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<p>(21) International Application Number: PCT/US90/06246 (22) International Filing Date: 1 November 1990 (01.11.90) (30) Priority data: 437,711 17 November 1989 (17.11.89) US (71) Applicant: GENERAL ELECTRIC COMPANY [US/ US]; 1 River Road, Schenectady, NY 12345 (US). (72) Inventor: GAGGAR, Satish, Kumar ; Box 349, Route 3, DuPont Manor, Parkersburg, WV 26101 (US). (74) Agents: VANDENBURGH, Howard, F.; Counsel, Inter- national Patent Operation, General Electric Company, 1285 Boston Avenue, Bldg. 23CW, Bridgeport, CT 06602 (US) et al.</p>		<p>(81) Designated States: DE (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), KR, NL (European patent). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: POLYMER BLEND COMPOSITIONS (57) Abstract The present invention is directed to the use of an epihalohydrin/ethylene oxide copolymer to impart antistatic properties to polyolefins, such as polypropylene.</p>		

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POLYMER BLEND COMPOSITIONS

BACKGROUND OF THE INVENTION:

FIELD: Polymers having electrostatic dissipative properties.

5 PRIOR ART: This invention is an improvement on the inventions described and claimed in U.S. Patents 4,588,773 (Federl et al I) and 4,775,716 (Federl et al II) and U.S. patent application Ser. No. 59,178, filed June 8, 1987 (Gaggar et al), all of which are assigned
10 to the predecessor of the present application's assignee.

Federl et al I relates to the use of an ABS graft copolymer containing a copolymer of epichlorohydrin and an oxirane composition, ethylene oxide. Federl et al
15 II, a continuation-in-part of Federl et al I, also concerns an antistatic graft ABS, but contains smaller amounts of an epichlorohydrin/oxirane copolymer having

a somewhat higher ratio of ethylene oxide to epichlorohydrin in said copolymer. US Patent Application Ser. No. 59,178 (Gaggar et al) is directed to the use of an alkyl methacrylate polymer to
5 compatibilize the antistatic composition with the ABS polymer.

Barnhouse et al; US Patent No.4,719,263, discloses that the antistatic properties of various polymers, including polyvinyl chloride (PVC), may be improved by
10 adding a copolymer of epichlorohydrin and ethylene oxide. This reference, however, makes no mention of the use of such antistatic agents for polyolefins, such as polypropylene.

SUMMARY OF THE INVENTION

15 The present invention is directed to the use of an epihalohydrin/ethylene oxide copolymer to impart antistatic properties to polyolefins, such as polypropylene. The need for thermoplastic molding compositions which rapidly dissipate a static charge
20 has grown substantially in recent years. It is reliably estimated that static electricity costs industry millions of dollars in expensive repair and replacement of sensitive electronic components alone. Major

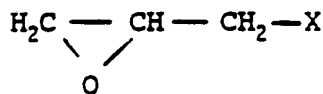
applications for such material include tote boxes for the storage of computer chips and other electronic components, xerographic copier parts and communications equipment. Static electricity is also a major hazard where explosive materials are present.

Static electricity is very expensive to control in polymeric materials. Until the invention of Federl I, thermoplastics were generally rendered at least partially antistatic by the incorporation of conductive materials into the resin, such as carbon black particles, or carbon (or metallic) fibers. The literature is replete with attempts to render polymers antistatic all of which have met with less than successful results.

Polyolefins, primarily polyethylene and polypropylene, constitute one of the largest classes of thermoplastics manufactured. Major uses include fibers and film, and injection and blow molded parts for a wide variety of products, such as automobile components and food packaging materials. Its versatility makes it one of the highest volume commodity resins manufactured worldwide. Most isotactic polypropylene is made by the polymerizing propylene with organo-metallic stereospecific catalysts (Ziegler-Natta). As used herein, the term "polyolefin" includes homopolymers and copolymers of both ethylene and propylene, as well as

impact modified versions thereof.

The antistatic agent, which constitutes 5-20 wt% of the blend, is a copolymer of an epihalohydrin, preferably epichlorohydrin, and an alkylene oxide, preferably ethylene oxide. Epihalohydrin monomers have the formula:



Wherein X is chlorine, bromine or iodine. Preferably X is chlorine, i.e. epichlorohydrin.

The epihalohydrin may be copolymerized with any of a variety of other known, copolymerizable monomers which have an oxirane group. Such monomers include glycidyl ethers, monoepoxides of dienes and polyenes, glycidyl esters and alkalene oxides. Examples of such monomers include vinyl glycidyl ether, isopropenyl glycidyl ether, butadiene monoxide, chloroprene monoxide, 3,4-epoxy-1-pentene, glycidyl acrylate, glycidyl methacrylate, 1,2-epoxy-3,3-trichloropropane, phenyl glycidyl ether, ethylene oxide, propylene oxide and trichlorobutylene oxide.

Preferably the monomer is an alkylene oxide such as ethylene oxide, propylene oxide, butylene oxide, 3,4-epoxy-1-pentene, 1,2-epoxy-3,3,3-trichloropropane.

trichlorobutylene oxide and the like. Ethylene oxide is most preferred.

In the preferred embodiment, epichlorohydrin and ethylene oxide are copolymerized to form the antistatic additive. Materials of this type are made commercially by B.F. Goodrich under the trademarks HYDRIN and STATRITE.

DETAILED DESCRIPTION OF THE INVENTION:

The invention can best be understood by referring to a specific example of the compositions generally described above. A blend was prepared 82.5 wt% polypropylene resin with 17.5 wt% of an antistatic copolymer (ASC) containing approximately 20% epichlorohydrin and 80% ethylene oxide. The two components were mixed using a single screw extruder at a melt temperature of about 425° F.

The melt mixed blend was then compression molded into plaques for testing the electrostatic dissipative properties as described in more detail below. Similarly, test plaques were also molded from the same polypropylene without the ASC for comparing the antistatic properties.

Plaques prepared in accordance with the foregoing example were tested for electrostatic dissipative

properties using Federal Test Standard 101B which is incorporated herein by reference. The results are set forth in Table I:

Table I

5	Example	A (Control)	B (PP + ASC)
	Surface Resistivity - Ohms	3.87×10^{15}	2.99×10^{13}
	Volume Resistivity- Ohms/cm	1.84×10^{15}	7.11×10^{13}
	Static Decay Rate Seconds		
	1 Day R.H. <15%		
10	10% Cut Off	Run On	0.06
	0% Cut Off	Run On	0.54
	Izod Impact R.T. Ft-lb/in	0.9	2.7
	Tensile Yield Stress, psi	4665	3945
	Modulus, 10^5 psi	2.7	2.7
15	Elongation %	>190	>190

The foregoing data clearly indicates superior electostatic dissipative properties when the epichloro-hydrin/ethylene oxide copolymer is added to the polyolefin as well as unexpected impact strength improvement. The notation "Run On" shows that the static build-up did not diminish in any significant manner during the test.

While this invention has been described in connection with a certain specific embodiment, it will be obvious to

those skilled in the art that other combinations may be used. Accordingly the scope of the invention should be determined solely by the appended claims.

CLAIMS

What is claimed is:

5 1. A polymer blend comprising: a polyolefin polymer,
and an effective amount of an antistatic agent, said
antistatic agent being a copolymer of epichlorohydrin
and ethylene oxide.

10 2. The composition of Claim 1 wherein the ratio of
epichlorohydrin to ethylene oxide in said copolymer is
from about 15:85 to about 40:60.

3. An antistatic polymer blend comprising: 93-80 wt%
polypropylene and 7-20 wt % of an antistatic agent
consisting essentially of a copolymer of 15-40 wt. %
epichlorohydrin and 85-60 wt % ethylene oxide.

INTERNATIONAL SEARCH REPORT

International Application PCT/US90/06246

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC (5): C08L 23/12, 23/02, 71/03		
U.S. CL. 525/187; 524/366		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
U.S.	525/187; 524/366, 910	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US,A, 4,624,989 (BERTA) 25 NOVEMBER 1986 See column 3.	1-2
X	JP,B 48-4612 (DAINICHI-NIPPON CABLES LT) 09 FEBRUARY 1973; See abstract.	1-2
X	US,A, 4,822,838 (WATANABE) 18 APRIL 1989 See comparative example 5.	1-2
Y	US,A, 4,719,263 (BARNHOUSE) 12 JANUARY 1988 See the entire document.	1-3
Y	US,A, 3,425,981 (PULETTI) 04 FEBRUARY 1969 See abstract, column 1, line 49 and column 2, lines 57-64.	1-3
<p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
01 APRIL 1991	26 APR 1991	
International Searching Authority	Signature of Authorized Officer	
ISA/US	<i>David Buttner</i> David Buttner	