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Physical and mechanical properties of spheroplastics based on hollow glass microspheres and polyacrylic binder

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Abstract

The paper considers the physical and mechanical properties of modern heat-insulating materials based on spheroplastics with polyacrylate as a binder and hollow glass microspheres as a filler for various fields of science and technology. The processes of interaction of components in samples of spheroplasty have been studied.

The modes of obtaining heat-insulating coatings by the sputtering method are studied. Optimal technological parameters for curing thermal insulation coatings are selected depending on the ratio of components, ambient temperature. The physico-mechanical characteristics of heat-insulating energy-saving materials based on polyacrylic binder are investigated. It is shown that the size of the particles and the fractional composition of the filler can in some way influence the strength characteristics of the filler-binder system. The influence of nature and the ratio of components on the strength of the thermal insulation coating was revealed. A rationale for improving the strength characteristics in the introduction of hollow glass microspheres using the Danneberg model is proposed. It is shown that when the volume fraction of polyacrylate is less than 30%, a sharp decrease in the strength of the spheroplastic is observed, due to a lack of a binder in the interspheral space.

Adhesive characteristics of heat-insulating coatings were studied when applying the presented compositions to various materials. Investigations of the strength at the separation of the sprayed coating from substrates of various nature have shown that the dependence of the modulus of elasticity on the binder content has a pronounced extreme character. An increase in the content of polyacrylate binder in excess of 45% volumetric leads to a decrease in tensile strength during detachment.

Studies have been carried out to determine the coefficient of linear thermal expansion of the thermal insulation coating, depending on the binder content. It is shown that with a decrease in the binder content, regardless of the external temperature, a linear thermal expansion coefficient is observed to decrease due to the predominance of the glass phase in the composition. The methods of applying the developed thermal insulation coatings to the surfaces to be treated and the technological application modes are described while maintaining the optimum physical and mechanical properties.

The authors proposed the use of the developed thermal insulation materials for construction and energy structures, working under mechanical conditions, elevated temperatures and other unfavorable factors.

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