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(54) **POLYURETHANES DE POLYETHER CONDUCTEURS D'ELECTRICITE**

(54) **ELECTRICALLY CONDUCTIVE POLYETHER POLYURETHANES**

(57) L'invention se rapporte à un procédé de fabrication d'un élastomère de polyuréthane conducteur d'électricité à partir d'un prépolymère de polyol de polyéther. Ledit procédé consiste à mélanger un prépolymère de polyol de polyalkylèneéther à terminaison isocyanate, de préférence un polyol de polyalkylèneéther à terminaison TDI ou MDI, avec des sels métalliques conducteurs, tels que du $CuCl_2$ dispersé dans un porteur miscible avec un prépolymère, de préférence du tri(bétachloropropyl)phosphate. On obtient ainsi un polymère durci avec une bonne conductivité, qui conserve toutes ses propriétés.

(57) A process is disclosed for making an electrically conductive polyurethane elastomer from a polyether polyol prepolymer by blending an isocyanate terminated polyalkyleneether polyol prepolymer, preferably TDI and MDI terminated polyalkyleneether polyol, with conductive metallic salts such as $CuCl_2$ dispersed in a prepolymer-miscible carrier, preferably tri(betachloropropyl)phosphate, thus providing a cured polymer with good conductivity while retaining its performance properties.

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(57) Abstract

A process is disclosed for making an electrically conductive polyurethane elastomer from a polyether polyol prepolymer by blending an isocyanate terminated polyalkyleneether polyol prepolymer, preferably TDI and MDI terminated polyalkyleneether polyol, with conductive metallic salts such as $CuCl_2$ dispersed in a prepolymer-miscible carrier, preferably tri(betachloropropyl)phosphate, thus providing a cured polymer with good conductivity while retaining its performance properties.

ELECTRICALLY CONDUCTIVE POLYETHER POLYURETHANES

Technical Field of the Invention

The present invention is directed to a process for producing conductive and semi-conductive polyurethane materials. More specifically, the present invention is directed to a method of incorporating a conductive moiety into an isocyanate terminated polyalkyleneether polyol prepolymer to provide a polyether polyurethane material that controls electrostatic discharge while retaining its performance properties.

Background of the Invention

A noteworthy problem in the modern electronic age is the buildup and discharge of static electricity. It has long been known that static charges, which develop between isolated bodies, are discharged when those bodies are brought into close proximity. Potentials as high as 30,000 volts have been reportedly generated by a person walking on a synthetic carpet.

Electrostatic discharge (ESD) can affect electronic equipment in which semiconductor devices are used. Particular problems are found in computer systems, telecommunications equipment, guidance systems, medical equipment and in a variety of other industrial environments. Amongst these industrial applications are printing rolls, safety shoe soling, copy machine rolls, and factory vehicle wheels. In factory environments, ESD is a safety concern when sparks from equipment such as trucks can ignite vessels or reactors containing flammable material such as solvents. A static discharge of a few hundred volts can severely damage or ruin expensive electronic equipment or destroy stored computer data.

There are known classes of materials available for ESD protection. One type are plastics or elastomers which are impregnated with conductive carbon black. These require high loading -- about 20-30 phr would be typical. This amount of carbon black is not usually practicable for reasons of high cost, the dark color of the impregnated article, and the fact that the properties of the elastomer may be compromised due to this

high loading.

Conductive materials can also be made of inherently conductive polymers. Such conductive polymers include polyacetylene, polyphenylene, and polypyrrole. Dopants such as AsF_3, substituted quinones, $FeCl_3$, $HClO_4$, BF_4 or iodine may be added to improve conductivity. However, stability and compatibility problems as well as high cost and limited availability have limited the use of these materials for industrial ESD protection.

Charge dissipative materials achieve their electrical conductivities through the use of topical chemicals such as antistats. These substances do not normally conduct electricity themselves but absorb moisture from the air which provide conductivity. Typically, these antistats are small molecules which migrate to the surface of the plastic material containing them and provide conductivity through said moisture absorption.

The conductivity and ESD protective properties of these materials are therefore dependent on the humidity of the environment. The performance of these materials also decreases over time as the antistat which has migrated to the surface may be lost by evaporation, cleaning, or contact with other objects.

Other known materials that are used to protect polyurethanes from ESD are surface active agents, represented by internal electrostatic discharge control additives. Included among these materials are organic salts of sulfur or nitrogen such as cationic ethoxylated amides, tetraalkylammonium methosulfate, and quaternary ammonium compounds. These organic materials possess. limited conductive properties since only small amounts (typically, 1-2 phr) of the material may be incorporated into the polymer matrix due to the compromising of performance of the polymer.

As a class, metals are inherently better conductors of electricity than non-metals, due largely to their electronic structures. It would therefore be desirable, in most applications, to have a metal or metallic

compound present in the polymer to impart conductivity into the final product.

Dispersion of metal salts into a polymer matrix are typically non-homogeneous, thereby producing inconsistency in the conductive properties of the finished polymer product. Since the polymers in use in industrial environments today are organic and non-metallic, successful incorporation of conductive properties by metals or metallic compounds into polymer matrices has not been possible. This is due, in part, to the inherent insolubility or immiscibility of these two classes of substances. Incorporation of a metal ion into an organic polymer has been done by Davletbaev et al in SU 1071627 as reported in WPI accession number 84-242732/39. In this disclosure, copper dichloride was reacted with 2,4-toluene diisocyanate in acetone. The instant invention achieves polyurethane conductivity without said reaction by the unique ability to incorporate a conductive salt, such as copper dichloride, into the polymer matrix by first dissolving it in a plasticizer which is soluble in the polymer and which acts as solvent for the inorganic conductive metal salt.

US patent 5,077,330 discloses a conductive polyurethane with antistatic protection from a polyoxyethylene diol, diisocyanate, and dibutyltin bis lauryl mercaptide.

European Patent Publication 566 418 A2, October 20, 1993 discloses conductive polyurethanes made by mixing chain extenders (polyol or polyamine) into an isocyanate-functional prepolymer with a solution of a metal salt. Isocyanate terminated polyester polyol prepolymers are the only polyurethane prepolymers exemplified. These polyester prepolymers when cured into polyurethane elastomers suffer from a number of disadvantages including: susceptibility to hydrolysis since the ester group is susceptible to attack by water causing rapid decline in physical properties. Polyesters further suffer from internal heat buildup when compressed and relaxed repeatedly. This heat buildup causes failure of the part. Polyester-based urethanes also suffer from

fungal growth and relatively poor low temperature flexibility.

It is therefore an object of the present invention to incorporate inorganic conductive materials into an isocyanate terminated polyalkyleneether polyol prepolymer organic polymer matrix. It is an additional objective to provide conductivity to the finished polymer product in its final use, particularly industrial use.

It is a further object of the instant invention to provide a conductive polymer, especially a polyether based polyurethane. Among these properties in the final products are hydrolysis resistance, excellent low temperature flexibility, fungal growth resistance and excellent hysteresis (low heat buildup during flexing and deformation) compared to polyester polyurethanes. These desirable properties may be measured by the physical properties of the polyurethane prepolymer as will be presented.

Summary of the Invention

It has now been found that conductive or semiconductive properties may be obtained in a polymer product without detriment to the mechanical or dynamic properties of the polymer product. These electrical properties are obtained by predissolving certain metal salts in a carrier containing an electronegative moiety and incorporating said carrier in a polymer composition.

In accordance with the present invention, a method is disclosed for producing an isocyanate terminated polyalkyleneether polyol prepolymer containing conductive metallic salts in its matrix. The metallic salts may be selected from those known to conduct electricity and whose cations may be represented by copper, aluminum, silver, nickel and the like. The anions of these salts are any of those which form salts with said cations. Typical anions may be represented by halogen, sulfate, phosphate or other such ions.

These inorganic salts are commonly known to be conductive. The process of this invention incorporates them into the polymer matrix and overcomes the insolubility of the inorganic salt into the organic polymer.

Since the salts are not soluble in organic media, particularly polyurethane prepolymer, the process of this invention is a unique and heretofore unknown solution of transforming an organic polymer matrix into an electrically conductive material via an organic carrier.

The carrier may be any organic isocyanate-inert material which contains one or more electronegative moieties in its structure. Examples of these carriers include but are not limited to tri (beta-chloropropyl)phosphate, tributylphosphate and tributoxyethylphosphate.

Detailed Description of the Invention

In the practice of the invention, the process of imparting conductivity may be to any an isocyanate terminated polyalkyleneether polyol prepolymer containing conductive metallic salts. Preferred are TDI- and MDI- terminated polyalkyleneether polyol prepolymers containing conductive metallic salts and those prepolymers cured with polyols and polyamines to form polyurethane and polyurethane/urea products.

Aromatic polyisocyanates are well known and are widely used in the preparation of polyurethane and poly urethane/urea elastomers. These isocyanates generally include preferred aromatic isocyanates such as TDI- 2,4-toluene diisocyanate, 2,6-toluene diisocyanate and MDI- 4,4'-methylene bis (phenylisocyanate). Also included in the category of aromatic diisocyanates are, for example, toluene-2,4-diisocyanate, toluene-2,6-diisocyanate, naphthalene-1,5-diisocyanate, diphenyl-4,4'-diisocyanate, diphenylmethane-4,4'-diisocyanate, dibenzyl-4,4'-diisocyanate, stilbene-4,4'-diisocyanate, benzophenone-4,4'-diisocyanate, 1,3- and 1,4-xylene diisocyanates and their mixtures.

Aliphatic diisocyanates and triisocyanates may also be employed including 1,6-hexamethylene diisocyanate, 1,3-cyclohexyl diisocyanate, 1,4-cyclohexyl diisocyanate, methylene bis(4-cyclohexyl diisocyanate), the saturated diphenylmethane diisocyanate (known as H_{12}MDI), and the like. In the preparation of polyurethane and polyurethane/urea elastomers, the diisocyanates are reacted with a long chain (high

molecular weight) polyalkyleneether polyol to produce a prepolymer containing free isocyanate groups which then may be chain extended with a short chain (low molecular weight) polyol or aromatic diamine to form a polyurethane or polyurethane/urea elastomer. Long chain, high molecular weight polyols, e.g. those having a molecular weight of above 250, are generally utilized to form the prepolymer and the chain extender is generally a short chain polyol, e.g., C_2-C_{10} polyol, or an aromatic diamine. The long chain, high molecular weight polyol provides flexibility and elastomeric properties to the resin, while the short chain polyol or aromatic diamine provides chain extension or cross-links and adds toughness and rigidity to the resulting elastomeric polymer.

High molecular weight polyols, namely polyalkyleneether polyols having a number average molecular weight of at least 250, are used to prepare the prepolymer of the instant invention. Molecular weight of about 650 to 3000 is preferred, with molecular weight of 1000 being the most preferred. However, the weight average molecular weight of the high molecular weight polyol may be as high as 10,000 or as low as 250. The preferred polyalkyleneether polyols may be represented by the general formula $HO(RO)_n H$, wherein R is an C_1 -C_8 branched, straight or cyclic alkylene radical and n is an integer large enough that the polyether polyol has a number average molecular weight of at least 250. These polyalkyleneether polyols are well-known components of polyurethane products and can be prepared by the polymerization of cyclic ethers such as alkylene oxides and glycols, dihydroxyethers, and the like by known methods. Polytetramethyleneether glycol (PTMEG) and poly-propyleneether glycol (PPG) are the preferred polyalkyleneether polyols.

The total polyalkyleneether polyol blend portion of the instant invention can be combination of high MW polyol, as previously described, and a low molecular weight polyol. An aliphatic glycol is the preferred low molecular weight polyol. Suitable aliphatic polyols are ethylene glycol, diethylene glycol, dipropylene glycol, neopentyl glycol,

1,3-butanediol, 1,4-butanediol, and the like. The most preferred low molecular weight polyol is 1,4-butanediol. In general, the weight of the low molecular weight polyol should be no more than 20% of the combination of high molecular weight polyol and low molecular weight polyol. A preferred range is 0 to 15% of the combination.

The prepolymers are prepared by reacting an isocyanate compound with a polyol or polyol blend, maintaining the temperature from room temperature to temperatures as high as 150°C for times necessary to react all the available hydroxyl groups. Preferred reaction temperatures are 50°C to 100°C; more preferred are 50°C to 85°C. The product is poured into containers under a nitrogen flush and stored at room temperature.

The curative used for the prepolymer can be selected from a wide variety of conventional and well known aliphatic or aromatic polyamine or polyol materials. Aromatic diamines are, for example, 4,4'-methylene bis(2-chloroaniline), 2,2',5-trichloro-4,4'methylenediamines, naphthalene-1,5-diamine, ortho, meta, and para-phenylene diamines, toluene-2,4-diamine, dichlorobenzidine, diphenylether-4,4'-diamine, including their derivatives and mixtures.

These diamines or polyols are generally the present ones used in the industry as curatives for polyurethane. The selection of a curative is generally based on reactivity needs, or property needs for a specific application, process condition needs, and pot life desired. Known catalysts may be used in conjunction with the curative if desired.

Representative of the most preferred materials are: 4,4'-methylene-bis(3-chloro)aniline (MBCA), 4,4'-methylene-bis(3-chloro-2,6-diethyl)aniline (MCDEA), diethyl toluene diamine (DETDA), tertiary butyl toluene diamine (TBTDA), dimethylthio-toluene diamine (Ethacure™ 300) from Ethyl Corporation, trimethylene glycol di-p-amino- benzoate (Polacure™ 740) from Polaroid Corporation, and 1,2-bis(2-aminophenylthio)ethane (Cyanacure from

American Cyanamid Company).

The stoichiometric ratio of isocyanato groups to hydroxyl groups of the prepolymer depends on which specific isocyanate and polyol are selected. For example, with TDI and PTMEG the ratio of isocyanato groups to hydroxyl groups should preferably be from 1.3/1 to 2.5/1 although somewhat lower and higher ratios are permissible. When the ratio is much lower, the molecular weight of the isocyanato terminated polyurethane becomes so large that the viscosity of the mass makes mixing of chain extenders into the prepolymer relatively more difficult. At the other extreme, a ratio of 2 isocyanato groups to one hydroxyl group is the theoretical ratio for the end-capping of a polyalkyleneether or ester polyol with a diisocyanate. An excess of the 2/1 ratio will result in high levels of free diisocyanate in the mixture but may be removed by distillation or chemical stripping as are conventionally practiced in the art to yield low free isocyanate prepolymers. Therefore, the preferred range is 1.6/1 to 2.00/1.

For curing these prepolymers, the number of $-NH_2$ groups in the aromatic diamine component should be approximately equal to the number of -NCO groups in the prepolymer. A small variation is permissible but in general from about 80 to 120% of the stoichiometric equivalent should be used, preferably about 85 to 100%. The reactivity of isocyanato groups with amino groups varies according to the structure to which the groups are attached. As is well known, as for example in U.S. Patent 2,620,516, some amides react very rapidly with some isocyanates while others react more slowly. In the latter case, it is optional to use catalysts. For some of the aromatic diamines, the temperature of the reaction or of the polyurethane reactant will need only be controlled in order to obtain the proper reaction time; thus, for a diamine that ordinarily would be too reactive, a catalyst would obviously be unnecessary, a lowering of the reaction temperature would suffice. A great variety of catalysts is available commercially for accelerating the reaction of the

isocyanato groups with compounds containing active hydrogen atoms (as determined by the well-known Zerewitinoff test). It is well within the skill of the technician in this field to pick and choose catalysts to fit his particular needs or desires and adjust the amounts used to further refine his conditions. Adipic acid and triethylene diamine are typical of suitable catalysts.

For example, when using MDI-type prepolymers, the isocyanate:polyol stoichiometric ratios range typically from 2:1 to 5:1. An even more preferred range of stoichiometric ratio of isocyanate:polyol would be from 3:1 to 4:1. Other isocyanates and polyols will require different ratios but these are well-known to those skilled in the art and may be adjusted to fit particular requirements.

Such properties as tensile, tear, hardness, and modulus are highly designable through selection of various polyol, isocyanate, and curative types. Incorporation of branched polyols or more highly functional isocyanates allows for modification of crosslinking. Urethane polymerizations based on longer-chain polyols result in more flexible elastomeric products. By proper choice of alcohol or amine curatives, vulcanizate hardnesses ranging from 15 durometer A to 75 durometer D can be obtained. Compounding with fillers, plasticizers, and other agents may be done to control a broad range of properties.

Urethane elastomers generally provide toughness, weatherability, and long wear as well as a combination of hardness and elasticity. The materials have high tensile and tear strength, high abrasion resistance, and excellent oil, oxygen, ozone, and radiation resistance. They retain a high degree of elasticity and resilience, even at high hardness and over a wide temperature range.

The urethanes of the instant invention also use a carrier to incorporate a conductive metallic salt into the polymer matrix. The term "carrier" as it is used herein will mean a material in which the inorganic metallic compound is soluble and is miscible in the polymer matrix. The

carrier may be any organic substance which has one or more electronegative moieties in its structure. Representative of this type of carrier are tri(beta-chloropropyl)phosphate, tributylphosphate, tributoxyethylphosphate and the like. As will be seen from the following examples, the presence of the conductive metallic material in the carrier does not impact or in any way affect the properties of the polymer product.

The examples of the present invention provide conveniently prepared, charge dissipative polymers with a surface resistivity of 10^{11} to 10^{6} ohms to provide permanent antistatic protection for a wide variety of commercially useful applications.

From the data presented in the tables that follow, it can be seen that the conductive properties become part of the cured polymer and as such are a property of the finished product made from the polymer. It can also be seen from the data that the urethane products which possess a three-fold or as high as a ten-fold level of reduced resistivity (from 10^{12} to $> 10^{9}$ and from 10^{17} to $> 10^{7}$) retain satisfactory performance as expressed by their physical properties.

The following examples are illustrative of the present invention and are therefore not intended as a limitation on the scope thereof.

EXAMPLES

Example 1: Preparation of Polyurethane Prepolymer from 4,4'-Diphenylmethane Diisocyanate (MDI) and Polytetramethylene Ether Glycol (PTMEG)

A polyurethane prepolymer was prepared by reacting three moles of MDI with one mole of a PTMEG diol of molecular weight 2000. The excess isocyanate content of this reaction was 6.1% by weight. A one percent (by weight) solution of cupric chloride ($CuCl_2$) was prepared by dissolving it in tri(betachloropropyl)phosphate. This $CuCl_2$ solution was added to the prepolymer along with the appropriate amount of butanediol

curative (6.2 g), at concentrations of 0.15, 1.5, and 15 parts per hundred (phr). In the data tables of this invention, the electrical conductivity of the elastomers prepared are presented in terms of the resistivity of the materials, which is expressed as "r" in ohm-centimeters. Its reciprocal is defined (Van Nostrand's Scientific Encyclopedia, 1968) as electrical conductivity.

Table 1: Electrical and Physical Properties of Examples 1a-1c and Comparative A

Example #	**A**	**1a**	**1b**	**1c**
$CuCl_2$ Solution phr	0	0.15	1.5	15
$CuCl_2$ phr	0	0.0015	0.015	0.15
Volume Resistivity(r) ohms-cm	1.6×10^{12}	1.9×10^{11}	7.0×10^{10}	9.4×10^{9}
Physical Properties:				
100% modulus, psi	590	670	690	750
Tensile strength, psi	4400	4850	4200	4000
Elongation, %	550	550	670	490
Tear Die C, pli	380	400	480	390
Tear Split, pli	66	70	120	50

Example 2: Preparation of Polyurethane Prepolymer from TDI and PTMEG

A polyurethane prepolymer was prepared by reacting 2 moles of TDI with one mole of PTMEG diol of 1000 molecular weight. The resulting prepolymer had an excess isocyanate content of 6.3%. A 10% solution of cupric chloride ($CuCl_2$) was prepared in tributylphosphate. This solution was added to the prepolymer at 10 and 15 phr. The appropriate amount (19 grams) of 4,4'-methylene bis 2-chloroaniline (MBOCA) as a curing agent was then added to cure the prepolymer/cupric chloride mixture.

Table 2: Properties of Example 2a-2b and Comparative Ex B

Example #	B	2a	2b
$CuCl_2$ Solution phr	0	10	15
$CuCl_2$ phr	0	1	1.5
Volume Resistivity(r) ohms-cm	6.3×10^{17}	1.1×10^{8}	1.4×10^{8}
100% Modulus, psi	1800	1710	1680
Tensile, psi	5000	5150	5100
Elongation, %	400	450	450
Die C Tear, pli	500	510	520
Split Tear pli	120	110	115

Example 3: Imparting Conductance to a TDI/PTMEG Prepolymer

A reaction product of TDI and PTMEG with an excess isocyanate content of 4.2%, was mixed with a 10% solution of cupric chloride at

5, 10, and 15 phr. The appropriate amount 12.7 grams of MBOCA curing agent was then added to cure the prepolymer/cupric chloride mixture.

Table 3 Electrical Properties of Comparative Ex C and Ex 3a -3c

Example #	C	3a	3b	3c
$CuCl_2$ Solution, phr	0	5	10	15
$CuCl_2$, phr	0	0.5	1.0	1.5
Volume Resistivity (r) oHms-cm	6.3×10^{17}	1.4×10^{8}	6.0×10^{7}	4.3×10^{7}
100 % Modulus,psi	1130	805	800	980
Tensile, psi	5030	3500	3500	5800
Elongation, %	420	490	550	460
Tear die C, pli	440	350	360	400
Split Tear, pli	77	62	63	70

Notes for Tables 1, 2 and 3: The measurements of volume resistivity shown in these tables was measured by ASTM D257. The physical properties shown were measured as follows: modulus, tensile strength, and elongation were measured by ASTM D412; Tear Die C was measured according to ASTM 624, and Tear Split was measured by ASTM D470 and expressed in pli or pounds force per linear inch.

The term "phr" means parts by weight per hundred parts by weight of prepolymer.

This data indicates a reduction in resistivity, as shown by r values decreasing to industrially acceptable levels. These levels in the acceptable antistatic range may be $10^{7,8, \text{ or } 9}$. These samples showed no loss of physical properties, as can be seen by the data presented.

Compared to the polyester polyol-based polyurethanes embodied in European Patent Publication 566 418 A2, the polyether polyol polyurethanes of this invention overcome the many disadvantages of the polyesters of this prior art including: susceptibility to hydrolysis since the ester group is susceptible to attack by water causing rapid decline in physical properties; internal heat buildup when compressed and relaxed repeatedly causing failure: excessive fungal growth and relatively poor low temperature flexibility. The elastomers and prepolymers of this invention overcome these disadvantages.

What is claimed is:

1. A process for making an electrically conductive polyurethane prepolymer comprising blending an isocyanate terminated polyalkyleneether polyol prepolymer with an inorganic conductive material selected from conductive metallic salts having cations selected from the group consisting of copper, aluminum, silver and nickel and anions selected from the group consisting of halogen, sulfate and phosphate.

2. A process for making an electrically conductive isocyanate-terminated polyalkyleneether polyol prepolymer comprising the steps of:

(a) reacting a molar excess of an isocyanate with a high molecular weight polyalkyleneether polyol at between about 30°C and 150°C for a time sufficient to form said prepolymer; and

(b) incorporating an inorganic conductive material into said prepolymer.

3. A process for making a prepolymer in accordance with claim 2 wherein said isocyanate is selected from the group consisting of 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 4,4'-methylene bis (phenylisocyanate), naphthalene-1,5-diisocyanate, diphenyl-4,4'-diisocyanate, diphenylmethane-4,4'-diisocyanate, dibenzyl-4,4'-

diisocyanate, stilbene-4,4'-diisocyanate, benzophenone-4,4'-diisocyanate, 1,3- and 1,4-xylene diisocyanates, 1,6-hexamethylene diisocyanate, 1,3-cyclohexyl diisocyanate, 1,4-cyclohexyl diisocyanate and methylene bis(4-cyclohexyl diisocyanate).

4. The process of Claim 2 wherein the inorganic conductive material is selected from the group of conductive metallic salts having cations selected from the group consisting of copper, aluminum, silver and nickel and anions selected from the group consisting of halogen, sulfate and phosphate dispersed in a carrier selected from the group consisting of tri(beta-chloropropyl)phosphate, tributylphosphate, and tributoxyethylphosphate.

5. The process for making a prepolymer in accordance with claim 2 wherein said isocyanate is selected from the group consisting of toluene diisocyanate and 4,4'-methylene bis (phenylisocyanate)

6. The process of Claim 2 wherein the conductive metallic salt is copper (II) chloride.

7. A process for making a prepolymer in accordance with claim 2 wherein said high molecular weight polyalkyleneether polyol is polytetramethylene ether glycol and said isocyanate is toluene diisocyanate and the ratio of isocyanato groups to hydroxyl groups is from about 1.3/1 to about 2.0/1.

8. A process for making a prepolymer in accordance with claim 2 wherein said high molecular weight polyalkyleneether polyol is

polytetramethylene ether glycol and said isocyanate is 4,4'-methylene bis (phenylisocyanate) and the ratio of isocyanato groups to hydroxyl groups is from about 2/1 to about 5/1.

9. An electrically conductive polyurethane elastomer formed by the reaction of:

a) a blend of an isocyanate endcapped polyalkylene ether polyol prepolymer with an inorganic conductive material selected from conductive metallic salts having cations selected from the group consisting of copper, aluminum, silver and nickel and anions selected from the group consisting of halogen, sulfate and phosphate; and

(b) a curative selected from the group consisting of aromatic diamine curatives and polyol curatives.

10. A polyurethane elastomer of claim 9 wherein said curative is an diamine curative is selected from the group consisting of

4,4'-methylene-bis-(2-chloroaniline),

dimethylthio-toluenediamine,

trimethylene glycol di-p-aminobenzoate, and

1,2-bis-(2-aminophenylthio)ethane.

11. A polyurethane elastomer of claim 9 wherein said curative is an aromatic diamine curative and the number of $-NH_2$ groups in said aromatic diamine curative to the number of -NCO groups in the prepolymer ranges from about 80% to about 120%.

12. A polyurethane elastomer of claim 9 wherein said

polyurethane elastomer possesses a volume resistivity of between 1 X 10^7 and 1 x 10^9 ohm-cm, and cured physical properties of 100% modulus of more than 500 psi, tensile strength at least 3500 psi, ultimate elongation greater than 450% and tear strengh measured by Die C at least 350 pounds-force per linear inch.

13. The process of Claim 2 for making an electrically conductive isocyanate terminated polyalkyleneether polyol prepolymer wherein said step (b) for incorporating an inorganic conductive material further comprises preblending said inorganic conductive material into a carrier miscible with both the inorganic metallic material and said prepolymer.

14. The process of Claim 13 wherein the carrier may be an organic isocyanate-inert material which contains one or more electronegative moieties in its structure.