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ELECTRICAL INSULATION

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The present invention relates to electrical insulation and particularly to improved electrical insulation compositions which contain plasticized polyvinyl halides.

Plasticized polyvinyl halide compositions, such as those described and claimed in Semon Patent 1,929,453 of Oct. 10, 1933, are synthetic rubber-like compositions. For example, gamma polyvinyl chloride plasticized with tricresyl phosphate yields a composition which is rubber-like in character but is not as susceptible to chemical attack as is rubber. These compositions are, however, electrically poor in character since they exhibit high power factor and high dielectric losses, particularly at higher voltages and high temperatures.

In accordance with the present invention, it has been discovered that a lead salt of a phenol markedly improves the electrical properties and electrical stability of plasticized polyvinyl halides.

One example of the invention is an electrical insulation composition comprising polyvinyl halide, tricresyl phosphate and the lead salt of p-tertiary amyl phenol. It was found, for example, that a composition containing 60% by weight of polyvinyl chloride and 40% by weight of tricresyl phosphate, which exhibits a power factor at 90° C. and 60 cycles of 98% and a loss factor (ϵ'') of the order of 4500, is so improved by the addition of as little as 3% of the lead salt of p-tertiary amyl phenol, that the power factor at 90° C. and 60 cycles is 0.084 and the loss factor is 0.780.

Another example of the invention is an electrical insulation composition containing polyvinyl chloride, tricresyl phosphate and basic lead phenolate. Such a composition containing 2% by weight of the lead phenolate shows a power factor at 90° C. and 60 cycles of 0.121 and a loss factor of 1.17.

In carrying the invention into practice it is important properly to incorporate the class of compounds in question with the plasticized polyvinyl halide composition. The ingredients preferably are compounded by milling on differential rollers such as are used in standard rubber compounding practice, but it is important that the rolls be set at the proper distance from each other and that the temperature and time of milling be carefully controlled. The setting of the rollers must be determined from their size and the temperature and time of milling is dependent on the size of the batch being compounded. For example, using a 100 gram batch of a composition containing

	Per cent
Polyvinyl chloride	57.5
Tricresyl phosphate	40.
Lead salt of p-tertiary amyl phenol	2.5

in which the lead salt was first incorporated in the tricresyl phosphate at room temperature and the solution thoroughly dispersed into the dry polyvinyl chloride, it was found that the optimum results on a 6-inch diameter laboratory mill in which the rolls were travelling at 32 R. P. M. were obtained when the rolls were set approximately 3 to 10 mils apart and a temperature of 126 to 132° C. was used. There was a very decided lowering of the electrical losses for the first 20 to 30 minutes of milling after which further milling produced only slightly lower electrical losses.

An advantageous addition is a finely divided carbon black such as the carbon black known to the trade as Dixie Special #102. The use of a small percentage, say about 2% of the finely divided carbon black, with the compositions of the present invention produces a still further lowering of the electrical losses.

Ageing of the compositions of the invention at elevated temperature for a period of time also has a beneficial effect in handling large factory batches. For example the dielectric losses can be considerably reduced by allowing the compositions to age in an air oven at 125° C. for several hours.

The following table shows illustratively examples of some of the various compounds which may be used in carrying out the invention together with electrical data on power factor and loss factor (ϵ'') as compared to a composition containing 60% polyvinyl chloride and 40% tricresyl phosphate:

Percent polyvinyl chloride	Percent plasticizer (tricresyl phosphate)	Lead salt of—	Percent	Percent carbon black	Power factor 90° C. 60 cyc.	Loss factor (ϵ'')
60	40				98	4500
57	40	p-Tertiary amyl phenol	3		0.084	0.780
58	40	β-Naphthol	2		0.440	4.96
58	40	Tertiary amyl β-naphthol	2		0.238	2.46
58	40	p-Phenyl phenol	2		0.135	1.37
58	40	o-Phenyl phenol	2		0.108	1.10
55.5	40	o-Phenyl phenol	2	2.5	0.0406	0.450
58	40	2-4 di-amyl phenol	2		0.103	1.17
58	40	o-Ethyl phenol	2		0.380	4.22
58	40	Phenol (basic)	2		0.121	1.17
54.5	40	Phenol	2.5	3	0.0502	0.576

It is to be understood that the compounds, proportions and figures given are illustrative of the invention but not limiting in character. The term "a lead salt of a phenol" as used in the claims is intended to embrace the lead salts of the higher phenols such as the naphthols and substituted naphthols.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. Electrical insulation having low power factor and low electrical loss factor comprising gamma polyvinyl chloride, tricresyl phosphate and a lead phenolate.

2. Electrical insulation having low power factor and low electrical loss factor comprising gamma polyvinyl chloride, tricresyl phosphate and a lead salt of p-tertiary amyl phenol.

3. Electrical insulation having low power factor and low electrical loss factor comprising gamma polyvinyl chloride, tricresyl phosphate and a lead salt of a phenol.

4. Electrical insulation having low power factor and low electrical loss factor comprising plasticized gamma polyvinyl chloride, a lead salt of a phenol, and a finely divided carbon black.

5. Electrical insulation having low power factor and low electrical loss factor comprising gamma polyvinyl halide, plasticizer and a lead salt of a phenol.

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