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Application Discussion of Plastic Decorative Materials in Interior Design

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Abstract: *With the continuous improvement of people's quality of life, people have a certain understanding of the requirements of indoor environment. Traditional decorative materials can no longer meet the needs of modern people, and they begin to require better safety, applicability and specific decorative materials. This paper first summarizes the emergence and development of plastics, then discusses the commonly used plastic decorative materials in interior design and their functions in use, analyzes their artistic characteristics, and discusses the application of plastic decorative materials in interior design.*

Keywords: *Interior Design, Plastic, Composite Materials, Materials Applications*

1 Production and Development of Plastics

In the process of human civilization, human beings have been seeking to change nature. The road to transforming nature is constantly moving forward. With the development of science and technology, people have begun to use synthetic materials to meet the growing material needs of human life. Plastic was born in this historical background.

In 1878, German chemist Carl Heinrich Kekule accidentally discovered a special compound-benzene when studying the structure of benzene ring, and thus produced a new chemical concept: aromatic. This new concept has a significant impact on the development of synthetic materials[1]. In 1902, American William Bosch discovered polystyrene molecules from experiments. He and his assistant Barnum made a plastic from polystyrene. This plastic is the first synthetic material with practical value in the world, which lays a foundation for the development of plastic industry in the future[2]. In 1907, the German chemist Bayer studied the polyphenethylen, he found in the experiment, The polystyrene monomer containing the benzene ring structure is chemically polymerized into polystyrene, and then heated and pressurized to cure it to obtain plastics. Bayer called this material ' styrene-divinyl benzene copolymer ' (referred to as ' BPS ') [3].In 1912, the German chemist Rudolf Clausius discovered when studying the polycondensation reaction of hydroquinone with divinyl benzene: In the process of polycondensation, in the presence of catalyst, divinyl benzene and dihydroxybenzene can undergo double bond addition reaction to form a new compound (referred to as ' bisphenol) [4]. This compound can be polymerized like ethylene to obtain resins, which are the precursors of modern plastics. In 1913, the German chemist Hans Meyer in the study of phenolic resin found that: adding a small amount of chlorine can make phenolic resin hardening, thus making the world's first thermoplastic phenolic resin-chlorinated rubber [5].

Nowadays, plastic materials are widely used in the fields of construction, industry and packaging, and have become indispensable materials in various fields. This paper analyzes the plastic decorative materials and their functions in interior design, and then discusses the application of plastics in interior decoration through different positions. Finally, it summarizes the application and development of modern plastic decorative materials, and puts forward the future thinking direction[6].

2. Plastic Decorative Materials and Their Functions in Interior Design

There are many kinds of plastic decorative materials, which are widely used in interior design. It is characterized by gorgeous color, light texture, strong plasticity, and color can be selected according to the needs of designers. At the same time, due to the excellent mechanical properties, heat resistance and corrosion resistance of plastics, it is easy to process and recycle, so it has been widely recognized in interior decoration.

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2.1 Nanocomposites

Nanocomposites refer to particles in the size range of 1-100 nm. Nanomaterials theoretically refer to having more than 2 atoms at the level of one atom and interacting with the surrounding environment, thus exhibiting properties that are significantly different from macroscopic materials. Nanomaterials can be divided into two categories: one refers to materials with nano-scale characteristics at the atomic level, such as carbon nanotubes, graphene, etc. ; the other refers to materials with nanoscale characteristics at the subatomic level, such as silicon, germanium, zinc and other metal nanocrystals and composite materials composed of various metal and non-metal nanoparticles.

In recent years, with the rapid development of materials science and nanotechnology, people have conducted extensive research on nanomaterials and their applications. For example, nanoparticles can increase the density of plastics, provide light transmittance, heat resistance and other properties of plastics, and make plastics less susceptible to aging. In the field of interior decoration, by introducing nano materials into coatings, adhesives, building waterproofing membrane and other products, it can not only greatly improve the performance and life of these products, but also improve their safety and durability.

2.2 Intelligent Plastics

Intelligent plastic is a new type of polymer material. It is a multi-functional and intelligent polymer material that can be processed and formed without solvent, without any additives and without special process treatment. The biggest advantage of this material in the use of life is that it has the characteristics of being able to perceive the external environment, and can change its own characteristics according to the perceived situation. Its typical representative is shape memory plastic. The following is a detailed introduction to intelligent plastics from the advantages, uses, and production processes of intelligent plastics:

(1) It has higher strength and toughness than traditional plastics. The mechanical properties of intelligent plastics have been greatly improved compared with traditional plastics, so that they not only have the properties of traditional plastics, but also have higher strength and toughness.

(2) It has good processing performance. Compared with traditional plastics, it can be processed by mechanical processing, physical processing or chemical processing. And because the intelligent plastic has good physical and chemical properties, its performance can be adjusted by changing a variety of physical and chemical conditions.

(3) It is highly designable. Intelligent plastics are designed and manufactured according to the requirements of users, through computer simulation, such as corrosion resistance, radiation resistance and other functional products can be designed according to different use environments and requirements. Intelligent plastics are widely used in various fields such as interior decoration and construction. At present, there are two kinds of research, development and utilization at home and abroad: polytetrafluoroethylene (PTFE) and polyphenylene sulfide (PPS). No other smart plastic can meet these requirements at the same time.

2.3 Conductive Plastic

Conductive plastic, also known as conductive rubber and conductive plastic, is a new type of composite material made by melt blending of conductive polymer (conductive fiber, conductive filler) and matrix resin. The material is a solid with self-lubricating properties, and its lubrication performance is similar to that of rubber. At the same time, it also has high modulus and strength, good electrical conductivity and thermal conductivity, as well as dimensional stability and chemical resistance. For example, Anhui Jiamu Rubber and Plastic Industry Co., Ltd. produced a conductive plastic --- PVC/PP composite conductive plastic, the composite conductive plastic is composed of 20-26 parts of PVC, 6-10 parts of PP, 10-14 parts of carbon fiber, 3-5 parts of polycarbonate, 3-6 parts of glass fiber, 7-11 parts of carbon black, 1-2 parts of barium stearate, 5-10 parts of calcium carbonate, 1.0-2.4 parts of flexibilizer, 0.8-1.2 parts of titanate coupling agent. PVC has good compatibility with PP. Carbon fiber, carbon black and glass fiber have good electrical conductivity as conductive agents. Glass fiber can enhance the mechanical properties of conductive plastics. The comprehensive mechanical properties of composite conductive plastics are good[7].

Conductive plastics mainly include conductive rubber and conductive fiber. Among them,

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conductive rubber is mainly used for electrical insulation products and electrical and electronic equipment; conductive fibers are used in the fields of wire and cable, sensors, capacitors and sensor networks. At present, the most widely used in interior decoration is conductive plastic products.

2.4 Flame Retardant Plastics

Flame retardant plastics are flame retardant, and flame retardant technology is still evolving. In decoration materials, flame retardant plastics are more and more widely used. For example, Styrofoam is thermally insulating and flame retardant. In public places, flame retardant is an important content, and the use of flame retardant materials can improve the safety of the place. At present, flame retardant materials are mainly used for indoor doors and windows and some decorative parts.

Northeastern University Ningya Boron and other professional groups have made some research on flame retardant plastics, and introduced a high-performance flame retardant plastic, which is composed of 150 parts of plastic substrate, 30-105 parts of polystyrene solution, 22-45 parts of flame retardant composite materials, 120-300 parts of mineral filler, 2.3-9.0 parts of curing agent, and 7.5-30.0 parts of chemical bonds. High-performance flame retardant plastics have high plasticity, high temperature resistance and significant flame retardant effect.

However, at present, many plastics with special functions have not been widely used, and the use of plastics in interior decoration still stays on the surface of materials, but these plastics with special functions will definitely be widely used in future interior design.

3. Artistic Characteristics of Plastic Decorative Materials

The characteristics and processing technology of the decorative material itself are the only elements that determine the artistic characteristics of the material. When applying materials in interior design, designers need to choose materials with strong artistic characteristics according to location, vision and other conditions, so as to create an artistic sense of interior space. In addition, the material can be specially processed according to the physical and chemical properties of the material to enhance the artistic properties of the material. The unique artistry of plastic decorative materials provides a rich material basis for the expression and expression of interior design art [8-10].

Plastic materials are easy to process and can be processed by different process methods, the most common plastic decoration material method is injection molding. Injection molding is the use of molds to heat plastic raw materials, through the nozzle in the mold to shoot out the plastic raw materials, processing different specifications and shapes of plastic decorative materials. The plastic raw materials of injection molding have a smooth surface and good transparency. Designers can design, match and combine plastic decorative materials of different shapes and different transparency, bringing people different sensory feelings, which has a great effect on the realization of artistic effects.

Plastic decorative materials can change their color by adding colorants during the production process, and can accurately control the brightness and purity of the color. In the surface processing of plastic decorative materials, metals, metal powders, metal compounds, plastic alloys, plastic powders, plastic pigments, etc. can also be added as a colorant. By adding different colorants, different effects of various colors can be achieved. This processing technology is simple and low cost. However, in its surface processing, one or two layers of protective film are generally added to prevent the surface of the decorative material from being damaged. In the surface processing of plastic decorative materials, different color effects can be achieved by using multi-layer film materials. At the same time, color film materials can be used in combination to make them have multiple color effects. Plastic decorative materials have different textures, such as soft, hard, slippery, frost, light and heavy. It can also imitate the texture of other non-plastic materials, such as metal texture, ceramic texture and so on[11-13].

Texture is very important in the creation of artistic effects. The experience of texture can bring users different psychological experience and tactile feeling ! Through reasonable use, we can create a variety of different feelings, such as intimacy, modernity, sublime and so on. The delicate texture gives a delicate feeling, and the rough texture makes people feel rough and powerful.

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4. Application of Plastic in Interior Decoration

4.1 The Application of Plastic Decorative Materials in the Ceiling

In interior decoration, suspended ceilings are an important part of interior design. Ceiling material is a kind of functional and decorative material in interior design. It has special requirements on roof decoration. First of all, it must consider the waterproof problem, followed by the thermal insulation performance, and finally consider the decorative effect. Therefore, the choice of ceiling decoration materials should be combined with the form and purpose of the building, and the construction difficulty and cost of the selected materials should be taken into account. Plastic material is a common ceiling decoration material, which has the characteristics of good waterproof, heat preservation and heat insulation. And plastic materials also have the advantages of light weight, high strength, good heat resistance and strong impact resistance. Therefore, the application of plastic materials in ceiling decoration is an economical and effective way.

The most commonly used plastic materials in indoor ceilings are acrylic plates, PVC buckle plates, and lighting plates (PP, PC, PET, APET). The following discusses the application of different plastic materials in ceilings:

Acrylic is a new type of plastic with high transparency, bright color, strong processability, easy dyeing and strong coloring. It is widely used in public spaces such as office ceilings, supermarket ceilings, and hotel lobby ceilings. For example, supermarket ceilings in shopping malls, large shopping malls and supermarkets are generally places with large crowds. Acrylic board ceilings show unique charm in shopping malls and supermarkets with their bright colors and light texture. Moreover, the acrylic ceiling has the functions of moisture proof, sun protection, anti-corrosion and so on, and has the reputation of ' never fading '. For example, hotels, hotel places, hotels, hotel decoration with acrylic panels are mainly used in the hotel lobby ceiling, restaurant ceiling and so on. The hotel lobby ceiling gives people visual enjoyment with its beautiful curves and gorgeous colors, while the restaurant ceiling is refreshing with its changeable colors and three-dimensional shapes.

PVC plastic buckle plate ceiling is one of the most popular new ceiling products in China. It uses high-quality polyvinyl chloride (PVC) as the main material, combines the performance advantages of plastics, metals and other materials, and has the waterproof, moistureproof, anti-corrosion and anti-deformation characteristics of PVC plate and metal plate. It has good flame retardant, antistatic, moistureproof, moistureproof and other functions, which can be applied to wet places such as kitchens and toilets. The product is simple to install, without special process, no need to reserve keel and wire, and can be installed only by adjusting the plastic buckle plate. At present, the main domestic PVC plastic buckle plate ceiling brands are: ' Meida ', ' Daya ', ' Jindao ', ' Zhongbao ', ' Huakai ', etc[14]. Scope of use of PVC plastic clasp ceilings: Kitchens, bathrooms and balconies are among the most contaminated places in home renovations. These spaces are humid environment, and very easy to breed bacteria and mold, so the decoration materials of these spaces must have high requirements. PVC plastic buckle ceiling has strong corrosion resistance and moisture resistance, and can be used in wet environment for a long time. Moreover, it also has moisture-proof and corrosion-proof functions, and is currently the most popular ceiling material in home decoration.

Lighting board is one of the most popular ceiling products in modern home decoration. The ceiling of the lighting panel is to separate the indoor and outdoor temperature by light, so as to ensure the cool and comfortable indoor environment. The daylighting board has the advantages of high temperature resistance, moisture resistance, mildew resistance and waterproof. In addition, it also has the characteristics of not easy to change color, not afraid of deformation, impact resistance and anti-ultraviolet. After installing the ceiling of the lighting board, the lighting effect is very good. With the increasing popularity of interior decoration, many people will install the lighting board ceiling at home, which is a very practical way of decoration. It can not only save indoor space, but also bring more lighting effects.

4.2 The Application of Plastic Decorative Materials in the Wall

The plastic decoration materials used in interior decoration include plastic wallpaper, artificial leather, plastic veneer composite decoration board, wood plastic composite board, plastic coating materials, etc. The following is an example to discuss the application of different plastic materials in indoor walls:

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As a new type of interior decoration material, plastic wallpaper has the characteristics that other decorative materials do not have, mainly in the following aspects: (1) Customability. Plastic wallpaper can customize different patterns and sizes according to customer needs. On the plastic wallpaper can be attached to a variety of different decorative paintings, patterns, text, etc. Whether it is modern simple wind, European classical wind, or Mediterranean wind, etc., can be achieved on plastic wallpaper.(2) Easy to clean. Due to the special material of plastic wallpaper, it has very good anti-pollution, not easy to adsorb dust, and the surface is easy to clean up. Its surface can be scrubbed directly with water[15]. Therefore, plastic wallpaper is especially suitable for places with high requirements for sanitary environment. (3) Decorative. Because plastic wallpaper has rich and diverse patterns and colors, it is very suitable for modern simple style, European classical style and other decoration styles.

Wood-plastic composite board is one of the most common plastic decorative materials in indoor wall decoration in recent years. Because of its good decorative effect, it has been loved by the majority of owners and designers. Wood-plastic composite board is made of polyvinyl chloride (PVC) as the main raw material and other auxiliary materials. The board has the advantages of light weight, non-toxic, tasteless, non-flammable, heat insulation, sound insulation, waterproof and so on[16], It is a new type of green building materials. The wall surface designed by wood-plastic composite board has the following characteristics: (1) The surface can be directly treated with paint or paint, Can also be sandblasting and sanding, can meet the different needs of different customers; (2) Designability is strong, can be designed into a variety of patterns and shapes according to customer requirements, thereby improving the decorative effect and product grade. (3)The installation is convenient and quick, and the wood-plastic composite board is set up in the production by the plate, the corner, the starting bar and the corner bar. The flat plate is set with a concave and convex groove, which can be directly assembled, greatly reducing the construction cost and construction period. (4) Safety and pollution-free, the wall of a large number of use of wood-plastic composite board, the indoor will not cause environmental pollution and radiation, wood-plastic composite board is the use of natural plant fiber as a substrate to produce materials, does not contain formaldehyde, benzene and other toxic and harmful substances.

4.3 The Application of Plastic in Ground Decoration

In recent years, with the continuous improvement of people's quality of life, people have a new understanding of decorative materials. Especially in the field of home decoration, plastic decorative materials are becoming more and more popular as a new type of green environmental protection decorative materials. The following describes the application of the ground from two plastic floor materials. Plastic flooring is a floor paving material made of synthetic resin as the main raw material. It has the advantages of low price, simple construction, and can be used many times, and has good environmental performance, so it is widely used in public space floor decoration. Plastic floor is mainly divided into three types: PVC (polyvinyl chloride) floor, PU (polyurethane) floor and PET (polyethylene terephthalate) floor. PVC floor has good wear resistance, but poor elasticity, and easy to scratch ; PU floor has good elasticity and wear resistance, but it is easy to age and deform. PET (polyethylene terephthalate) floor has good elasticity, strong wear resistance and rich color, but the price is high. PVC carpet is mainly divided into two kinds: one is PVC transparent carpet, transparent PVC transparent carpet is mainly used for mall ground decoration. Transparent PVC carpet has good decoration and softness. Its raw material is polyvinyl chloride, which is non-toxic, odorless and non-volatile. Therefore, it is widely used in food and beverage and cosmetics industries. The other is PVC sanded carpet, sanded PVC sanded carpet is mainly used for home decoration floor decoration. Because it is made of polyvinyl chloride, it is non-toxic, odorless, non-volatile, antistatic, non-deformable, wear-resistant, water-resistant and oil-resistant. It is widely used in toilet and kitchen floor paving.

5. Summary

In a word, as a new type of material, plastics and their composites are very functional and targeted in terms of performance characteristics. Depending on the part used in the interior decoration, plastics with different characteristics can be used or modified to create more suitable plastic materials.

Therefore, in the process of interior decoration, the choice of plastic materials should not only consider the visual effect, but also pay attention to the physical characteristics of plastic materials. In the process of interior decoration, we should pay attention to the following points when choosing

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plastic decorative materials for design and application:

(1) Due to the variety, characteristics and styles of plastic decorative materials, designers can boldly conceive and design in interior design based on such material basis.

(2) The physical properties and chemical properties of plastic decorative materials cannot be surpassed or achieved by other materials, and their advantages should be brought into full play and applied to various parts reasonably;

(3) At present, the development of plastic decorative materials is rapid, and new plastic materials will continue to be developed. The choice should tend to be more green and harmless plastic materials.

In interior decoration, plastics and their composite materials have good development prospects and contain unlimited potential and possibilities, waiting for designers to discover and explore.

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References

[1] Zhou Xinjun. Research progress on application of polypropylene. Acetaldehyde acetic acid chemical industry. 2018(06):23-31+22+19.
[2] Feng Nan, Huang Lei. The Application of Plastics in Modern Interior Soft Decoration. Plastics Technology. 2020, 48(10):135-138.
[3] Xue Haoyang. Analysis of the application of environmental protection materials in interior decoration design. Western leather. 2019, 41(03):82.
[4] Pan Yu, Wang Yu, Shi Yingfang. Application of honeycomb sandwich plastic plate in interior space decoration. Acetaldehyde acetic acid chemical industry. 2020, 48(11):138-142.
[5] Luo Sha. The perfect combination of technology and art-the application of polymer materials in interior design Nanjing Forestry University, 2011.
[6] Zhao Danqing, Ge Zhaohui, Chen Ying. Application of plastic and its composite materials in interior decoration materials. Plastics Technology. 2020, 48(07):149-153.
[7] Xie Mengyuan. Application of Plastics in Interior Decoration Materials Synthetic resins and plastics. 2020, 37(05):99-102
[8] Li Xiaogang, Wang Rui, Jin Li. Discussion on the application of plastic decorative materials in interior design. Plastics Technology. 2020, 48(04):139-141
[9] Tu Jun. The application of recycled plastic building materials in modern home design. Synthetic resins and plastics. 2018(11):100-102.
[10] Zhong Wenhan, Huang Zhenwei, Chen Mingxia. The application characteristics and prospects of polycarbonate furniture. Furniture. 2015(03):12-16+23.
[11] Pu Bo. Application Analysis of Plastic Decoration Materials in Interior Design. Plastics industry. 2018, 46(02):144-147.
[12] Jiang Yuming, Liu Zhiyi. Analysis of green environmental protection design in building interior decoration design. Habitation. 2018(35):25.
[13] Wang Shiyuan. Development trend of nanocomposites. Global Market Information Bulletin. 2018, (30):182.
[14] Zhang Qiang, Cui Xianmin. Study on irradiation test of a conductive plastic film potentiometer. Spacecraft environmental engineering. 2016, 33(6):639-642.
[15] Deng Xinyue. The characteristics and application of wood-plastic composites big technology. 2016, (33).
[16] Zhou Yu. Polyurethane foam material and polystyrene foam material in interior design application comparison. Synthetic resins and plastics. 2019, 36(6):40-44.