

The Influence of Materials on Industrial Product Design

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Abstract

The manufacturing process begins with the design finalization, materials selection, combination, and finally complete the production of products. The materials always take a very important position in industrial design. However, material selection is essential to a successful design. This article mainly explores the role of materials, especially aesthetic feeling of products, and the characteristics of materials in industrial product design.

Keywords

Materials, industrial design, product design, material selection, environmental factors.

1. The Age of Materials

The new materials has a very important status in the human society development. The Stone Age, The Bronze Age, and the Iron Age, even entire epochs have been named for materials. Every new era of human society is accompanied by the emergence of new material. The 20th century is often known as the Silicon Age because many breakthroughs in materials science have led to silicon chips and the information revolution. In addition, other new materials are changing the lives of modern people. Modern skyscrapers are built with steel or reinforced concrete frameworks and curtain walls of glass or polished stone. the celluloid were made of polymer, which produces photographic images on a flexible material was a crucial step toward making possible the advent of motion pictures. Both aluminum and heavy nickel superalloys often exhibit a combination of high strength and low weight, these alloys became widely used in many forms of industry, including the construction of modern aircraft. Bioceramics' properties of being anticorrosive, biocompatible, and aesthetic make them quite suitable for medical usage. No matter what our society is like, we can not do without material. There are many factors that affect product design, the type of materials is one of the most important.

2. Types of Materials

2.1. Natural Materials

The earth is rich in natural materials like stone, wood, mud, bamboo, ore, natural-fiber, and metals. The designers use those materials to improve the quality of life with with great creativity and imagination.

2.2. Synthetic Materials

Synthetic materials are artificial materials produced by organic chemical synthesis. Plastics are typically organic polymers of high molecular mass and often contain other substances. They are usually synthetic, most commonly derived from petrochemicals. Because of their low cost, ease of manufacture, and versatility, plastics are used in a multitude of products of different scale, including paper clips and spacecraft. They have prevailed over traditional materials, such as wood, stone, horn and bone, leather, metal, glass, and eramic, in some products previously left to natural materials.

2.3. Composite Materials

A composite material (also called a composition material or shortened to composite, which is the common name) is a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components. The individual components remain separate and distinct within the finished structure, differentiating composites from mixtures and solid solutions.

The new material may be preferred for many reasons: common examples include materials which are stronger, lighter, or less expensive when compared to traditional materials.

More recently, researchers have also begun to actively include sensing, actuation, computation and communication into composites, which are known as Robotic Materials. Typical engineered composite materials include: reinforced concrete and masonry, composite woods, reinforced plastics, ceramic matrix composites, metal matrix composites, and other Advanced composite materials.

Composite materials are generally used for buildings, bridges, and structures such as boat hulls, swimming pool panels, racing car bodies, shower stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks.

2.4. Environmental Protection Materials

The world economy could grow fast in this century. This will put enormous pressure on Earth's resources. We must follow the principles of environmental protection and sustainable development in practice. So a number of designers came up with environmental friendly clothes that used organic cotton, organic bamboo fibers, fabric remnants, post consumer plastic including soda bottles, discarded fishnet, recycled nylon, even soy (all of which used eco-friendly dyes). In the recent years, bamboo, this renewable material, which has become the world's most recognized green materials because of its wide variety of applications across a number of industries. This is due to bamboo's rich appearance, relentless durability and sustainability factor. The uses of bamboo can be found all the way from the construction and building industry, to clothing, housewares, furniture and now it has rapidly expanded into the pet industry.

3. Material Perception

The perception of materials is a process which the cognitive experience of materials acting on human beings. Texture is the perceived surface quality of material in the design. It is an element of two-dimensional and three-dimensional designs and is distinguished by its perceived visual and physical properties.

The physical texture is the patterns of variations upon a solid surface. This can include -but is not limited to- fur, wood grain, sand, smooth surface of canvas or metal, glass, and leather.

Physical texture differentiates itself from visual texture by having a physical quality that can be felt by touching the surface of the texture. Specific use of a texture can affect the smoothness that an artwork conveys. For instance, use of rough surfaces can be visually active, whilst smooth surfaces can be visually restful. The use of both can give a sense of personality to a design, or utilized to create emphasis, rhythm, contrast, etc.

Material perception consists of two levels of concepts: one is the texture, which is the formal element caused by the geometric details of the surface; the other is the material properties, which are the content elements caused by the physical and chemical properties on the material surface. Material sense has two basic attributes at the same time: one is the physiological attributes, that is, the surface of the material acts on the human tactile and visual sensory system stimulating information. Such as: hard and soft, rough and delicate, warm and cold,

rough and smooth, dry and wet, etc. The second is the physical properties, that is, the material surface conveys the meaning of information to the perceptual system.

4. Selection of Design Materials

The product functions are performed by materials. Materials and structures are necessary for satisfying products. Usually there is a relatively definite relationship between material and structure, at the same time there is an uncertain relationship between structure and function, so there is also an uncertain relationship between material and function. In other words, we can use a variety of materials in order to achieve the same function, and each material can form a reasonable structure to complete the desired function, and then produce the corresponding form of modeling. When a designer makes a product, he must first consider what to choose material. The quality of material selected has a great influence on the internal and external quality of products.

Usually, we should pay attention to several aspects in material selection.

(1) Functional factors

① Safety performance. Material selection must be in accordance with the relevant criteria and take full account of the risks that may be foreseen.

② Appearance requirements. The appearance of a product is largely influenced by its visible surface, and takes the form of structure that the material allows to be manufactured.

③ Technical performance. The process performance required by the material is closely related to the processing routing of parts manufacturing.

(2) Market factors

The designers must evaluate the requirements of the target consumer group. As to materials, consider that the influences of the types of common products on consumer's attitudes. The materials expected by consumers sometimes that the designers are not prepared to adopt. Moreover, for certain products, the materials selected by consumers are sometimes bound by traditional customs. The selection of a new material may not be accepted by the consumers in a certain period.

① Accessibility. When considering the use of a certain material initially, the designer should first know whether there is such material at hand. If not, let's see if we can get it within a specified time limit. If the material needed is not available within a specified time, another material must be considered instead.

② Economy. The economy of selecting materials always plays a very important part in industrial design. While satisfying the use requirements, artistic modeling, technology, and accessibility, it is best to choose the domestic materials at lowest cost, to achieve the greatest economic benefits, and to make the products have the strongest competitiveness in the market.

(3) Environmental factors

① Selecting the same materials. When we design the products, the same kind of material should be used as far as possible so that the products can be recycled and reused.

② Reduce surface decoration. The product is made directly from raw materials without any coating or plating on the surface, this to recover and reuse easily.

③ Degradable materials. Degradable materials can be decomposed naturally after being abandoned and absorbed by the nature. Plastic waste, especially plastic packaging materials, is a tough problem in the process of plastic molding, processing and use.

④ Waste recovery . We should make full use of waste materials to facilitate recycling of resources. The reuse of waste can not only effectively reduce the amount of waste that may pollute the environment, but also greatly save raw materials. Therefore, it will be of great

significance for using recycled material to make products, or even directly from waste, and should become an important subject in modern industrial design.

5. Summary

Along with the new materials continue to emerge, each material has its own special function, it has brought endless imagination to the designer. The value of material during product design does not lie in whether the material itself is high-grade and expensive but in whether the material itself can properly express the connotation of the product. The material is to express itself through the product. When it is used in the design and production process of various products, material has a substantial content, and then shows the beauty of material. This requires designers in the use of material language must understand its personality, using appropriate materials to express the corresponding products, to meet the needs of consumers. With the diversification of science and technology, the development of materials is also varied. Multi-material configuration, such as hard material and soft material, rough material and delicate material configuration contrast, mutual display of its material performance, show its beautiful attributes, material and product design are interactive, sometimes a design promotes the improvement of the process to achieve the unique function of the product. Sometimes a new technology, new materials can react with the design, which this stimulate more creative inspiration of designers, promote the sublimation of design. Nowadays, the development and application of nano-materials and technology provide basis and technical support for more high-tech products, and provide a broader design space for designers.

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