Claims

1. An additive formulation suitable for antistatic modification and improving the electrical conductivity of inanimate organic material, consisting essentially of

(A) from 1 to 50% by weight of an olefin-sulfur dioxide copolymer,

(B) from 1 to 50% by weight of a compound which comprises one or more basic nitrogen atoms and has at least one relatively long-chain linear or branched hydrocarbon radical having at least four carbon atoms or an equivalent structural element which ensures the solubility of component (B) in the inanimate organic material,

(C) from 0.1 to 30% by weight of an oil-soluble acid and

(D) from 1 to 80% by weight of a high-boiling organic solvent which consists of one or more molecule types, where at least 80% by weight of these molecule types have a boiling point of more than 150°C at standard pressure,

where the sum of all components adds up to 100% by weight.

2. The additive formulation according to claim 1, consisting essentially of
(A) from 10 to 30% by weight of component (A),
(B) from 10 to 30% by weight of component (B),
(C) from 2 to 15% by weight of component (C) and
(D) from 40 to 78% by weight of component (D).

3. The additive formulation according to claim 1 or 2, in which component (A) is a copolymer of sulfur dioxide with one or more linear or branched 1-olefins having from 2 to 24 carbon atoms.

4. The additive formulation according to claims 1 to 3, in which component (A) has a number-average molecular weight M_n of from 2000 to 1 000 000.

5. The additive formulation according to claims 1 to 4, in which component (A) comprises less than 15 mol% of olefin not converted in the copolymerization with the sulfur dioxide.

6. The additive formulation according to claims 1 to 5, in which component (B) is an α-olefin-maleimide copolymer having at least one basic nitrogen atom.

7. The additive formulation according to claim 6, in which component (B) is obtainable by free-radical polymerization of one or more linear or branched α-olefins having from 6 to 50 carbon atoms with maleic anhydride and subsequent reaction with one or more aliphatic polyamines.

8. The additive formulation according to claim 6 or 7, in which component (B) has a weight-average molecular weight M_w of from 500 to 50 000.

9. The additive formulation according to claims 1 to 8, in which component (C) is an organic sulfonic acid which has a hydrocarbyl radical having from 6 to 40 carbon atoms.

10. The additive formulation according to claims 1 to 9, in which component (D) consists to an extent of at least 80% by weight of a high-boiling aromatic hydrocarbon having from 9 to 30 carbon atoms or a mixture of such high-boiling aromatic hydrocarbons.

11. The additive formulation according to claim 10, in which component (D) is a mixture of high-boiling aromatic hydrocarbons having from 9 to 20 carbon atoms.

12. A process for preparing the additive formulation according to claims 1 to 11, which comprises first mixing components (A) and (C) homogeneously with one another in the presence of at least a portion of the high-boiling organic solvent (D), and then incorporating component (B).

13. The use of the additive formulation according to claims 1 to 11 for antistatic modification and improving the electrical conductivity of inanimate organic material and for preventing electrostatic charge in the course of chemical and physical processes.

14. The use according to claim 13 for antistatic modification and improving the electrical conductivity of cosmetic preparations, medicament formulations, photographic recording materials, paints and varnishes, plastics, waxes, solvents, mineral oil products and fuels.

15. Antistatically modified inanimate organic material having improved electrical conductivity, selected from cosmetic preparations, medicament formulations, photographic recording materials, paints and varnishes, plastics, waxes, solvents, mineral oil products and fuels, comprising from 0.01 to 2000 ppm by weight of the additive formulation according to claims 1 to 11.

16. A process for preparing olefin-sulfur dioxide copolymers which comprise less than 15 mol% of olefin not converted in the copolymerization with the sulfur

dioxide, which comprises using the sulfur dioxide in an at least 1.4-fold molar excess and performing the polymerization in a high-boiling inert organic solvent which consists of one or more molecular types, where at least 50% by weight of these molecule types have more than 8 carbon atoms.

17. A process for preparing olefin-sulfur dioxide copolymers which comprise less than 15 mol% of olefin not converted in the copolymerization with the sulfur dioxide, which comprises using the sulfur dioxide in an at least 1.1-fold molar excess and performing the polymerization at from 15 to 38°C, especially at from 20 to 30°C, under autogenous pressure.

18. The process for preparing olefin-sulfur dioxide copolymers according to claim 17, wherein the polymerization is performed in a first stage over a period of from 0.5 to 5 hours at from 30 to 38°C under autogenous pressure, and thereafter in a second stage over a period of from 1 to 5 hours at from 20 to 29°C under autogenous pressure.

Claims

1. An additive formulation suitable for antistatic treatment and improving the electrical conductivity of inanimate organic material, comprising:

(A) from 1 to 50 mass% of an olefin-sulfur dioxide copolymer,

(B) from 1 to 50 mass% of a compound which comprises one or more basic nitrogen atoms and has at least one long-chain linear or branched hydrocarbon radical having at least four carbon atoms and is an α-olefin-maleimide copolymer having at least one basic nitrogen atom, said compound comprising a hydrocarbon radical having at least 12 carbon atoms on the basic nitrogen atom in the N-imide side chain,

(C) from 0.1 to 30 mass% of an oil-soluble acid, and

(D) from 1 to 80 mass% of a high-boiling organic solvent which comprises one or more molecule types (where at least 80 mass% of these molecule types have a boiling point of more than 150°C at standard pressure),

where the sum of all components adds up to 100 mass%.

2. The additive formulation according to claim 1, comprising:
   (A) from 10 to 30 mass% of component (A),
   (B) from 10 to 30 mass% of component (B),
   (C) from 2 to 15 mass% of component (C) and
   (D) from 40 to 78 mass% of component (D).

3. The additive formulation according to claim 1 or 2, in which component (A) is a copolymer of sulfur dioxide with one or more linear or branched 1-olefins having from 2 to 24 carbon atoms.

4. The additive formulation according to any one of claims 1 to 3, in which component (A) has a number-average molecular weight M_n of from 2000 to 1 000 000.

5. The additive formulation according to any one of claims 1 to 4, in which component (A) comprises less than 15 mol% of olefin not converted in the copolymerization with the sulfur dioxide.

6. The additive formulation according to any one of claims 1 to 5, in which component (B) is obtained by free-radical polymerization of one or more linear or branched α-olefins having from 6 to 50 carbon atoms with maleic anhydride and subsequent reaction with one or more aliphatic polyamines.

7. The additive formulation according to any one of claims 1 to 6, in which component (B) has a weight-average molecular weight M_w of from 500 to 50 000.

8. The additive formulation according to any one of claims 1 to 7, in which component (C) is an organic sulfonic acid which has a hydrocarbyl radical having from 6 to 40 carbon atoms.

9. The additive formulation according to any one of claims 1 to 8, in which component (D) comprises to an extent of at least 80 mass% a high-boiling aromatic hydrocarbon having from 9 to 30 carbon atoms or a mixture of such high-boiling aromatic hydrocarbons.

10. The additive formulation according to claim 9, in which component (D) is a mixture of high-boiling aromatic hydrocarbons having from 9 to 20 carbon atoms.

11. A process for preparing the additive formulation according to any one of claims 1 to 10, which comprises first mixing components (A) and (C) homogeneously with one another in the presence of at least a portion of the high-boiling organic solvent (D), and then incorporating component (B).

12. The use of the additive formulation according to any one of claims 1 to 10 for antistatic treatment and improving the electrical conductivity of inanimate organic material and for preventing electrostatic charge in the course of chemical and physical processes.

13. The use according to claim 12 for antistatic treatment and improving the electrical conductivity of cosmetic preparations, medicament formulations, photographic recording materials, paints, plastics, waxes, solvents, mineral oil products and fuels.

14. Antistatically treated inanimate organic material having improved electrical conductivity, selected from cosmetic preparations, medicament

formulations, photographic recording materials, paints, plastics, waxes, solvents, mineral oil products and fuels, comprising from 0.01 to 2000 ppm by mass of the additive formulation according to any one of claims 1 to 10.

15. A process for preparing olefin-sulfur dioxide copolymers which comprise less than 15 mol% of olefin not converted in the copolymerization with the sulfur dioxide, which comprises using the sulfur dioxide in an at least 1.4-fold molar excess and performing the polymerization in a high-boiling inert organic solvent which comprises one or more molecular types (where at least 50 mass% of these molecule types have more than 8 carbon atoms).

16. A process for preparing olefin-sulfur dioxide copolymers which comprise less than 15 mol% of olefin not converted in the copolymerization with the sulfur dioxide, which comprises using the sulfur dioxide in an at least 1.1-fold molar excess and performing the polymerization in a first stage over a period of from 0.5 to 5 hours at from 30 to 38°C, and thereafter in a second stage over a period of from 1 to 5 hours at from 20 to 29°C.