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3,374,288

POLYCARBONAMIDE FILAMENTS CONTAINING POLYALKYLENE OXIDE, SODIUM PHENYL PHOSPHINATE AND SODIUM AMINOALKYL-PHOSPHINATE

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ABSTRACT OF THE DISCLOSURE

Stabilized filaments may be prepared from synthetic linear polyamides by the addition of 0.5 to 1.0 mole percent of sodium aryl phosphinate and 0.5 to 1.0 percent of sodium aminoalkyl phosphinate, with the further addition of at least 2.0% of a polyalkylene oxide based on the weight of the polyamide. In an example a polymeric composition is prepared from 73 lbs. of hexamethylenediammonium adipate ammonium salt, 68.1 gms. sodium phenyl phosphinate, and 60.2 gms. of sodium 3 - aminopropyl phosphinate.

This invention pertains to filaments of synthetic polyamides. More particularly it concerns a process for the preparation of filaments of synthetic polyamides which are durably antistatic and have improved heat stability.

Filaments of synthetic polyamides have found extensive application in textile markets. A tendency to generate static electricity limits the acceptability of such fibers in certain applications. This problem can be eliminated by blending with the fiber-forming polymer, prior to spinning into filaments, a small amount of a poly(alkylene oxide) compound. The antistatic nature of such filaments is durable to scouring treatment. Furthermore, scouring removes some of the dispersed antistatic additives leaving microscopic voids in the fiber which provide a delustering effect giving a fabric with increased covering power. Unfortunately, the presence of these antistatic additives in polyamides greatly increases their tendency to discolor when subjected to heating operations normally employed in textile processing. Processes which effectively improve the heat stability of unmodified polyamides, as described in United States Patent 2,981,715, are inadequate to satisfactorily control the heat stability of these modified, antistatic polyamides.

An object of this invention is therefore to provide a process for the preparation of filaments of synthetic polyamides which are durably antistatic and have improved resistance to thermal discoloration.

Another object is to prepare filaments having improved dye lightfastness, dye thermal stability, acceptable processability during manufacture and improved initial whiteness.

Other objects will become apparent from the discussion to follow.

These objects are accomplished in the present invention by a process which includes the steps of preparing a synthetic polyamide by melt polymerization in the presence of from about 0.5 to about 1.0 mole percent sodium aryl phosphinate and about 0.5 to about 1.0 mole percent of sodium aminoalkyl phosphinate, followed by blending at least 2.0 percent (by weight of the polyamide) of a poly(alkylene oxide) antistatic compound into the molten polyamide prior to spinning into filaments. A preferred embodiment of this invention is the aforementioned process wherein the sodium aryl phosphinate and the sodium aminoalkyl phosphinate are present in an equimolar ratio. Another preferred embodiment of the

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invention is the process wherein about 0.7 mole percent sodium phenylphosphinate and about 0.7 mole percent of sodium 3 - aminopropyl phosphinate are present during the polymerization followed by blending of the molten polyamide with at least 2.0% by weight of a poly(ethylene oxide) compound having a molecular weight greater than 1,000. The blended polymer is then spun into filaments in a conventional manner.

The term "polyamide" is used in this invention to signify a synthetic linear polycarbonamide having recurring amide units as an integral part of the main polymer chain and commonly called nylon.

The preparation of durably antistatic filaments by blending a poly(alkylene oxide) ether compound with a polyamide is fully described in British Patents 990,713 and 963,320.

This invention resides in the discovery that among the known phosphinate stabilizers for nylon as described in U.S. Patent 2,987,715, improved performance is realized with the filaments of the invention when a combination of certain sodium salts of organophosphinic acids are used as compared to an equal quantity of a single additive. One of the compounds in the combination is the sodium salt of an arylphosphinic acid, preferably phenyl phosphinic acid. As described in the reference patent such compounds are extractable from the finished product by conventional scouring or washing treatments.

The second additive of the combination of this invention consists of the sodium salt of an amino alkyl - phosphinic acid, preferably sodium 3 - aminopropyl phosphinate. By means of the reactive amino group the additive becomes attached to the polymer chain as an end-capping group when present during polymerization. By being so incorporated, the additive is resistant to removal by normal extraction processes.

United States Patent 2,927,841 discloses that phenylphosphinate compounds undergo oxidation to some extent during the polymerization reaction. The aminoalkyl phosphinate compounds likewise are found to decompose to some extent during high temperature nylon processing. As a result, a polyamide with a molecular weight higher than that expected for a given mole percentage of an amino end-capping compound is obtained. Since the precise final composition is unknown, the product of this invention is referred to with respect to the process which produces it.

Example I

Alkyl phosphinate stabilizers containing end-capping functional groups can be prepared by the addition of sodium hypophosphite to the corresponding olefinic compound in the presence of a free radical initiator. Processes are described in U.S. Patent 2,724,718.

Sodium 3-aminopropyl phosphinate is prepared by placing the following reagents into a sealed bomb: allylamine (28.5 g.; 0.5 mol), sodium hypophosphite monohydrate (53.0 g.; 0.5 mol), methanol (650 ml.) and di-*t*-butyl peroxide (3.0 g.). The bomb is heated at 130° C. for four hours. The reaction mixture is cooled to room temperature, concentrated to near dryness on a steam bath under nitrogen and dried further in a vacuum oven at 50° C. for 24 hours. The product is a pale yellow viscous oil (75.7 g.; 0.522 mol; yield—104%). The greater than theoretical yield is attributed to moisture resulting from the hygroscopic nature of the product. The neutralization equivalent as determined by titration of the amino group with hydrochloric acid is found to be 169 vs. theoretical neutralization equivalent of 145.

Poly(hexamethylene adipamide) polymers are prepared containing 0.7 mol percent of the following phosphinate additives: sodium 3-aminopropyl phosphinate, sodium 1-carboxypropyl-2-phosphinate and sodium 3,4-dicarboxy

cyclohexyl phosphinate monohydrate. Description of the polymer preparation containing sodium phenylphosphinate is typical of the procedure used.

Hexamethylene diammonium adipate salt (56.1 g.; 0.214 mole) and sodium phenylphosphinate (0.25 g.; 0.0015 mole) are placed into a glass polymer tube and sealed. A prepolymer cycle is carried out for two hours at 220° C. The tube is broken and the prepolymer crushed into small chunks. Poly(ethylene oxide) glycol ether, Dow E-20,000 (7.5 g.; 0.17 mole), is mixed intimately with the prepolymer (165 g.). The mixture is added to a test tube containing 10 ml. of water. The test tube is connected to a steam line, adapted for mechanical stirring and immersed in a refluxing vapor bath of dimethyl phthalate. After evacuation to remove air, the mixture is blended by stirring under steam at 282° C. for 2 hours. The resulting mass is cooled to room temperature, crushed into 1/8 inch flakes and dried in a vacuum oven at 70° C. for 24 hours. The polymer has a relative viscosity in 90% formic acid of 49 and analyzed for carboxyl and amine ends of 47 and 57 respectively. The flake is melt spun between 300-320° C. to yarn of about 300 denier using a 1/2 inch screw-melter. The spun yarn is cold drawn 3-3.5× in a conventional manner.

Extractability of the phosphinate additive is measured by phosphorus analysis before and after an aqueous scouring treatment, whereby organic matter is destroyed and phosphorus oxidized to orthophosphate by sulfuric and nitric acids. Phosphorus is then determined colorimetrically as the heteropoly blue complex, after addition of molybdate and reduction with hydrazine sulfate. The scour solution is prepared from distilled water (50:1-bath:yarn ratio by weight), 2% of technical grade sodium lauryl sulfate based on yarn weight and 2% of yarn weight of trisodium phosphate. The yarn samples are boiled for 30 minutes in the scour solution followed by

absorption in bromine solution followed by titration of the excess bromine.

Thermal color stability of the yarns is determined by heat setting sections of fabric from knit tubing at oven temperatures of 180° C. for selected time intervals followed by measurement of "b" values in a Colormaster Differential Colorimeter. The method is described in U.S. Patent 2,981,715. In this yarn series the yarn containing sodium 3-aminopropyl phosphinate shows a significant improvement in thermal stability over that containing an equimolar amount of sodium phenylphosphinate, 9.8 vs. 14.8 "b" values respectively after 3 minutes at 180° C. Both additives give yarns with essentially the same initial whiteness of "b" value of 5.2 and 5.8 respectively. The yarns containing the carboxy phosphinate show thermal stability equivalent or inferior to that containing the sodium phenyl phosphinate. These yarn color results correlate with development of color within the individual additives themselves upon exposure to high temperatures.

Example II

Poly(hexamethylene adipamide) containing both sodium phenyl phosphinate and sodium 3-aminopropyl phosphinate is prepared using a conventional autoclave procedure. The autoclave is charged with 73.0 lbs. of hexamethylene diammonium adipamide salt solution (47.8% by weight), 68.1 g. sodium phenyl phosphinate in 300 ml. water (0.5% by weight; 0.71 mole percent) and 60.2 g. sodium 3-aminopropyl phosphinate in 180.6 g. solution (0.71 mole percent). Polymers are also prepared in an identical manner containing no phosphinate additives as well as 0.71 mole percent sodium phenyl phosphinate; 0.48, 0.71 and 0.95 mole percent sodium 3-aminopropyl phosphinate; and 0.7 mole percent sodium 3,4-dicarboxy cyclohexyl phosphinate.

Polymer analyses are shown in Table B.

TABLE B

Item	Phosphinate Additives, (Mole percent)	Phosphorus (p.p.m.)		RV	End-groups	
		Calc.	Found		Carboxyl	Amine
A.....	None ¹	0	0	37	90	38
B.....	Sodium phenylphosphinate (0.71) ¹	990	1,068	37	96	41
C.....	Sodium 3-aminopropylphosphinate (0.48)	666	607	52	65	54
D.....	Sodium 3-aminopropylphosphinate (0.71)	990	913	47	83	48
E.....	Sodium 3-aminopropylphosphinate (0.95)	1,315	1,175	47	80	44
F.....	Sodium 3,4-dicarboxycyclohexylphosphinate monohydrate (0.71)	990	813	34	100	36
G.....	{Sodium phenylphosphinate (0.71) Sodium 3-aminopropylphosphinate (0.71)}	1,980	1,472	44	87	50

¹ Contains 0.40 mole percent acetic acid as a viscosity stabilizer.

a thorough rinsing with distilled water. Results are shown in Table A.

TABLE A

Addition 0.7 mole percent	PEO (wt. percent)		Phosphorus (p.p.m.)		
	Unscoured	Scoured	Calc.	Unscoured	Scoured
Sodium phenylphosphinate.....	4.4	4.0	940	815	0
Sodium 3-aminopropylphosphinate.....	4.2	4.1	940	853	704
Sodium 1-carboxypropyl-2-phosphinate.....	5.0	4.1	940	797	625
Sodium 3,4-dicarboxy-cyclohexylphosphinate monohydrate.....	4.9	3.4	940	878	669

It is readily seen that the sodium phenyl phosphinate undergoes complete extraction as previously described in U.S. Patent 2,981,715. However, the phosphinate additives containing polymer reactive functional groups remain primarily within the polymer. The aminopropyl phosphinate is the most permanent additive. The scoured yarns are also shown to retain an appreciable amount of the poly(ethylene oxide)glycol ether antistat. The poly(ethylene oxide) content is measured by decomposition of the polyether with hydroiodic acid into ethyl iodide and ethylene. An absorption tube containing silver nitrate is used to remove ethyl iodide by precipitation as silver iodide. The quantity of ethyl iodide is determined by titrating the excess silver ion. Ethylene is determined by

Yarns are prepared from the above polymers by melting the polymer in a screw extruder which feeds into a

polymer blender. Simultaneously, poly(ethylene oxide) glycol ether having a molecular weight of approximately 20,000 is melted and fed to the blender by means of a separate extruder. The molten polymers are mechanically mixed in the blender. The feed rate of the polymers is adjusted to give approximately 5% of the poly(ethylene oxide) based on weight of the polyamide. The molten polymer blend is fed to a meter pump, filter pack and spinneret in a manner conventional for melt spinning processes.

The spun yarns are two-stage drawn to a total draw ratio of 3.7× giving a final yarn denier of 255 containing 17 filaments. The yarns are 4-ply and bulked in a

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conventional manner for carpet yarn giving a final denier of about 1300.

The yarns are scoured as described in Example I and analyzed for phosphorus and poly(ethylene oxide) content. Results in Table C show almost complete extraction for the sodium phenylphosphinate additives whereas a considerable portion of the polymer-reactive phosphinate remains in the polymer. It is also seen that a considerable amount of the poly(ethylene oxide) additive is removed by scouring but an appreciable amount remains in the polymer.

Several of the above yarns which have not been bulked are knit into tubing fabrics. Scoured patches of the knit tubing are heat set at 180° C. for selected time intervals followed by measurement of whiteness retention by determination of "b" values as previously described.

TABLE C

Item	PEO (percent by wt.)		Phosphorus (p.p.m.)		
	Unscoured	Scoured	Calc.	Unscoured	Scoured
A-----	6.4	2.0	0	13	0
B-----	6.6	2.3	935	704	54
C-----	5.9	2.4	633	497	391
D-----	6.4	2.6	935	758	607
E-----	6.5	3.6	1,250	1,108	814
F-----	6.5	2.5	935	762	499
G-----	6.9	2.6	1,870	1,220	655

TABLE D

Item	"b" values	
	Initial (scoured)	Heat set (3 min., 180° C.)
A-----	4.7	14.1
B-----	3.7	14.0
D-----	3.4	13.2
E-----	3.8	14.2
G-----	2.4	7.6

Results in Table D show that all of the phosphinate additives improve initial yarn color after scouring and prior to heat setting for these yarns containing poly(ethylene oxide), as has been reported for unmodified polyamide yarns in U.S. Patent 2,981,715, but that following the heat treatment only those antistatic yarns which contain both the sodium phenylphosphinate and the polymer reactive sodium 3-aminopropylphosphinate give a significant improvement in yarn thermal stability. This result is contrary to what would be expected from results on unmodified 66 nylon yarns as described in U.S. Patent 2,981,715.

The bulked carpet yarns are scoured and dyed to give five compound shades. The yarns are placed in a stock dye solution (100:1-solution:yarn by weight) to which the desired combination of dyes are added depending upon the shade intended. The mixture is heated to boiling over a 30-minute period followed by boiling for another 30 minutes. At this point, ammonium sulfate (4% by yarn weight) is added as a 1% solution in water and boiling continued for one hour. The samples are rinsed thoroughly and allowed to dry.

A stock dye solution is prepared by adding 0.52 g. sodium salt of an unsaturated long-chain alcohol sulfate surface active agent, 0.52 g. levelling salt, an ethylene oxide-propylene oxide condensation product, and 15 drops of concentrated ammonium hydroxide to 5300 ml. dis-

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tilled water. Compound dye shades are prepared by adding specified quantities of standard 0.1% by weight dye solutions of individual dyes to the stock solution. Quantities of these standard solutions added to 300 g. of the stock solution for dyeing 3.0 g. fabric samples to produce various shades are shown in Table E.

TABLE E.—0.1% SOLUTION ADDED/300 G. STOCK SOLUTION

Shade	Dye Color Index		
	Acid Green 25 (gms.)	Acid Orange 64 (gms.)	Acid Red 182 (gms.)
Grey-----	0.95	0.45	1.00
Sand-----	0.55	1.85	1.35
Sea-----	2.95	0.05	0.50
Green-----	3.30	6.30	1.00
Tan-----	1.10	4.80	2.25

Double thicknesses of dyed yarns one inch wide are mounted on cards, exposed to ultraviolet light in an Xenon Arc Atlas Weather-ometer and rated for dye fading. Fading is rated according to the Gray Scale whereby 5 denotes no fading, 3 denotes appreciable fading and 1 denotes almost complete loss of color. Results in Table F show no effect on dye lightfastness for any of the individual additives even in concentrations up to 0.95 mole percent. However, the combination of sodium phenylphosphinate and sodium 3-aminopropylphosphinate in an equimolar ratio of 0.71 mole percent show a significant improvement in lightfastness of about ¼ to one full unit on the Gray Rating Scale, where a plus or minus sign indicates a ¼" unit change in the direction indicated by the sign and hyphenated numerals indicate a half unit difference between the two numbers.

TABLE F

Item	Gray Rating (exposure hrs.)									
	Sand		Grey		Sea		Green		Tan	
	80	160	80	160	80	160	80	160	80	160
A-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	3-	3-2
B-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	3-	3-2
C-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	3-	3-2
D-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	5	3-2
E-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	3-	3-2
F-----	4-3	3-2	3+	3-2	3	3-2	3-	3-2	3-	3-2
G-----	4-	3-	4-3	(3-2)	3+	(3-2)	4	3-	4-	3-

Example III

Yarns are prepared from poly(hexamethylene adipamide) containing about 5% poly(ethylene oxide) ether glycol having molecular weight of about 20,000 plus (A) 0.7 mole percent sodium 3-aminopropyl phosphinate and 0.7 mole percent sodium phenylphosphinate, (B) 0.7 mole percent sodium 3-aminopropyl phosphinate, (C) 1.4 mole percent sodium 3-aminopropyl phosphinate (D) 0.7 mole percent sodium phenylphosphinate (E) 1.4 mole percent potassium phenylphosphinate and (F) no phosphinate additive. Dye lightfastness studies of these yarns processed as described in Example II and reported in Table G show that Item A is markedly superior to any of the other items even when they contain an equivalent mole percent of a single phosphinate additive.

TABLE G

Item	Gray Rating			
	Sand Shade		Sea Shade	
	30 Hrs.	60 Hrs.	30 Hrs.	60 Hrs.
A-----	4	3-	3+	3-2
B-----	3-	2-	3-	2
C-----	3	2	3	2
D-----	3-	2	3	2-
E-----	3-	2-	3	2
F-----	3-	2-	3	2

Carpet yarns are prepared by injection spinning 5.0% poly(ethylene oxide) glycol ether having a molecular weight of about 20,000 into poly(hexamethylene adipamide) which has been melt polymerized in the presence of various levels of the polymer-reactive sodium 3-aminopropyl phosphinate and the unreactive extractable sodium or potassium phenylphosphinate. Potassium phenylphosphinate is used for the higher concentrations of the extractable phosphinates because of improved processability over the sodium phenylphosphinate at these concentrations.

Items are prepared in the presence of (A) no phosphinate additive, (B) 0.7 mole percent sodium phenylphosphinate, (C) 1.4 mole percent potassium phenylphosphinate (D) 0.7 mole percent sodium 3-aminopropyl phosphinate, (E) 1.4 mole percent sodium 3-aminopropyl phosphinate, (F) 0.7 mole percent sodium phenylphosphinate and 0.7 mole percent sodium 3-aminopropyl phosphinate, (G) 1.4 mole percent potassium phenylphosphinate and 0.7 mole percent sodium 3-aminopropylphosphinate, (H) 2.1 mole percent potassium phenylphosphinate and 0.7 mole percent sodium 3-aminopropyl phosphinate and (I) 0.7 mole percent sodium phenylphosphinate and 1.4 mole percent sodium 3-aminopropylphosphinate. The carpet yarns are bulked dyed with premetallized acid dyes as described in Example II using two compound dye shades and lightfastness evaluated by exposure in a Xenon Arc Atlas Weather-ometer. Ratings according to the Gray Scale are contained in Table H.

TABLE H

Item	Gray Rating			
	Sand Shade		Green Shade	
	80 Hrs.	160 Hrs.	80 Hrs.	160 Hrs.
A.....	3+	2	3	2+
B.....	3+	2+	3+	2+
C.....	3+	2+	3+	2
D.....	3+	2	3+	2
E.....	4-3	2	3+	3+
F.....	4+	3	4+	3-
G.....	4-	3-2	4-	3-
H.....	4-	3-	4-	3-2
I.....	4-	3-	4-	

It is readily seen that Item F which is prepared in the presence of 0.7 mole percent each of sodium phenylphosphinate and sodium 3-aminopropyl phosphinate gives performance superior to individual additives at the same molar concentration and even to the combined additives at concentrations greater than 1.0 mole percent.

In the process of this invention it is essential that the phosphinate compounds be present during the polymerization of the polyamide. It is in this way that the amino alkyl phosphate compound becomes permanently attached to a polymer chain such that it is not extracted during subsequent processing. It is also essential that the extractable phosphinate compounds be present during the polymerization to avoid total loss of the protective effect of the permanent stabilizer through oxidation during polymerization. Removal of the extractable phosphinate from the yarn after spinning is not necessary but frequently desirable. However, the reactive phosphinate remains in the polymer and therefore provides additional protection during subsequent processing and end-use which cannot be realized when only extractable phosphinate stabilizers are used.

The use of any amount of the phosphinate combination stabilizer is observed to provide some stabilization; however it is preferred that each additive be present in at least 0.5 mole percent based upon the polyamide salt, and it is generally most desirable to have about 0.7 mole percent of each additive. Amounts up to the limit of

solubility of the phosphinate compound in a particular polyamide may be advantageous. Most of these compounds are not highly soluble in molten polyamides and the addition of amounts in excess of the solubility is usually undesirable. Regardless of the solubility, amounts in excess of 1.0 mole percent for each of the additives provides no additional protection over that realized by the preferred amount. These preferred concentrations give good protection against heat yellowing of the polyamide as well as providing protection for the dyed fibers against the effects of both heat and ultraviolet light.

The invention has been described in terms of its effect in improving properties of antistatic polyamides in filament form. It is obvious that similar results can be obtained upon fabrics, films, bristles, and other extruded or shaped articles which are likely to be subjected to heat and light in the form of relatively thin cross sections. The compositions embodying this invention may contain also conventional additives such as pigments, delusterants, dyes, plasticizers and the like.

This invention applies broadly to linear polyamides having carbonamide linkages as an integral part of the polymer chain. These include polyamides prepared by reactions of diamines and dicarboxylic acids and their acid forming derivatives and also polyamides prepared from amino acids and their amide forming derivatives.

The polyamides of course must be melt-spinnable. Typical examples are poly(hexamethylene adipamide), polycapraamide, polyundecanoamide and polyamides from bis(paraaminocyclohexyl) methane with azelaic, sebacic or other aliphatic dicarboxylic acids. Other polyamides are those containing isophthalamide groups and those prepared from piperazine and the like.

Melt spinnable copolyamides and polyamide mixtures may also be used in this invention.

The antistatic additives useful in this invention are poly(alkylene oxide) ether glycols having a molecular weight of at least 1,000. Alternatively the poly(ethylene oxide) may have as one or two end-groups alkoxy or aryloxy radicals such as methoxy, ethoxy, phenoxy, nonylphenoxy, 2,6-ditertiary butylphenoxy and the like.

Proper distribution of the poly(alkylene oxide) as a separate phase in the fiber is essential to obtain a uniformly antistatic and uniformly opacified product. This is best obtained by mechanically mixing the melts in the polymer transfer line, although a conventional screw extruder may also be used when the two polymers have been previously combined. When properly mixed and spun the poly(ethylene oxide) is uniformly distributed as a separate phase, appearing as a plurality of rod-shaped particles dispersed in the polyamide, overlapping but not interconnecting within the fiber.

Filaments made in the process of the present invention may be used alone or blended with other natural, synthetic or man-made fibers. They are readily adaptable to most textile operations and fabric end-uses. They are especially useful in pile fabrics such as velvet, rugs, carpets and artificial fur.

Products from these fibers are especially useful due to their antistatic properties, attractive luster, fiber opacity accompanied by improved whiteness, whiteness retention and dye stability resulting from this invention.

Many modifications of this invention may be made by those skilled in the art without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. A process for preparing stabilized filaments of a synthetic linear polyamide, which includes the steps of melt polymerizing a synthetic linear polyamide in the presence of from about 0.5 to about 1.0 mole percent sodium aryl phosphinate and from about 0.5 to about 1.0 mole percent sodium aminoalkyl phosphinate, blending at least 2.0 percent by weight, based on the weight of said polyamide, of a poly(alkylene oxide) antistatic

compound into the molten polyamide and subsequently spinning said molten polyamide into filaments.

2. The filaments produced by the process of claim 1.

3. Claim 1 wherein said sodium aryl phosphinate and sodium aminoalkyl phosphinate are present in an equi-
molar ratio. 5

4. The process which comprises melt polymerizing a synthetic linear polyamide in the presence of about 0.7 mole percent sodium phenyl phosphinate and about 0.7 mole percent sodium 3-aminopropyl phosphinate, blending at least 2.0 percent by weight, based on the weight of said polyamide, of a poly(ethylene oxide) compound having a molecular weight greater than 1,000 into the molten polyamide, and spinning said polyamide into filaments. 10

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