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Basalt and Different Fillers Used for Polymers

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Abstract: Localization of fillers added to polymeric materials is considered one of the urgent issues in Japan. Localization of fillers makes it possible to reduce costs in the construction of industrial enterprises by up to 30% and reduce the production time of polymer composite products by up to 2 times, increase labor productivity by several times and, accordingly, reduce the cost of finished products by optimizing jobs. The unrepeatable rich composition of basalt ore leads to an increase in its field of use. This gives scientists the task of creating new technologies by making changes to traditional technologies that are theoretically and practically important in production. Among these tasks, the development of technologies for using local raw materials - natural basalt as a filler for polymers - is of particular importance.Currently, scientific research is being conducted in the world to increase thermostability of polymer composite materials, tolerance to aggressive environments, increase shelf life, improve physical and mechanical properties, and study the effect of fillers added to these properties. In this regard, it is necessary to expand the capabilities of materials for long-term and extreme conditions. Special attention is paid to natural basalt and reinforcing fillers.

Keywords: Inorganic fillers, glass fibers, asbestos, monocrystalline fibers of oxides, inorganic fillers in powder form.

Introduction:

Inorganic fillers: Available in fiber or powder form. Inorganic fillers used in fiber form include fiberglass, asbestos, and wollastonite. Fillers used in powder form include kaolin, talc, metal oxides (TiO, ZnO, Fe2O3, etc.) and salts (CaCO3, etc.).

Glass fibers: Glass fibers are mainly used as reinforcing fillers in polymer composites due to their chemical and thermal resistance, low relative elongation and high strength. Products made from glass wool (based on glass fibers), glass textolite (made from glass fabric) are used in various industries.

Asbestos: A fibrous filler consisting of a mixture of magnesium and calcium silicates. The advantage of asbestos as a filler is that it combines the high temperature and water resistance of inorganic materials with the strength of organic fibers. In the field of plastics, asbestos is used to obtain more frictional (friction) materials. In recent times, it is being tried to replace asbestos with other fillers as much as possible because it is harmful to human health.

In recent years, the demand for materials based on polymer composite materials (PCM) has been increasing day by day. The reason for this is that PCMs are competitive with metals. Because today, there are opportunities to reinforce PCMs by adding various additives that increase their strength, that is, increase their mechanical strength and toughness several times. Also, the price of polymers is much cheaper than metal. This, in turn, naturally leads to an increase in the demand and needs for PCMs.

It is known from scientific sources that natural basalt, which is available in the territory of our republic, is used as an additive to PCMs [1]. Currently, natural basalt is crushed in devices of various designs and produced in powder, fibrous, granular and other forms. When using such basalt in PCMs, the resulting composite material becomes a reinforced structural polymer material. The main factors determining their physical and mechanical properties are: the strength of the polymer material and the structure of the surface of the reinforcing fiber; the physicochemical processes occurring in it, as well as the mechanical and physicochemical properties of the polymer matrix (binder); interphase adhesive bonds at the "fiber-binder" boundary; basalt fiber is formed by the orientation processes of the polymer composition [2, 3]. The reinforcing fibers of PCMs are basalt fibers, which are considered one of the promising raw materials for the production of structural composite materials. Since they provide the opportunity to produce inexpensive and environmentally friendly products with complex properties [4]. In addition, the properties of such materials are significantly affected by technological factors: methods of obtaining structural composite materials, technological parameters for obtaining products from them - pressure, temperature, molding time, etc. Especially in the production of structural composite products with large external dimensions, it is advisable to use basalt fibers with a diameter of 7-15 μm [5]. This is because the products produced are distinguished by their unique physical and mechanical properties, namely their high tensile strength and very low elongation at break.

Now, let's understand the basalt formation at various locations:

Place 1: At oceanic divergent borders. We can find most of Earth's basalt at the tectonic plate boundaries in the ocean that forms a global ridge system in the middle of the ocean. The convection currents in the mantle pass hot molten magma to the.

Earth's crust via eruptions on the seabed, therefore, forming large landscapes of pillow-shaped basalt after cooling down. However, since these activities occur far away from human observation/view, we find that seismic readings are the only way of monitoring such basalt flow.

Place 2: Oceanic hotspots In a similar process, we discussed above, the oceanic hotspots are known to produce huge amounts of basalt. The magma flow at any one spot can burst anytime, and continuous lava flow at such locations may slowly accumulate to become an island.

Place 3: Continental volcanic activity. Dark basalt (a basalt type) is formed inland, it mostly comes from large vents and fissures that deposit large amounts of basaltic lava to the surface of the Earth. These eruptions continue for a long period or a time, which ultimately result in vertical stacks or columns.

Place 4: Basalt rock cycle The basalt rock cycle is a process that commences over a time-a period of millions of years. All the basaltic magma is pulled out of the mantle to the Earth's crust because convection currents are continually pushed away from the fissures because of the new magma flow.

Finally, over a period of many years (millions of years), the older basalt crust slowly sinks back into the magma, ending its cycle where it began or started its formations.Properties of BasaltLet's discuss some physical properties of basalt:Rock Hardness Rock Hardness property is usually measured to determine the compressive fracture strength, to determine whether a rock is a soft rock or a hard rock. The rock hardness of basalt is 6 as per the Mohs scale and can be observed through a combination of its compressive strength. Generally, 100-300 Mpa or Megapascal is the compressive strength. Its tensile strength is10-30 Mpa, and its shear strength is 20-60 Mpa, which denotes that depending on the mineral makeup, basalt rocks fall in the category of a strong – very strong. Rock hardness property is common among the densest, fine-grained textured rocks, such as basalt.DensityThe density of

basalt is very high, the density of basalt can be seen through the combination of the porosity of the rock, i.e., 0.1 – 1% and its bulk density is 2.8 – 3 Mg aka megagram per meter cube; It is because about 50 per cent of basalt is made of silica.Basalt rocks are mainly composed of pyroxene olivine and plagioclase, these rocks are rich in Magnesium and iron.

The most porphyritic minerals in basalt rocks are augite and olivine. Basaltic lavas are pumiceous and spongy.These stocks can be categorized into two parts in terms of petrographic basis Alkali basalts- that contain olivine.Tholetiic basalts are basalts without olivine.Use of Basalt uses during Ancient Times during the ancient period of the Roman Empire, engineers employed basalt for discovering roads, and also to make seats in areas of public performances viz: stadiums and amphitheatres. Basalt rocks were also widely employed in mills for grinding purposes. The Rosetta Stone is also formed of basalt. ConstructionThere are several uses of this rock in construction. For instance, crushed basalt is used in making the base for roads and pavements, as a part of concrete mixtures for constructing railroads, and as filter stones in drainage projects. The rock is also employed in slabs and sheets to create tiles, bricks, and other stone objects for constructing buildings and large monuments. AgricultureMany farmers and gardeners employ basalt rock dust fertilizer because it is good for increasing the growth of plants while making it tough for weeds to spread in flowerbeds or other unwanted growing areas. Industrial ManufactureThe tensile strength of basalt is quite high, it is much greater than carbon fibre/fibreglass. Therefore, melted composites of the basalt rock are employed for manufacturing pipes and rebars that are used in the construction of wind turbine blades.Other uses Basalt rocks are used for construction purposes of buildings, blocks or are also used in the groundwork.

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