PROPERTIES OF POLYAMIDE-BASED COMPOSITES

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Annotation: The influence of dispersed and fibrous fillers on the main performance characteristics of polymer composites based on aliphatic and aromatic polyamides has been studied. It is shown that the reinforcement of polyamides with fillers makes it possible to obtain composite materials with high strength, hardness, modulus of elasticity, chemical resistance, and wear resistance.

Keywords: polymer composites, polyamides, fillers, properties.

Introduction

Polymer composite materials (PCM) are currently the most numerous and rapidly developing type of modern materials in developed countries. These materials are constantly being updated and improved. In addition to improving the properties of materials, work is constantly underway to improve the technology of manufacturing products from them, as well as assembly technologies and diagnostics of operational reliability. Huge funds, estimated in the hundreds of millions of dollars, and the efforts of the best research centers are directed to work related to the technology of special PCM. And this is not only because the results of the work can be used in many industries, but mainly because the materials obtained have unique and predictable properties, providing a scientific and technical breakthrough, strategic and economic security of the country. The development of the global chemical industry in the third millennium is characterized by the rapid growth of the polymer materials industry (PM), the main directions of which are to improve the quality of polymers and improve their methods recycling, the creation of new plastics, as well as the expansion of their applications.

One of the leading places in the plastics industry is devoted to the creation of new PM with improved performance characteristics. Polyamides (PA) are among the most promising polymer binders. A distinctive feature of PA is the presence of a repeating amide group –CO–NH– in the main molecular chain. There are aliphatic and aromatic PA; PA containing both aliphatic and aromatic fragments in the main chain are also known.

Aliphatic PA, which are multifunctional structural materials that are 6-7 times lighter than bronze and steel, are successfully used to replace non-ferrous metals and their alloys. They are durable, have a low coefficient of friction paired with any metals, work well and quickly; the wear of friction pairs when using PA parts is reduced in 1.5–2 times, while the complexity of their manufacture is reduced by 35%, and the cost is reduced by 50% compared to metal products (steels and bronze).They are resistant to oils, alcohols, esters, alkalis and weak acids.

Due to the improved characteristics, the share of PA 6 in the global market of thermoplastic structural materials currently reaches 30 %, and the total global production of this polymer is 3.4 million tons [3]. The disadvantages of aliphatic PAS include a significant decrease in physical and mechanical characteristics in a humid environment, low stability of strength and electrical insulation properties, as well as insufficiently high dimensional accuracy of products made of them.

To work in extreme conditions (under high static and dynamic loads, in a wide temperature range, under conditions of intense friction), it is more advisable to use products made of aromatic PA – phenylones. Aromatic compounds are polar compounds with strong intermolecular

interaction due to hydrogen bonds. These features of macromolecules determine the characteristics of the operational properties of materials based on these polymers. Phenylones are non-flammable and chemically resistant to the action of fuel oils, their performance is maintained at 153-553 K. In terms of strength, they are inferior only to reinforced plastics, compositions based on them can be used in friction units with specific loads up to 50 MPa.

One of the most important advantages of PA is the low coefficient of friction during oil lubrication (0.05–0.10) and increased wear resistance. However, when

working in conditions without lubrication, the coefficient of friction of PA increases sharply, and insufficiently high thermal conductivity, load-bearing capacity and resistance to oil and moisture limits the scope of application of PA products [7]. Considering this, in order to improve the basic performance characteristics, it is highly advisable to introduce dispersed and fibrous fillers (Np) into the composition of polyamide binders.

References:

1. Pesetsky S. S. Polymer composites of multifunctional purpose: prospects of development and application in Belarus / S. S. Pesetsky, N. K. Myshkin // Polymer materials and technologies. - 2016. – Vol. 2, No. 4. – pp. 6-29.

2. Polymer materials: research, production, application / S. S. Pesetsky,S. G. Sudyeva, N. K. Myshkin [et al.] // Science and Innovation. – 2008. – № 3 (61). – Pp. 50-55.

3. Katsevman M. Is not just easier, it is more reliable and more durable / M. Katsevman // Science and life. - 2003. –No. 9. – pp. 46-48.

4. Sokolov L. B. Fundamentals of polymer synthesis by polycondensation method / L. B. Sokolov – M.: Chemistry,1979. – 264 p.

5. Handbook of plastics: reference book: in 2 volumes / edited by V. M. Kataev, V. A. Popov,

B. I. Sazhin. – M.: Khimiya, 1975. – Vol. 2. – pp. 254-291.

6. Burya A. I., Arlamova N. T. Composite materials based on aromatic polyamides //RZH "Deponovani naukovi roboty". – 02/22/2000. – No. 1. Dep. IN VINITI RAN. 2000. – № 7 (341).

7. Tretyakov A. G. Materials for friction units / A. G. Tretyakov // Polymers – money. – 2006. – No. 4/18. – p. 72.