Theoretical Study on Composite Bars of Basalt Fiber
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Abstract. This paper introduces the current development of basalt fiber, this paper expounds the made of basalt fiber composite reinforced by basalt fiber, used to advantage in the field of civil engineering, and process and the main use of present domestic and foreign research.

Research Background of Basalt Fiber Reinforced

With the rapid development of economic construction, people are increasingly looking for more and more new materials for building construction. This is an essential part of human life, it cannot be limited to the use of wood and stone. In the past engineering structures, the common concrete structure and steel structure, followed by masonry structure, wood structure and glass curtain wall structure, especially in urban and rural buildings. Reinforced concrete is widely used in modern engineering structures as a kind of excellent traditional building material. This is because first of all, the steel bar is protected by concrete and has the characteristics of durability and fire resistance. Secondly, its integrity is better. Can be modeled, can be local materials, steel and reduce cost and other characteristics. However, the use of reinforced concrete in the process there are many problems, such as self-important, in corrosive and other adverse environmental durability.

Based on these factors, domestic and foreign scholars have carried out research on new materials. The research indicates that high performance fiber composite (FRP) products are a new and excellent material for strengthening and improving concrete structure, masonry structure and steel and wood structure.

As a new fiber reinforced composite material, basalt fiber reinforced plastic (BFRP) has the advantages of green, economy and environmental protection. At the same time, China has a completely independent intellectual property rights of low-cost large-scale development of basalt fiber and its products, new technologies, new devices and new technology, BFRP material application prospects. Basalt fiber composite rib is a new type of non-metallic composite material, which is made of basalt fiber as reinforcing material, synthetic resin as basic material, and adding appropriate amount of auxiliary agent, pultrusion process and special surface treatment.

FBR can be widely used in fire fighting, environmental protection, aerospace, military, shipbuilding, engineering plastics, construction and other military and civilian fields, and can be widely used in various fields. It not only can promote the rational development of mineral resources in China and high value-added applications, but also to fill the gaps in the domestic basalt fiber, the line into a new industry. Developed countries have also been related to their research and industrial development in recent years, domestic manufacturers have also been able to produce basalt fiber, and the production process has reached or exceeded the level of the former Soviet Union. Because of the basalt fiber have a good comprehensive performance and cost-effective, more and more optimistic by the material industry and users. China also has been the basalt fiber as long-term planning to encourage the development of one of the four high-tech fiber.
Research Significance of Basalt Fiber Reinforced

Basalt fiber composite tendons with high strength, light weight, alkali, acid and resistance to corrosion of natural elements such as excellent physical and chemical properties. At the same time, the thermal expansion coefficient of basalt fiber composite tendons is similar to that of concrete, which ensures the simultaneous deformation of concrete and reinforcement. And the material can be continuously produced in the longitudinal direction. The continuous concrete can be configured according to the length of the road section, which reduces the longitudinal welding process of reinforcing steel bar and greatly improves the construction progress of the project, and has wide application prospect.

Basalt fiber is a kind of natural inorganic nonmetallic material, which can play an important role in many fields such as national defense construction, transportation, construction, petrochemical, environmental protection, electronics, aviation, spaceflight etc, compared with common carbon fiber and other fibers. Because of its good electrical insulation and non-magnetic properties, basalt fiber composite ribs can be used as reinforcing bars instead of reinforcing bars in structures with special requirements, such as anti-radar interference, and are currently used in many seismic stations in China. The effect is very significant.

At present, the use of high-performance fiber composites to transform and enhance the structure of the use of performance and disaster prevention capabilities to become a structural engineering research hotspot. Modern major civil engineering projects on the structural materials, design and construction, use management and maintenance, and so put forward higher requirements than before, especially in terms of durability. In the application of the project is more carbon fiber composite materials, glass fiber composite materials and aramid fiber composite materials, among them carbon fiber composite material is the most ideal, but its drawback is the high cost of basic raw silk carbon fiber depends on imports, and production technology is only in the United States, Japan and a few other developed countries, China does not have this raw silk.

At present, China does not have the production of carbon fiber precursor case, the development of the use of a new independent intellectual property rights of fiber composite materials is particularly important. In this case, China began to study this year to develop basalt fiber, which is an inorganic fiber material, the use of volcanic eruptions into a glassy basalt ore by high temperature melting quickly drawn from the fiber.

Basalt production of raw materials is formed after the volcanic rock condensed basalt ore. China has a vast territory, the Mainland and Taiwan are rich in reserves, which for us, first of all, on the source, to have certain advantages. Although, to meet the basalt fiber into basalt fiber and rare.

Main Characteristics of Basalt Fiber Composite

As a new composite material FRP tendon compared with the traditional, has the following characteristics:

1) High tensile strength. FRP tendons tensile strength significantly more than ordinary steel, and high strength steel wire strength almost. So if want to make full use of the strength of FRP tendons, generally need to exert prestress.

2) The stress-strain curves of the FRP tendons are always straight and there is no obvious yield step. This is obviously different from the ordinary steel, FRP tendons is one of the important characteristics.

3) The density is small. The density of various FRP tendons is only 16% ~ 25% of the reinforcement, which will help to reduce the weight of the structure, especially in the suspension bridge.

4) Good electromagnetic insulation. For some special requirements of the building, such as radar stations. As the existence of reinforced concrete structure of the whole structure of the electromagnetic field will be detrimental to the use of the impact, and FRP tendons are non-magnetic materials, used to replace the steel is very appropriate.
As one of the types of FRP tendons, the basalt fiber composite tendons have these advantages. At the same time, basalt fiber composite ribs processed by basalt fiber have the following advantages:

1) Excellent mechanical properties
   Basalt fiber tensile strength generally can reach 2000Mpa, elastic modulus can reach about 90Gpa, basalt fiber softening point of 960 degrees Celsius, its strength at high temperature can maintain strength for a long time.

2) Stable chemical properties
   Basalt fiber has a high alkali resistance to acid, in cement can maintain a high degree of stability, alkali resistance is much better than glass fiber.

3) Outstanding high temperature characteristics
   Basalt fiber at 400 degrees temperature, the fracture strength can be maintained 85%, 600 degrees in the work, the fracture strength can still maintain about 80%. Therefore, in addition to basalt fiber can be used for high-temperature insulation materials, but also can be used as liquid nitrogen and other containers or equipment, the most effective ultra-low temperature insulation material.

4) Good dielectric properties
   Basalt fiber volume resistivity higher than the glass fiber one order of magnitude, containing only 20% less than the conductive oxide.

5) A good resin composite capacity
   Basalt fiber and a variety of resin composite, than the glass fiber and carbon fiber has a better adhesive strength.

**Basalt Fiber Main Purpose**

Basalt fiber and concrete are similar in chemical composition, so BFRP material has good compatibility with concrete, and has good alkali corrosion resistance. As the basalt fiber has good alkali resistance, the basalt fiber composite ribs made of basalt fiber can replace the ordinary steel bar and form the BFRP reinforced concrete system. It can be used to study the tensile and bending experiments of concrete beams.

In the field of civil engineering, basalt sheet as a complete replacement or partial substitution of carbon fiber products are mainly used in structural reinforcement, a large number of practical projects have been used, and the effect is good. Especially in the basalt fiber reinforced plastic columns experimental study shows that the performance of basalt fiber reinforced columns to achieve even more than the use of carbon fiber reinforced column performance, and its price is only 19% of carbon fiber.

Basalt fiber composite tendons can be used for anchor reinforcement for slope and other parts, and because of its good electrical insulation and non-magnetic, can have special requirements in the structure (anti-radar interference or sensitive electrical test equipment structure) As a steel bar to replace the use of force, the current structure is also a number of seismic stations in the pilot use, the effect is good.

**Looking Forward to**

At present, the research on basalt fibers in China has gradually increased, but there are still many problems need to be further studied. The basic work of this paper is only to analyze some basic mechanical properties of the basalt composite ribs made of basalt fiber, and carry out the basic bending test of concrete beams made of basalt composite bars instead of steel bars. Conclusion, but due to limited conditions, and manufacturers of continuous improvement of production processes, there are many things to be further explored:

1) The mechanical properties of basalt fiber composites, with the manufacturers continuous improvement of the production process, whether the mechanical properties will be improved, the experimental results will change, these are the need to further verify.
2) As a new type of new material, many properties of basalt fiber materials, such as corrosion resistance, fatigue resistance and concrete interface properties, need further study.

Reference


