

Polyurethane foams filled with glassfibre

© **Alsu A. Nazirova**,⁺ **Dina I. Fazylova**, **Lubov A. Zenitova**,* and **Elena A. Kiyanenko**

Department of Technology of Synthetic Rubber. Kazan National Research Technological University

K. Marx St., 68. Kazan, 420015. Republic of Tatarstan. Russia.

Phone: (843) 231-42-14. E-mail: zenit@kstu.ru

*Supervising author; ⁺Corresponding author

Keywords: polymeric composition material, fiberglass, honeycomb panels.

Abstract

The article is concerned with development of rigid polyurethane foams (PUF) reinforced with glassfibre. These foams are intended for use in constructions of sandwich panels, shipbuilding, transport, for the manufacture of products with high requirements for thermal insulation.

For this purpose we selected polyurethane foams as objects of study, which have unique heat and sound insulation indexes, high adhesion characteristics to various substrates.

As a reinforce filler was used chopped fiberglass. The importance of fiber glass is explained due to the multi functionality of its application, a wide range of sectors of the national economy and the military-industrial complex, which uses fiber glass and products from it. As well as, fibers of reinforcing filler perceive mechanical stress, determining the basic mechanical properties of polymer composite materials (PCM): strength, resistance to deformation, rigidity. Matrix, which locates in the interfiber space, is used for distribution of mechanical stresses between the fibers, also partly takes these mechanical stresses and, very importantly, determines the solidity of the material.

We are investigated polyurethane foams, which are filled with glassfiber in the amount of 5, 10, 15, 20 % mass. Their physical and mechanical properties were investigated. It is shown, that with increasing of reinforcing filler in polyurethane the strength characteristics are growing, and also increasing the hardness. The best complex of physical and mechanical properties has polyurethane foam, which is filled with glassfiber of 15 % mass.

The increase of glassfibre content in polyurethane foam decreases absorption of water, toluene, heptane. The lowest rate of water absorption have the polyurethane foam with the contents of fiberglass 10 % mass.

It was also determined the thermal stability of developed polyurethane foams. It was shown that with increasing content of glassfiber in the composition, the upper limit temperature of thermal degradation of determined PUF filled with glass fiber of 15 %, mass. rose, compared to the unfilled counterpart. Coefficient of thermal conductivity of the developed polyurethane foam is 0.39 W/mK against 0.33 W/mK for unfilled analogue, that allows it to be a material having high insulating ability. The filling composition with glass fibers leads to increased coefficient of thermal conductivity. Due to its structure the polyurethane foam has excellent thermal insulation properties, it can be used as sandwich panels in the construction, shipbuilding, transport.

References

- [1] L.I. Bondaletova, V.G. Bondaletov. Polymer composite materials Part 1; Tutorial. *Tomsk: Publishing house of Tomsk Polytechnic University*. **2013**. 118p. (russian)
- [2] M.Yu. Yablokov. Polymer composite materials: preparation methods; methodological guidance. *Moscow*. **2011**. 56p. (russian)
- [3] M.A. Maksyutov. Polyurethane: structure, properties and applications [electronic resource], - <http://uretantech.ru> - an article on the Internet (reference date: 4.05.2016). (russian)
- [4] K.E. Perepelkin. Polymer composites based on fibers, their main types, properties and applications [electronic resource], - <http://www.uncm.ru/Page310.html> - an article on the Internet (access date: 15.05.2016). (russian)
- [5] Composite materials based on polyurethanes. edited by J.M. Byuista. *Moscow: Chemistry*. **1982**. 240p.
- [6] D.I. Fazylova, L.A. Zenitova, F.M. Palyutin. Urethane adhesives based on products of JSC "Kazan SK plant". *Vestnik of the Kazan State Technological University*. **2006**. No.2. 262p. (russian)
- [7] K.E. Perepelkin. The reinforcing fibers and fibrous polymeric composites. *SPb.: Fundamentals and Technology*. **2009**. 380p. (russian)

- [8] L.A. Zenitova. Synthesis, properties and applications of urethane elastomers with isocyanurate rings in the chain: PhD Thesis in technical sciences: protected: 21.11.91, approved. 04.17.92. *Kazan*. **1991**. 351p. (russian)
- [9] L.A. Zenitova, I.N. Bakirov, N.A. Mukmeneva, A.R. Galimzyanova, E.V. Tsyganova. The use of new polyurethane in the construction. *Butlerov Communications*. **2002**. Vol.3. No.11. P.45-47. ROI: jbc-02/02-3-11-45
- [10] <http://strport.ru/poly/kak-uteplit-betonnyi-pol> [electronic resource] - an article on the Internet (reference date: 5.05.2016). (russian)