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ELECTRICAL INSULATING MATERIAL

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The present invention relates to rubber-like material and has for its object the production of elastic non-thermoplastic objects made from non-thermoplastic non-heat-convertible organic material by a process of plasticization and thermo-setting.

Many processes are well known in the art, and they follow two general methods: (1) Mixing the original material with a suitable plasticizer whereby it can be formed, molded, or extruded as the desired object and, (2) mixing the material with a suitable thermo-setting material whereby the object, after formation, molding, or extrusion, may be thermo-set into a non-plastic, non-heat-convertible state.

By heat-convertible is here meant susceptibility to change in chemical composition by exposure to temperatures below 250° F.

My invention consists in using a single material both as plasticizer and thermo-setting material. This has the advantage of eliminating the effect that ordinary plasticizers and thermo-setters usually work against one another in attaining some desired property of the final object of manufacture.

As an example of this process I select a non-thermoplastic non-heat-convertible hydrocarbon of molecular weight over 5000 such as Vistanex, with the object of making insulation for electric conductors. A suitable thermo-setter and plasticizer for this purpose would be commercial rubber hydrocarbon but this is too viscous to act as a plasticizer. I, therefore, reduce the viscosity of the rubber by chemically controlled oxidation, i. e., oxidation by a small proportion of oxygen activated by a catalyst. Organic catalysts, such as mercapto-benzothiazole, have been found suitable but there are many materials, known to organic chemists, which may be substituted therefor.

My process, in the case of Vistanex, consists in milling the rubber with the catalyst until a degree of plasticity is obtained, permitting the milled mixture to be extruded with the equipment customarily used on rubber compounds commonly made. The rubber thus processed is then milled with Vistanex until homogeneity is attained. Mineral activators, such as zinc oxide and whiting, are then added, followed by anti-oxidants and accelerators such as are used in rubber compounding. Finally the curing agents, such as sulphur, selenium and/or tellurium, are added.

The mixture may be formed by any process known to the art. In the case of insulated wire, the mixture may be applied to the wire by extrusion or the strip method. In any case, the formed object is thermo-set by heat and pressure as in ordinary vulcanization.

By the above process, I am able to make a Vistanex insulation containing over 40% Vistanex by weight, having a very desirable and hitherto unattainable combination of electrical, mechanical and chemical properties.

A specific case is that of a wire insulated with compound prepared as described above and containing, by weight, 50% Vistanex, 41% plasticized rubber, 2% zinc oxide, 1% whiting, 2% stearic acid, ¾% sulphur, the remainder being the usual pigments, organic accelerators and anti-oxidants known to those conversant with the art.

The properties are as follows:

Tensil strength, lbs./sq. in	730
Elongation at break from 2" to	11.6"
Set, after elongation from 2" to 6"	3/16"
S. I. C., 60 cycles, 70° C	2.7
Power factor, 60 cycles, 70° C., per cent	0.4
Power factor, 1000 cycles, 70° C., per cent	0.4
Dielectric strength, volts/mils	475.
Acetone extract, percent	4.0
Appearance of acetone extract	Straw color
Chloroform extract, over	40.0
Appearance of chloroform extract	Colorless
Flexibility at low temperatures	Very good
Specific gravity (important for portability	0.97
Ability to resist sun-checking	Very good
Megohm constant per mile	10,000.

This combination of properties makes this insulation particularly desirable for high voltage power cables and for communication cables.

As far as I know the only available organic materials which are non-thermoplastic and non-heat-convertible, are hydrocarbons which are soluble in chlorinated solvents, such as chloroform. I can, therefore, use the physical properties of the chloroform extract as an indicator of the characteristics of the non-thermoplastic hydrocarbons used.

The particular physical property of the chloroform extract most useful as an indicator of Vistanex content is the "Viscosity Index". This is a number expressing the effect of temperature on viscosity and as such may be used as an index of thermoplasticity. A value of over 200 would