



Development of silicone rubber coated fiberglass thermal insulation gasket

When the power tube is radiating, adding insulation layer of insulating media as thermal material between heating element (power tube) and the radiator, such as mica, polyester film, PTFE, etc., this method has some effect, but with the shortages of poor thermal conductivity, mechanical properties. Since only 40% of the rated power can be used, this method has been eliminated, so take silicone rubber coated glass cloth thermal conductivity insulating gasket as thermal conductivity material, to ensure the insulation properties of the premise, not only improve the thermal conductivity, but also improve the strength of silicon rubber, and it's widely used in the automotive industry, computer industry, radiators, power supplies, military supplies and electrical motor controller.

Experimental material

110-2 silicone rubber, conductive filler boron nitride, fiberglass cloth ($S = 0.1$ mm), solvent gasoline is commercially available industrial product.

Instrument and equipment

High - voltage breakdown tester TK - 1, thermal conductivity tester for the TC - 35, coating machine MATEX 1 200 mm, Drum equipment $T 700 \times T 1 800$.

Technological process

Semi-finished fiberglass fabric → Dewaxing → Pretreatment → Coating → vulcanization → Trimming → Inspection → Warehouse

Results and discussion

Effect of thermal filler on thermal conductivity of silicone rubber

The insulating properties of metal oxides as the main thermal conductivity filler, to investigate the different types of thermal conductive filler on the thermal conductivity of silicone rubber results, pls check Table 1.

Table 1 thermal conductivity of silicone rubber filled with different types of thermally conductive fillers

Type	Thermal conductivity filler	Filler	Heat conductivity coefficient	Breakdown voltage
		(mass fraction)	W/(m. K)	kV/mm
	Al2O3	0.50	0.6	18





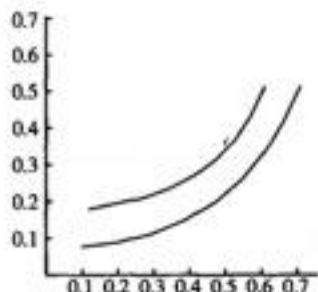
Silicone formula 1#	Al2O3	0.75	0.9	17
	BN	0.50	0.8	18
	BN	0.75	1.2	17
Silicone formula 2#	Al2O3	0.50	0.6	18
	Al2O3	0.75	0.95	18
	BN	0.50	0.9	19
	BN	0.75	1.2	18

Remark: Silicone formula 1#: 110-2 silicone 100; The hydroxyl silicone oil 4; Reinforcing agent 25; Vulcanizing agent 1. 2; The silicone formula 2 # : 110-2 100 silica gel; Diphenyl 2 hydroxyl silane 5; Reinforcing agent 30; Vulcanizing agent 1. 0; size distribution of Al2O3 and particle of the BN are same.

From Table 1, Al2O3 and BN have different influence on heat conductivity of silicone rubber, when the amount of the filler is similar to BN, the heat conductivity of silicone rubber can be increased. Thus, the heat conductivity is related to the type of the filler, coefficient of heat conductivity increases with an increase in the amount of heat conductive filler. Meanwhile, from table 1, with the same amount of heat conductive filler on the silicone rubber formulations 1 #, 2 #, the heat conductivity is almost the same, it means that the type of silicone oil and the degree of sulfide do not affect the heat conductivity of silicone rubber obviously. Different types of metal oxide thermal insulation filler on the insulation properties of silicone rubber has little effect.

Effect of particle size distribution of heat conductivity filler on thermal conductivity.

Al2O3 as a thermal conductivity filler, and add sample, the effects of different thermal conductivity of filler particles on the thermal conductivity were investigated, pls check Pic 2.



Pic 2 Effect of thermal conductivity filler with different particle diameters on thermal





conductivity

From Pic 2, that the samples with the two particle sizes have a higher thermal conductivity than those with a single particle size filler. This is mainly due to the particle-filled polymer system. For modulus, relative dielectric constant are affected by the particle size distribution of the filled particles. When the amount of filling is large, the particle size distribution of the filler is mainly affected by the maximum stacking fraction ϕ_m (ϕ_m = the actual volume of the filler/the apparent volume of the filler) of the filler, thus, when the particle size distribution of the filler changes, the maximum stacking fraction will also change.

The influence of coating process on rubber fabric products appearance.

The main factors affecting the dimensional accuracy of the main coating products are the mortar concentration. Rubber concentration is too high, although the coating of the efficiency, the thickness is uneven; if the rubber concentration is low, although the product accuracy meets the requirements, but the efficiency is very low, high cost, and don't have market competitiveness. After repeated tests, the best rubber concentration is 30%.

The quality of the coating machine is also an important factor affecting the coating process. The newest coating machine is much better than the old coating machine on the precision, automated program. The newest coating machine keeps the tolerance within 0.05mm, but the tolerance for old machine within 0.20mm. Thus the quality of the coating can be increased with the newest coating machine.

The influence of vulcanization process to the appearance of the rubber fabric product.

We take three methods of hot air vulcanization, compression vulcanization and vulcanization. Hot air vulcanization by the impact of the surface coating; molding segmentation vulcanization efficiency is low, and also affected by human relatively; drum sulfide curing can overcome the shortages of the first two vulcanization methods, this product is very adaptable.

Conclusion

① The effect of different types of thermal conductivity filler to silicone on the thermal conductivity is different, the thermal conductivity increases with the increase of the amount of conductive filler, meanwhile, silicone oil type and different vulcanization process on the thermal conductivity of silicone rubber has little effect. ② Different heat conductivity of filler particles on the thermal





conductivity of different effects, of which two kinds of particle size of the filler than the single particle size filler with high thermal conductivity. ③ The concentration of rubber has a great impact on the coating process, the appropriate concentration is about 30%, meanwhile, the quality of the coating machine is also an important factor in coating process. ④ The appearance of drum sulfur vulcanized silicone fabric products is good.

