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STUDYING OF THE USE OF BASALT MINERALS AS A POLYETHYLENE FILLER AND ITS PHYSICOCHEMICAL PROPERTIES

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Abstract. In this article, a study of the use of basalt minerals as a polyethylene filler was conducted. According to the obtained results, basalt fibers and basalt fabrics were extracted from basalt minerals and applied to basalt in the amount of 30%. The composition of the composite was studied and analyzed using IR spectra.
Keywords: basalt mineral, polyethylene, filler, basalt fiber, IR spectrum.

1. Introduction.

Basalt (Latin, Hebrew for iron). It is a stony rock. Basalt is a dark dense igneous rock. Previously, it was studied by adding it to other groups of superficially similar rocks[1]. The rocks of this group are trapps, which are later divided into dollerite, anamesite and basalt. By chemical composition. Basalt-based, low silicic acid, belongs to new rocks with a content of 42-55%. Basalt rocks are used in the production of basalt fibers. The mineral structure is porphyry glassy or solid crystalline aphid[2]. The first type of rocks is distinguished by the presence of small inclusions of black pyroxene prisms and isometric crystals of yellow swamp-colored olivine. Such spikes can occupy four parts of the entire mass. In addition, hornblende and orthopyroxene can be found in basalt[3].. Apatite is one of the most common minerals. Basalt fibers are used in residential and commercial buildings, and in heat and sound insulation and fire protection in residential and commercial buildings, bathrooms, saunas, household services and other facilities, thermal insulation in large-diameter pipes in energy units, thermal insulation in household gas and electric stoves, cooking cabinets, etc., external and internal in building restoration heating of the side, heating of flat roofs, insulation of oxygen columns, insulation in the production of low-temperature equipment and the use of nitrogen, in triple-layer construction panels in enterprise refrigerators and freezers in household refrigerators[4]. The concept of polymer "nanocomposites" is a newly emerging concept, while retaining the meaning of "polymer composite", only

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composites containing organic and inorganic nanofillers as a dispersed phase (nanocomposites of various geometric shapes and sizes - from 1 to 100 nm) are considered. The improved properties of nanocomposites embody the common properties of the components and are significantly different from the properties of traditional composites. The authors proposed a ball mill method for using carbon nanotubes as a filler in PE (up to 10 wt.%), and this method has several advantages, such as not using solvents, ultrasonic stirrers, modification of nanotubes, and high temperature[5]. Using this method, it was possible to evaluate the morphology and physiology of the products obtained. Using this method, a high level of filler dispersion and high mechanical indicators of composites are achieved. This work demonstrates the use of calcium carbonate as a filler for low density PE, linear PE, high density PE and PP polymers. The main technological stages and mechanical properties of obtaining polymer composite materials based on calcium carbonate and polyolefins were discussed[6]. Basalt's unique properties have made it one of the most essential materials. Basalt is non-flammable and can withstand temperatures up to 9000C-15000C, is resistant to strong and mechanical effects, has high sound and thermal insulation properties, biological resistance and chemical neutrality, is resistant to the effects of corrosive acid and alkaline environments, and is a filler that does not accumulate radiation. Basalt is an environmentally friendly material, harmless to humans and animals. Basalt is one of the volcanic rocks with high strength and high density, as well as high chemical properties, fire resistance, strength, sound and thermal insulation properties[7].

Materials. Obtaining basalt fiber based on basalt minerals and making fabric from it. Application of the resulting basalt fiber P-Y 342 - $(CH_2—CH_2—)n$ is a product of high molecular weight polymerization of ethylene, a thermoplastic polymer with a density of 940-944 kg/cm^3 and a melting point of 125-135 °C.

Methods. The fluidity index of the thermoplastic fluid of the obtained product is the flow rate (liquefaction index) and its properties are studied using methods such as differential scanning calorimetry.

2. Experimental part

The production technology of basalt fibers is based on four main stages: basalt gravel pre-treatment (grinding washing drying), melting of basalt in blast furnaces to obtain continuous fiber in the form of a complex yarn, continuous fiber formation,

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weaving cloth or preparing other forms of finished products from fiber.

The fluidity index of composite materials determines their processing conditions, specific temperature and pressure of fluidization. Studying them helps to develop methods of polymer processing. According to the obtained results, the fluidity index does not change significantly until the amount of fillers in the compositions reaches 30%, and it increases when it reaches 40%. The variation of SOC does not depend on the type of compound. Therefore, the optimal concentration of fillers for YuZPE and QZPE is 30%[8].

Table 1

Effect of modifier (TEAS) on flow rate of composites based on high (YuZPE) and low (QZPE) density polyethylene

The contain of the composition	The amount of modifier obtained in relation to the amount of filler in the composition (wt.%) TEAS				
	0	**0,5**	**1,0**	**1,5**	**2,0**
QZPE/BT	1,6	1,5	1,2	1,2	1,2
QZPE/PEMA/BT	1,0	0,8	0,5	0,5	0,5
YUZPE/BT	0,5	0,4	0,3	0,3	0,3
YUZPE/PEMA/BT	0,4	0,3	0,2	0,2	0,2

It can be seen from Table 1 that the inclusion of maleated polyethylene and TEAS in the composition of the composite has a significant effect on the decrease of the flow index of the composites. It was found that with the increase in the exfoliated part of aluminosilicate particles in the polymer, its flow index decreases.

A comparative analysis of the physico-chemical properties of the composites made by adding modified fillers to YuZPE is presented. From the table, it can be seen that the composite based on YuZPE/PEMA/TEAS/BT has higher impact resistance and tensile strength properties than composites with other components.

It can be seen that when the modifier TEAS was added in the amount of 1.0 wt.%, the impact resistance of the composite increased compared to the composite without the modifier (from 50 kDj/m^2 to 71 kDj/m^2) [9,10].

Table 2

Comparative analysis of physical and mechanical properties of composites based

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on YuZPE

The contain of the composition	Impact resistanc, kDj/m2	σ bending strength, mPa	σ breaking strength, mPa	Relative elongation, %	Relative elongation, %
	ГОСТ 4647-80	ГОСТ 4648-80	ГОСТ 14236-81	ГОСТ 14236-81	ГОСТ 18599-21
YUZPE	50	24	21	750	3
YUZPE/BT	47	37	38	178	2,6
YUZPE/TEAS/BT	62	38	42	164	2,8
YUZPE/PEMA/TEAS/BT	71	40	53	156	2,3

As a result of addition of modifier TEAS with maleated polyethylene in the amount of 1.0 wt.% to YuZPE, the impact resistance increased by 30 wt. % is more observed in compositions based on basalt. It can be seen that the impact resistance property has increased from 50 kDj/m2 compared to the original YuZPE, to 62 kDj/m2 and 71 kDj/m2 in YuZPE/TEAS/BT and YuZPE/PEMA/TEAS/BT composites, respectively. Modifiers are important in improving the physical and mechanical properties of composites. plays a role. This may occur as a result of their interaction with the polymer base.

3. Results and its discussion

In order to determine the interaction between polyethylene and fillers, as well as the reason for the improvement of the properties of composite materials, the analysis of the IR-spectra of polymer composite materials was carried out. Absorption frequencies of 2850-1470 cm^{-1} belonging to the $–CH_2$ group are observed in the IR-spectra of PKMs. In the IR-spectrum, absorption frequencies belonging to the =CH– group in the 2987 cm^{-1} region, and to the $=CH_2–$ group in the 2892 cm^{-1} region are observed. In the areas of 2000 and 2800 cm^{-1} there are areas belonging to the –NH groups. The presence of Si-O- groups in the 1000-1100 cm^{-1} areas and -O-O- groups in the 880-870 cm^{-1} areas is observed. In addition, in the 400-700 cm-1 range of the IR

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spectrum, short low-intensity lines belonging to compounds containing halogens are formed[11,12].

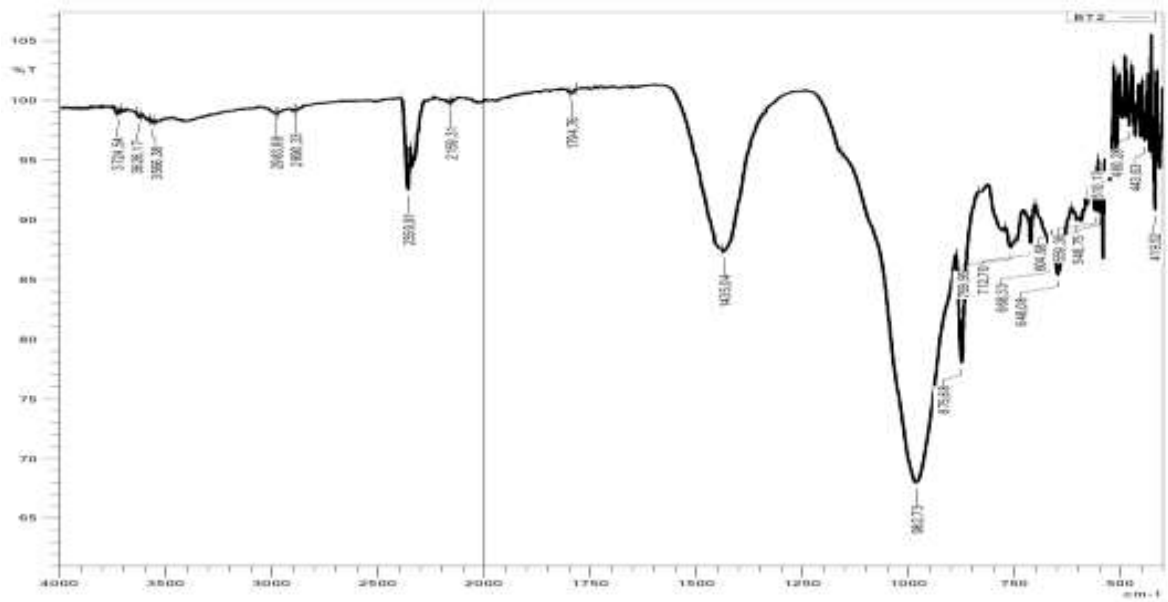

Figure 1. IR spectrum results of YuZPE/PEMA/TEAS/BT composition.

It was noted that the 35953 cm^{-1} areas belong to the valence vibration frequencies of hydroxyl groups. Accordingly, as a result of the participation of the polar oxygen-containing parts of the fillers in the adsorption interaction with the polymer base, some properties of polyethylene-based nanocomposites are improved. Therefore, in the IR field, the composition based on tetraethylammonium stearate and polyethylene does not have absorption spectra higher than 3100 cm^{-1}, which belong to the fillers. As a result of the uniform distribution of the fillers on the polymer base, high absorption frequencies are observed due to the interaction of the groups on the surface of the fillers and the breaking of hydrogen bonds[13].

4. Conclusion.

As a result of the conducted scientific and research works, it was shown the possibility of creating composite materials with improved complex technological and operational properties based on fillers of different shapes and quantities. Adding 30% of dispersion and fibrous basalt to the polyethylene composition, an increase in the heat resistance of the compositions was achieved. It was recommended to use basalt fibers as effective fillers in obtaining heat-resistant polymer compounds in local production.

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References.

1. Liu Tao; Yu Fengmei; Yu Xuejian; Zhao Xiuli; Li Ai; Wang Jianhua Basalt fiber reinforced and elastomer toughened polylactide composites: Mechanical properties, rheology, crystallization, and morphology // J. Appl. Polym. Sci., 2012, № 2;C. 1292-1301.

2. Zhang Yihe; Yu Chunxiao; Chu Paul K.; Lv Fengzhu; Zhang Changan; Ji Junhui; Zhang Rui; Wang Heli Mechanical and thermal properties of basalt fiber reinforced poly (butylene succinate) composites // Mater. Chem. and Phys., 2012, C. 845-849

3. Петропавлоский Г.А. Гидрофилные частично замещенные эфиры целлюлозы и их модификация путём химического сшиваниуа. – Л.: Наука. 1988. – 295 с.

4. Xie Jianfei; Yao Lan; Xu Fujun; Li Yishuang; Shan Zhongde; Hui David; Qiu Yiping Fabrication and characterization of three-dimensional PMR polyimide composites reinforced with woven basalt fabric // Composites. B, 2014, C. 268-275.

5. Егорова О. В.; Кадыкова Ю. А.; АртеменкоС. Е. Направленное регулирование структуры и свойств полиэтилена, наполненного дисперсными наполнителями //Пласт. Массы., 2012 , С. 57-59

6. J.S.Pal. Singh Sunder, Dutt Dharm, Gupta.Gutd /Исследование щелочной сулфитной варки целлюлозы на основе растений/.Indian J., Med, Sei 1991-45,№ 8, с.173.

7. Зимин Д. Е. Исследование поверхностных уавлений на границе раздела фаз волокно-связующее // Доклады 10 Всероссийской научно-практической конференции, Бийск, 26-28 мауа, 2010 С. 159-161

8. Ying Shuni; Zhou Xiaodong Изучение композитов на основе полипропилена и базальтового волокна, модифицированных блоксополимерными агентом сочетания // Plast. Sci. and Technol., 2012, № 5, С. 39-43

9. Кахраманов Н. Т., Кахраманлы Ю. Н., Фараджев Г. М. Свойства наполненных кристаллических полимеров// Азерб. хим. ж. N 2, 2007, С.135-141

10. Курбанов А.А. Разработка рационалной технологии переработки разнотипных базалтов Узбекистана // автореферат докторской диссертации по

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спец. 04.00.14–Обогащение полезных ископаемых (технические науки), Навои, -2016. С.29.

11. Kim M. T.; Rhee K. Y.; Park S. J.; Hui D. Effects of silane-modified carbon nanotubes on flexural and fracture behaviors of carbon nanotube-modified epoxy/basalt composites // Composites. B,2012 ,№ 5, С. 2298-2302

12. Кадыкова Ю. А.; Егорова О. В.; Улегин С. В.; Бредихин П. А.; Фархутдинова Э. Г.; Сотник В. А.Влиуание базалта на показатели горючести и физико-механические свойства полимерматричных композитов на его основе // Приволж. науч. вестн.; 2013, № 1, С. 7-9

13. Kurniawan D.; Kim B. S.; Lee H. Y.; Lim J. Y. Effect of silane treatment on mechanical properties of basalt fiber/polylactic acid ecofriendly composites // Polym.-Plast. Technol. and Eng. , 2013, № 1 , с. 97-100