Платформа 2

Сучасні аспекти матеріалознавства та технологій в текстильній та фешн-індустріях

УДК 678:661.183.7:544.773. 433

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POLYURETHANE HYBRID COMPOSITES FUNCTIONALIZED WITH BIO-BASED COMPONENTS

Purpose. *Synthesis of composites based on cyclocarbonates of vegetable oils and study of their properties.*

Keywords: *hybrid polymer composites, block copolymers, cyclocarbonates of vegetable oils.*

Objectives. The main task of this work is the synthesis and research of composites based on oligomers of functionalized vegetable oils and epoxy resins, since they are becoming more and more widespread in global science, which is connected with the development of new technologies that require the creation of materials with high physicochemical and mechanical properties. The most common are composites whose organic matrix is a copolymer or block copolymer. This combination is the basis of most modern composites. Hybrid polymer composites are formed from a large number of components, including oligomers of different chemical nature, modifiers, compatibilizers (binders, connect by chemical bonds, on the one hand, the organic matrix with the filler), fillers (polymerization shrinkage decreases to (0.5 - 0.7)%; the coefficient of thermal expansion decreases, the hardness of the material increases) catalysts, activators, which makes it possible to regulate their properties, to study the possibilities of combining components of different chemical nature and structure.

Methodology. IR spectroscopy on a Tensor-37 spectrophotometer with Fourier transform in the spectral region (600-4000) cm^{-1}, TGA, DSC, TMA.

Research results. For the formation of polymer compositions, the synthesis of aminourethane-containing oligomers of CKRO with IFDA and CKRO with AEP

was carried out in mass at a temperature of 100°C for 8 hours until the complete disappearance of the cyclocarbonate group in CKRO. The next stage was the preparation of block copolymers based on functionalized rapeseed oil oligomers by curing the epoxy component (POSS-ep or DER-331, DGEB) at a stoichiometric ratio of amino group to epoxy group with aminourethane-containing oligomers based on CKRO with IFDA and CKRO with AEP.

Table 1 - **Physical and mechanical properties of polyurethane hybrid composites**

No	Components of the polyurethane composition	Tensile strength, MPa	Extension, %
1	BKP60%(CC DGEBD+AEP)+40% DER-331	60,8	15
2	BKP60% (CKRO+AEP)+20% DER-331+20% DGEBD	7,38	88
3	BKP60%(CKRO+IFDA)+20% DER-331+20%DGEBD	9,04	95
4	BKP60%(CKRO+IFDA)+40% POSS-ep)	10,22	110

The table shows that the physical and mechanical parameters can be adjusted depending on the chemical nature of the amine and epoxy. When using DER-331 and CKRO, there is a decrease in strength, and during stretching - a significant increase in the elongation of the BKP compared to the sample without CKRO. The samples that were obtained from IFDA are distinguished by the greatest elongation when stretching BKP up to 110%, which can be explained by the formation of additional hydrogen bonds in rigid blocks. Curing of epoxides with oligoaminourethanes of rapeseed oil leads to a significant increase in the elongation of block copolymers.

Conclusion. Thus, as a result of the conducted research, it is shown that the use of oligoaminourethanes of cyclocarbonates of vegetable oils allows to regulate the physical and mechanical properties of synthesized polyurethane hybrid composites using epoxy resins. The developed hybrid composites have the prospect of application in the textile industry in the process of impregnating textile fibers or filling compositions with fibers for special purpose textile products.

References

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