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Research of New Molded Silicone Rubber in Value Silicone

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Abstract

The special function of silicone rubber stems from its unique molecular structure, which has both inorganic and organic properties, and is superior to ordinary organic rubber in performance. As some industries require more reliable elastomers, these silicins are also rapidly expanding. Review the synthesis, general properties, applications and nanocomposites of silicone rubber. New molding silicone rubber as a new form of silicone rubber, is widely used in the value of silicone to replace petrochemical products, for aerospace, arms industry, automotive, construction, electrical and electronics, medical and food processing industry and other industries, plays an important role in value silicone, this paper first introduces the new molding silicone rubber, then analyzes its advantages, finally analyzes the application of new molding silicone rubber in value silicone.

Keywords

New add molding; Silicone rubber; Value silicone; Silicone industry

1. Introduction

Silicone rubber is a biocompatible and sustainable material with numerous applications. We specialize in the production of silicone parts, and we manufacture these parts using different types of silicone rubber. This material not only offers excellent properties in terms of moldability and durability, but is also sustainable and environmentally friendly.

2. Overview of New Addition-forming Silicone Rubber

New addition-forming silicone rubber is an injection molding process where it is molded over, under, or through a base material to create the final part. This manufacturing process supports variations in hardness and stiffness, allowing product designers to combine the advantages of both materials. For example, soft silicone rubber can be molded over a handle or lid made of hard plastic. The plastic provides strength and stiffness, while the silicone rubber offers a soft touch.

New addition-forming silicone rubber, also known as in-mold assembly, supports ergonomics, color variations, and brand identity in applications such as healthcare and baby care. A representative from Shenzhen Jinlian Technology Co., Ltd. stated, "As a coating material, silicone also imparts functional properties such as impact resistance, vibration damping, and environmental resistance. New addition-forming silicone rubber adds value to product design, but it's important to start with some basic principles. Designers also need to understand the role of technology and molds in successful projects."

2.1 Basic Principles

New addition-molded silicone rubbers are not simply a layering process. Instead, the overmold is assembled with the base material. The strength of this chemical or mechanical bond is critical, but bonding silicone to non-silicone materials is difficult. For particularly challenging material combinations, the base material may require flame, corona discharge, or plasma treatment. However, typically, bonding is achieved by mechanical undercuts, protrusions,

or indentations that prohibit the part from being ejected from the mold. Undercuts support overmolding, but these part features increase the cost and complexity of the mold. Overmolding one hardness and color onto another of a different hardness and color is also a specialized discipline. Differences in molding techniques must also be considered [1].

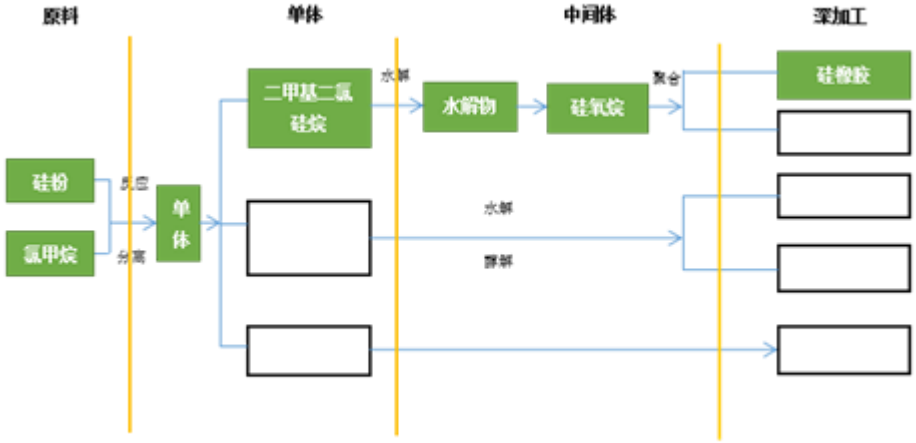

Figure 1. Silicone industry chain.

2.2 Technology

New addition-molded silicone rubbers can be made by multi-shot molding or insert molding. In two-shot molding, the first shot is the base material and the second shot is the overmold. A press with multiple barrels injects two different resins into the same injection mold tool. The entire operation uses a single machine in a continuous process, but because both the mold and the machine are more expensive, two-shot molding is more suitable for high-volume production. Insert molding involves placing a substrate into a mold and then overmolding a portion or all of the substrate. To achieve optimal bond strength, the molder may need to preheat the substrate to bring its surface temperature closer to the melt temperature of the overmold. Insert molding is more cost-effective than two-shot molding for smaller volumes; however, insert molding requires a tool for the substrate and a separate core and cavity to create the volume for the overmolding material.

2.3 Silicone Rubber Overmolding Process

The liquid silicone rubber overmolding process consists of two steps: placing the finished plastic or metal body into the mold section of a new additive silicone rubber mold, and then overmolding the new additive silicone rubber directly onto the part. The molded substrate can be made of multiple, identical or different materials. Generally, widely used prefabricated substrates include non-toxic thermoplastics and metals. The addition of substrates helps modify the appearance and hardness of silicone products as desired. Consequently, silicone overmolding can provide waterproofing, insulation, shock absorption, and sealing properties to the substrate. It can be said that silicone overmolding adds value to product design.

Liquid silicone overmolding can be further subdivided into insert molding processes, depending on the substrate material and placement. From a practical perspective, insert molding typically uses metal as the substrate material, as metal generally offers higher hardness gains. "During overmolding, it's crucial to ensure the substrate can withstand high temperatures, a crucial prerequisite for proper curing of the liquid silicone rubber. Furthermore, Xintuo Silicone will test the adhesion between the substrate and the new additive silicone rubber to optimize production details."

Tooling and mold costs aren't the only consideration for designers. A sharp transition is required between the overmold and substrate. The overmold also needs to avoid thinning or feathering to prevent delamination. Regarding gate size, the ratio of flow length to wall thickness is crucial for adhesion. To minimize flow length, the gate is located in the thickest wall area. Because air entrapment can interfere with adhesion, the mold needs to have deep enough vents to avoid flashing.

One benefit of the new additive silicone rubber parts and components is that the manufacturing process allows

for the use of non-plastic substrates, such as steel. It's worth noting that, with the exception of other thermoplastics and newer addition-type silicone rubbers, overmolding is the only way to incorporate the material into the injection molding process.

3. Advantages of New Addition Silicone Rubber

Addition silicone rubber/plastic injection molding is a cost-effective and versatile process used by manufacturers across numerous industries and applications. From handles overmolded with new addition silicone rubber to complex electronic assemblies, there are numerous reasons why rubber overmolding is a good choice for customer projects.

Cost and Time Savings. By molding silicone rubber directly onto a metal or plastic substrate, customers eliminate the expense and time required to manually assemble complex parts. This can significantly reduce manufacturing costs and turnaround time, enabling customers to bring products to market more economically. Overmolding allows for the assembly of different components in a single process, which clearly generates higher returns for customers. The process primarily involves overmolding a thermoplastic substrate after it has been molded, within the same mold and on the same machine. The overmolding process is beneficial because it allows for the integration of materials, components, and multiple functionalities into a single part. These are permanently fused, providing a better and more cohesive result.

Design Flexibility. New addition silicone rubber/thermoplastic injection molding is an excellent choice for meeting the complex design requirements of the automotive and medical industries. Silicone rubber overmolding produces parts that are waterproof, airtight, and more resistant to shock and vibration.

Quality Control. The new additive silicone rubber/plastic injection overmolding process offers high tolerances and stringent quality controls, making it suitable for any application requiring precision. Shenzhen Jinlian Technology Co., Ltd. said: "Overmolded silicone rubber parts can be produced to the exact specifications of the customer, and product certification is limited to two materials instead of five, plus adhesives and adhesion promoters [2]. The process capabilities of properly designed and molded additively molded silicone rubber parts are no different from those in the thermoplastic world. Variations require that tolerances be applied to the individual components in the assembly. The tolerance stack will then be greater than any single component. By combining the assembled components in the case of multiple components, the tolerance stack can be folded.

The application range is wide. This process can enable various materials to be combined with each other, so such products can often be extended to areas that are difficult to reach with traditional silicones. The most typical examples are the medical and automotive industries, which have complex requirements for parts.

Since we have a two-component silicone rubber molding system, we can also obtain the best functions of both materials. We are able to eliminate the need for post-molding assembly operations. The initial investment is reduced because we only need a single tool to create the part. The inspection and qualification costs of the tool are also reduced, which is something to consider. Since the process only involves one machine cycle, it is actually very efficient, which allows us to focus on providing the best quality and experience while providing amazing results and a very comprehensive experience.

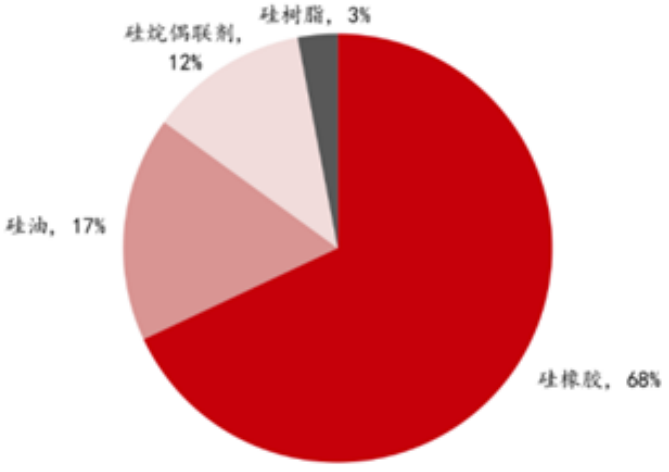

Figure 2. Silicone applications.

4. Applications of New Addition Silicone Rubbers in Value-added Silicones

New addition silicone rubbers have a wide range of applications in value-added silicones, such as wearable devices, mechanical reinforcement, gaskets, seals, fluid components, medical catheters, and electronics.

Some of the most highly purified silicone rubbers are used in insulating tapes, sealants, varnishes, lubricants, keyboards, and housings. High thicknesses of rubber can be injection molded into insulators and lightning arresters. Aerospace silicone rubber is used in space suit fabrics, tooling materials, seals and gaskets, and other products used in aircraft manufacturing and maintenance. The construction industry uses silicone rubber for adhesives, sealants, and coatings thanks to its weather resistance and ability to bond to metals. Automotive applications include shock-resistant and weather-resistant parts as well as coatings and varnishes, but only the most heat-resistant, oil-resistant, and fuel-resistant types are used for these purposes. Medical silicone rubber can be found in tubing, adhesives, and defoamers. Consumer products using this material include non-stick bakeware, food containers, tableware, toys, and jewelry, including silicone rubber bracelets[3]. However, it can also be found as an ingredient in shampoos, laundry soaps, cosmetics, and deodorants. It is important to note that with proper material selection, many plastic substrates require a lower glass transition temperature than the addition silicone rubber to cure properly. Where possible, select a base material with a glass transition temperature above 300°F to ensure proper cure. Also consider using one of the newer "primerless" or "self-adhesive" grades of addition silicone rubber. These formulations bond well to thermoplastics themselves.[4] Keep your thermoplastic substrate free from contamination; any contamination will affect adhesion, so it is important to keep the substrate clean before overmolding. This problem is less severe if the substrate is molded in a two-piece mold along with the addition silicone rubber, rather than being molded separately and transferred from one machine to another. This is why, whenever possible, it is best to use a two-piece molding technique rather than transfer sleeve molding.

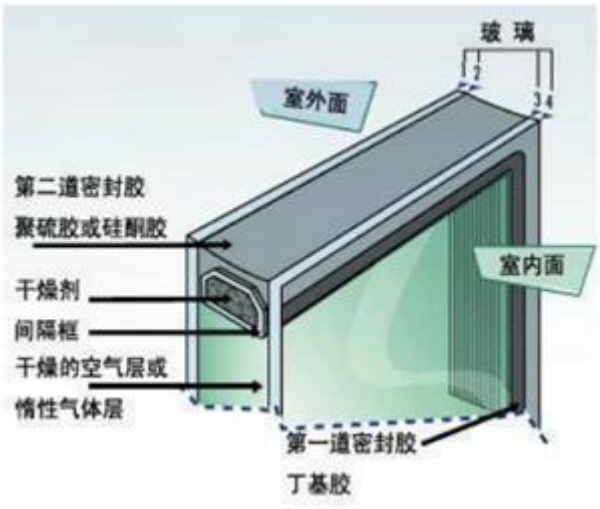

Figure 3. Application diagram.

5. Conclusion

In recent years, overmolding has become a fundamental technology for component manufacturers. It offers significant value by reducing assembly costs, improving quality, and expanding device design possibilities.

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