



Application of New Synthetic Stone Materials in Interior Design

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Abstract. With people's attention to environmental protection, as well as the continuous optimization of environmentally friendly materials synthetic stone, it is gradually becoming one of the main materials for interior decoration. The research on synthetic stone materials can promote its application as a major environmental protection material in the field of interior decoration, enhance its competitiveness in the field of interior materials, and promote the energy conservation and environmental protection of the construction industry. This paper studies the application of synthetic stone materials in interior design from the basic characteristics, shape, texture and color of synthetic stone materials. Based on the aesthetic needs of the modernization process, it can innovate new application methods and play a more important role in interior, architecture and other fields.

Keywords: Synthetic stone; Interior design; Environmental protection materials; Decorative materials;

1 Introduction

With the development of modern technology, the strength and quality of environmentally friendly synthetic stone are constantly optimized and are more and more widely used in interior decoration design. Synthetic stone material as a decorative stone, in addition to the characteristics of stone, but also with fire, beautiful, erosion resistance and other aspects of excellent performance, is gradually becoming one of the main materials for interior decoration. In order to meet people's diversified interior decoration needs, the new environmental protection material synthetic stone is applied to the interior decoration design, making the interior space decoration more rich, so that it has a broader application prospect.

2 Basic Properties and Applications of Synthetic Stone Materials

Synthetic stone material is a new type of decorative stone which is composed of waste slag, waste material, ore and tail material, which is environmentally friendly, high

performance and cheap. It not only has the texture of natural stone, but also the selectivity of color and texture that natural stone can not reach. The performance of synthetic stone is also very outstanding, its wear-resistant, anti-slip, stable, but also has a noble and elegant decorative effect, is also one of the main reasons for being widely used. Synthetic stone materials can be widely used in interior decoration, in addition to its own characteristics, but also has the following advantages:

(1) Low carbon environmental protection. Synthetic stone material is completed by synthesizing scrap, waste and tail material, which greatly plays the recycling of waste[1].

(2) Economical and applicable. Compared with natural stone, the production cost of synthetic stone material is relatively low, and the processing process is simple, and it can be popularized and applied.

(3) High temperature resistance. Synthetic stone can be used as a kitchen decoration material to play a role in fire prevention.

(4) Waterproof and anti-cracking. The density of synthetic stone material is good, and it is difficult to be eroded and cracked by rain, wind and high temperature exposure.

In recent years, synthetic stone has been favored by many people in architectural decoration materials and other aspects, and has strong competitiveness in other fields. However, considering its characteristics, synthetic stone materials are more suitable for interior design. For example, the application of synthetic stone on the one hand enhances the beauty of the building interior, but also reduces the damage caused by some toxic substances in the interior[2];The color of synthetic stone material is smooth, and there are a variety of patterns to choose from. Its appearance is easy to polish and carve. It is used more in landscape production and rockery mural decoration, and the decorative effect is the best[3].Process research on energy saving and new material brand in architectural decoration engineering design This makes synthetic stone materials have great potential in interior design.

3 Design Method and Elements of Synthetic Stone

3.1 The Shape Design of Synthetic Stone

The synthesis process of synthetic stone materials mainly has the following two kinds: ① Stone powder, stone ballast millimeter as the main filler, resin as the binder, through the processing on the mold to form materials of different sizes and specifications, so that although efficient and low cost, but need to use large equipment and a lot of labor; ② With the larger particle size of the ballast for grading, resin as a binder, stirred with steel mold to shape, through the vacuum vibration molding. After the billet appears, it is sawed and polished, and finally made into various plates.

The composite board assembled from the composite stone plate has various colors, rich shapes, excellent decorative effects, and has both sound insulation and heat preservation performance, and the assembly process only needs simple splicing, without cement mortar. The plate processing technology of synthetic stone is much the same as that of natural stone. First, the raw material (Figure 1) is sawed, then polished, corrected to a shaped plate, and then further rough grinding, fine grinding and polishing to

achieve the surface luster required by the standard, and then the plate is cut out to the required size with a cutting machine, and finally waxed to show its color and brightness. In order to eliminate the small holes remaining on the surface of the plate during molding, paste with resin and calcium powder as the main raw materials is manually applied on the surface of the rough grinding stone, and the microholes are filled, and then dried to cure.

The resin, filler, natural stone particles, initiator, accelerator, additives are mixed in proportion, stirred evenly, injected into the mold, paved according to the requirements, and finally formed a synthetic stone layer. During the synthesis process, the temperature needs to be controlled within 150 ° C to avoid the influence of the resin and the addition process due to heat, impact, warping, cracking, pollution, etc. In addition, the resin has good wettability and can prevent cracking. For example, the table panel of the cabinet requires a water absorption rate of less than 0.06%, and it also needs to have a high thermal temperature and anti-pollution ability to contact with hot products and various foods. The addition of chelating dispersant in the resin can enhance the bonding between the materials, thus reducing water absorption and improving the pollution resistance and impact resistance of the synthetic stone.

Usually the resin filler in the synthetic stone, mainly the addition of aluminum trioxide powder, marble powder, quartz powder or talc powder, can make the proportion of the synthetic stone controllable, on the other hand, as long as it is properly filled, it can also improve the performance of the synthetic stone. The synthetic stone made of the addition of filler has excellent flammability and anti-pollution, and the addition of adjuvants, auxiliaries and other auxiliary materials further increases the impact resistance, toughness, wear resistance of the synthetic stone, but also increases the density and reduces the water absorption.

Synthetic stone in the installation process of indoor construction is easy to appear joint, on the one hand, because the contact surface of the plate is not smooth enough, the bonding surface is not sufficient; On the other hand, the clamping strength of the fixture is not enough when bonding. Solving the above problems can reflect the characteristics of seamless splicing of synthetic stone (Figure 2), therefore, it is recommended that the treatment method at the splicing place is best to use the concatenation processing method to avoid the splicing situation during the installation process.

Synthetic stone panels are also used in a wide range of fields, such as interior design walls, floors (Figure 3), furniture countertops and home cabinets countertops. When used in high-rise building decoration, the plate can be used as a rational material to reduce the building load and achieve ideal expectations. Compared with the traditional natural marble, granite, ceramics, artificial granite and quartz stone made of plates, the composite board is more practical, as an innovative material, has great prospects for development.



Fig. 1. Synthetic stone blocks. (Source of the picture:<http://www.cn-winsun.com>)



Fig. 2. Seamless splicing of synthetic stone on kitchen countertops. (Source of the picture:<https://zhishi.fang.com>)



Fig. 3. The application of synthetic stone in interior design. (Source of the picture:<http://www.stone315.com>)

3.2 Optimization of Synthetic Stone Production Process

The production process of synthetic stone involves many aspects, including material selection, reaction condition control, production equipment, etc. In terms of material selection, some more economical and environmentally friendly raw materials can be selected to ensure the performance and environmental protection of synthetic stone, such as the use of recycled materials or waste; In terms of reaction condition control, further determine and control the temperature and pressure in the synthesis reaction process, so that the nature of the output product is more stable, better performance, and can also improve production efficiency and product quality; In terms of production equipment, the introduction of automation technology and intelligent manufacturing systems to reduce labor costs, improve production efficiency and reduce scrap rates. Optimizing the production process and reducing the production cost of synthetic stone can make it more competitive in the material market.

3.3 Synthetic Stone Surface Decoration

Interior decoration materials need to have a certain impact on the vision, and then produce the corresponding aesthetic needs and psychological feelings. Therefore, the design of synthetic stone surface decoration can better meet people's needs for interior decoration, in line with most people's aesthetic. In the process of production, color stone particles with a particle size of 1-5 mm are added to increase the pattern and decorative effect of synthetic stone, and the pattern and color are determined by the size and color of the stone particles.

The choice of the pattern and color of the synthetic stone (Figure 4) directly affects the decorative effect of the product and the audience, so the allocation and addition of the synthetic stone pigment are very important, and it needs to be constantly compared and tried. For example, imitation marble, we must first understand the color and texture of natural marble, roughly determine the production program, through continuous trial production, continuous adjustment, and finally choose the right program to put into production. In this way, the synthetic stone can be closer to the natural stone, more natural texture, and the reality of the synthetic stone depends on the degree of care and operational experience of the trial production.



Fig. 4. Color and texture design of synthetic stone (Source of the picture:<https://www.zhu-faner.com>)

3.4 Color Application of Synthetic Stone

The main advantages of synthetic stone are also reflected in the color, which not only retains the texture of natural stone, but also breaks through in color and texture. Using colored stone as synthetic stone raw materials for artificial coloring, casting into stone, one molding, the prepared color synthetic stone has a rich color and a variety of textures, but also has high performance and low cost[4]. It can manufacture products of different colors according to different requirements, and can also be improved and developed according to the trend and market demand, making up for the defects of monotonous color of natural stone. Can better meet people's needs.

At present, the light and elegant color based on beige has great room for development in interior design, where the surface of the material similar to the natural Shaanna beige has a fine texture, which is favored by most users. Shaanna beige synthetic stone products are made of finer stone materials and secondary dyeing at a later stage to make them more ornamental. To improve the design concept and technique of its pattern, go deep into the concept of curved lines, and carry out a new pattern preparation process in the square material forming machine under vacuum, which can improve the level and texture of the pattern, make it closer to the fine, continuous and mesh pattern of the natural stone pattern, and further improve the market value of the material.

The forming process of synthetic stone sheet adopts pumice carving with a pattern on the surface as a mold, and adopts layered pressing. First, a mixture composed of fluorite or light storage material is laid on the bottom of the mold, and then the ordinary material as a base is placed on the upper part of the mold for pressing. The plate produced by this process has a three-dimensional surface of pumice stone carving, and has a texture similar to natural stone, in addition to its unique luminous nature, but also makes the plate more artistic, and opens a new direction in interior design.

The double-planet mixer used in sheet molding equipment, in its vertical mixing rod, the movement of the epicycloid trajectory of rapid operation, the material will naturally form a pellet, and in two to three mixers mixed different colors of the loose material mix, the mixing of synthetic stone is very convenient, can naturally form a gradual and permeable color effect. The effect will also change with the change of the order and ratio of the mixing materials and auxiliary materials.

In the process of making synthetic stone, the texture and color of the product can be changed by changing the method of adding and matching colors. At present, several colors of raw stone powder and several colors of pigments are commonly mixed into synthetic stone to make the synthetic stone material have a richer color and improve the surface effect. The marble in the synthetic stone (Figure 5) adopts the maximum granular stone configuration, adding two or three pigments to mix into a background color process, showing a more distinctive pattern.

Several stone materials, such as green, blue and white "blue waves", white with red silk "mountain flowers", yellow, green and white blend "landscape green" and blue and purple showing light lines "night rose", have a bright color and are easy to configure large particle size products. If the bottom color of the microcrystalline synthetic stone is a light color, and the liquid pigment is a deep color in the secondary addition, the two colors can form a mutual penetration effect of the two colors under the effect of the

vibration and fluctuation of the molding, and the formation of a subtle natural blend of the magic color[5].The formation of fine streaks of synthetic stone microcrystals can further improve the artistry and product quality of synthetic stone, so that it is closer to natural stone.



Fig. 5. Marble material for synthetic stone (Source of the picture:<https://www.tesequ.com>)

4 The Application of Synthetic Stone Materials in Interior Design

4.1 Application of Synthetic Stone in Interior Environment Design

Floor tiles made of synthetic stone and ceramic are now widely used in interior design. Synthetic stone has wear resistance, durability, but also has the characteristics of high strength and high hardness, so it is used more in the ground, walls, bathrooms and other places. And some of the few ceramic materials have substances that are harmful to humans, will have an impact on the human nervous system, and even lead to poor spirits. Therefore, in recent years, more and more people choose synthetic stone materials as floor materials, not only the pattern is diverse, it is not easy to produce cracks, and it will not affect people's health. Synthetic stone is mostly used for laying materials on the ground, and its production cost is reduced to the level of tile, which is a better substitute for tile material. It can also be an integrated combination of synthetic stone and ceramic tile, the resin matrix composite material as a filler, laid on the ceramic tile body, and the composite stone, the bending strength of the synthetic material can be further improved.

Through some processing methods, synthetic stone materials can be made to have more high-quality results. For example, simulation results are achieved using innovative processes such as preform, transfer roll, strip copying, patterned fabric, dynamic

spraying and steering fabric. Another example is the imitation of its transparent lines with aluminum hydroxide powder, the combination of double horizontal axis mix and double planet mix, and its secondary dyeing process can achieve better viewing effect[6].The environmental performance of synthetic stone is mainly reflected in anti-bacterial performance, environmental protection requirements, health effects, waste utilization and magnetic field effects, so as to adapt to different scenarios. Compared with other commonly used interior building materials (Table 1), it not only provides a large number of choices for the shape and color of interior design, but also provides quality assurance for other aspects of interior design material application.

Table 1. Basic properties of synthetic stone and other interior building materials.

Materials	Ingredient	Effect on Human
Synthetic stone	Synthetic stone is usually composed of polymer resin as one of the main components, and the filler is usually stone powder, glass powder or other natural or synthetic materials	The materials also usually meet relevant environmental and health standards and are generally not harmful to human health
Marble	Calcium carbonate	It usually does not contain harmful chemicals, but its surface needs to be cleaned and sealed regularly to prevent the penetration of contaminants. Marble surfaces may be sensitive to acidic substances, and marble may also be affected by contaminants in the environment, which may cause spots or discoloration to form on the marble surface.
Natural stone	Different kinds of natural stones may contain different mineral compositions	Some natural stones may contain high levels of radioactive elements such as uranium and thorium

Table 2. Comparison of synthetic stone and other interior building materials. (Self-drawn by the author)

Materials	Advantage	Disadvantage
Synthetic stone	<ol style="list-style-type: none"> 1.Rich colors and diverse styles 2.The color difference is stable and controllable, and there will not be much difference 3.High strength, strong impact resistance 4.Easy processing, easy grinding, convenient maintenance 5.No radioactivity, will not cause harm to people 	<ol style="list-style-type: none"> 1.Poor acid and alkaline resistance 2.Easy to be infected by colored substances

	6.Less surface gap, not easy to seepage	
Marble	<ol style="list-style-type: none"> 1.Soft color and texture, natural and simple 2.Easy grinding, convenient care 	<ol style="list-style-type: none"> 1.Large color difference, not suitable for large area spread 2.There are many cracks, and the processing process needs to be reinforced with glue 3.Easily damaged, easily damaged during transportation or use 4.Easy to seep, difficult to clean
Natural stone	<ol style="list-style-type: none"> 1.Bright color and rich texture 2.Acids and alkalis resistant, adapt to a variety of climates 3.Wear and scratch resistant 	<ol style="list-style-type: none"> 1.Insufficient elasticity, easy to break after heat or collision, and difficult to repair 2.High hardness, more difficult to finalize, not easy to polish, polish, processing 3.There are natural gaps, easy to stain, easy to dye, not easy to clean

4.2 Synthetic Stone in Other Fields of Application

In addition to the wide application of synthetic stone in indoor space, in the outdoor community activities and leisure and fitness areas, stone pavilions and tables made of synthetic stone materials can make people closer to nature, in this environment can also make people feel more comfortable and enhance people's sense of belonging. Based on the beauty of its appearance and color, as well as excellent performance, synthetic stone is also often used in parquet carving or sculpture[7]. Synthetic stone, as a class of composite materials, is covered by a large number of metallic minerals in synthetic stone, which can improve the strength and hardness of the stone, even in a very harsh environment, it is difficult to produce cracks, which can extend its service life. Based on this advantage, it is also more widely used in the field of landscape environment, and in real life, synthetic stone is usually used to complete horticultural carving and rockery. It reduces environmental pollution and improves resource utilization[8].

Synthetic stone can sometimes be used with wood composite, the use of wood impregnated resin and synthetic stone composite process, in the fiber gap filled with polyester resin, to solve its deformation problem, the composite of new materials with natural stone hardness, can replace ordinary synthetic stone products.

5 Conclusion

As a new type of decorative material, synthetic stone material meets most of the application needs in the actual scenes of interior design due to its richness of categories and diversity of colors. By virtue of its own characteristics and advantages, it makes full

use of excavating and designing new application methods to broaden the scope of its use in indoor environment. Through the analysis and summary of the application of synthetic stone in the interior, this paper optimizes the process of synthetic stone, hoping that synthetic stone can innovate more applications based on the aesthetic needs of the modernization process, and play an increasingly important role in the interior, architecture and other fields. Synthetic stone with its high cost performance and after a certain period of market test, will occupy an increasingly important position in the field of building decoration, with its lower production costs can be more competitive in the market.

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