of H$_2$SO$_4$, H$_2$S, and CS$_2$ at a temperature of 110-120°C.

Evaluation of physico-mechanical properties of the plastics was carried out in conformity with operating standards. Thermal analysis of specimens was carried out on a derivatograph from the Hungarian company MOM, in an air medium (specimen in the form of a powder, 100 mg; heating rate, 2°C per min; crucibles, platinum; standard, aluminum oxide).

In the study of chemically resistant carbon-reinforced plastics by the thermal analysis method, difficulties are introduced because of the multicomponent nature of the system, the presence of several layers of material, and, correspondingly, the possibility of assigning the results obtained to the system as a whole, and not to its individual components. Therefore it was of interest to carry out comparative studies of specimens which differed in one of the preparation parameters or a service parameter.