УДК
677.027.6

ASAULYUK T.S., SEMESHKO O.Ya.,
SARIBYEKOVA Yu.G., BONDARENKO S.G.
Kherson National Technical University, Ukraine

# STUDY OF PROPERTIES OF STYRENE-ACRYLIC POLYMER

***Purpose.*** *Study the characteristics of styrene-acrylic polymer for use as a coating for textile materials.*

***Scientific novelty.*** *It is proved that individual polymer films based on self crosslinking styrene-acrylic water dispersion are not sufficiently resistant to wet treatments. The addition of crosslinking agent in an amount of 6% increases the resistance of the film to washing by 5.7%.*

***Practical value.*** *The results of the experiment are of practical value for the development of new polymer coatings for textile materials.*

***Keywords:*** *styrene-acrylic dispersion, crosslinking agent, polymer film.*

***Objectives.*** Study of the structural characteristics and physicochemical properties of polymer films formed from acrylic dispersion for use as coatings on textile materials.

***Methodology.*** As the object of study, we used a water dispersion of a self crosslinking styrene-acrylic copolymer (solid content 45%; pH = 7-9; viscosity at 20°C <500 mPas·s). The degree of curing of the polymer was assessed by the amount of acetone-insoluble fractions of the formed polymer films, which was determined by the gravimetric method after extraction of the samples in a solvent. To calculate the structural parameters of the network of the polymer under investigation, the sol-gel method was used. The determination of the proportion of the sol-gel fraction of polymer films was carried out by sequential extraction of samples with acetone and benzene. Then the sol fraction (S), the equilibrium degree of swelling (α), the proportion of dry polymer in the swollen gel ($V_r$), the degree of crosslinking of the polymer (j), and the proportion of active chains ($V_c$) were determined during the calculations [1]. The hydrolytic degradation of polymer films was evaluated by the difference in mass of the samples before and after treatment.

***Research results.*** Analysis of the results shows that films based on the studied styrene-acrylic polymer are distinguished by a significant amount of acetone-insoluble fraction — 64%, which is due to the high degree of intermolecular crosslinking. The calculated characteristics of the spatial network of the studied styrene-acrylic polymer are presented in Table 1.

Table 1 – **Characteristics of the spatial network of styrene-acrylic polymer**

| S, % | α | $V_r$ | j | $V_c$ |
|---|---|---|---|---|
| 3.45 | 18.302 | 0.055 | 0.188 | 5.398 |

Since textile materials with polymer coatings are exposed to water and soap hydrolytic degradation during operation, the resistance of the films to water treatment for 1 h at various temperatures and to soap-soda treatment for 30 min at 60°C was further studied (Table 2).

Table 2 – **Effect of water and soap-soda treatments on the stability of individual styrene-acrylic polymer films**

| Hydrolytic stability, % | | | Resistance to soap-soda treatment, % |
|---|---|---|---|
| 40°C | 60°C | 95°C | |
| 96.63 | 92.27 | 97.18 | 88.36 |

The results of the experiment (Table 2) show that the individual film of the styrene-acrylic polymer under investigation has an insufficiently high resistance to the action of water and soap-soda solution. The decrease in resistance to hydrolysis is due to the presence of hydrophilic groups in the molecular chain of the polymer, which is a characteristic feature of polymer films formed from aqueous dispersions. Therefore, to ensure high performance properties, it is necessary to obtain the spatial structure of the polymer network, which requires the introduction of functional groups for the formation of crosslinks. This occurs by introducing into the polymer composition a crosslinking agent that reacts with the reactive groups of the polymer particle during film formation.

In this work, a partially etherified melamine resin was used as a crosslinking agent. Analysis of the results shows that the introduction of a cross-linking agent in the amount of 6% into the polymer composition makes it possible to increase the resistance to soap-soda treatment by 5.7%.

***Conclusion.*** Thus, it can be concluded that the use of the studied styrene-acrylic polymer as a polymer matrix to impart special properties to textile materials is possible provided that a composition with a crosslinking agent is created. Further research will be directed to studying the use of other classes of crosslinking agents.

## References

1. Avvakumova N.I., Budarina L.A., Divgun S.M., Zaikin A.E., Kuznetsov E.V., Kurenkov V.F. Praktikum po fizike i himii polimerov. M.: Himiya. 1990. 304 p.