Claims

1. A film for a medical device or packaging formed from a blend comprising:

a base polymeric formulation comprising polyethylene and poly(ethylene oxide), the polyethylene being present in the blend in an amount in the range of about 50 to less than about 70% by weight and the poly(ethylene oxide) being present in the blend in an amount in the range of greater than 25 to 50 % by weight; and

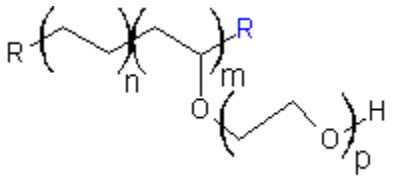
an additive comprising a polyethylene-poly(ethylene oxide) amphiphilic graft copolymer (PE-*g*-PEO) being present in the blend in an amount in the range of about 0.01 to about 5.0 % by weight, wherein a portion of the PEO of the amphiphilic graft copolymer (PE-*g*-PEO) comprises end groups converted to a nitric oxide-releasing agent;

wherein the film is both breathable and a microbial barrier.

2. The film of claim 1, wherein the film has an air permeability before sterilization in the range of 3.5 to 25 seconds per 100 cm^3 according to Gurley Densometer Air Permeability Measurements and a percent permeation of less than 0.1%, preferably wherein the film has a percent penetration in the range of 0.001 to 0.075%.

3. The film of claim 1 or 2 in the form of wound dressing or medical device packaging.

4. The film of anyone of claims 1 to 3, wherein the PE-*g*-PEO is a product of ethylene oxide ring-opening polymerization of an ethylene vinyl acetate copolymer having from 10 to 40 weight percent of vinyl acetate, wherein the PE-*g*-PEO is according to Formula (I):



(I),

wherein R is hydrogen, alkyl, substituted alkyl, vinylic substituted alkyl, hydrocarbyl, substituted hydrocarbyl, or vinylic substituted hydrocarbyl group; the molar value of m is in the range from 2 to 40 mole percent; the molar value

of n is in the range from 60 to 98 mole percent; and p is in the range from 5 to 500 ethylene oxide units.

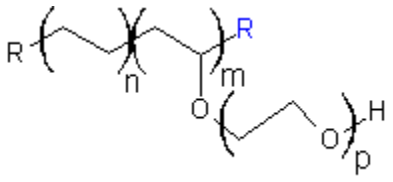
5. The film of anyone of claims 1 to 4, wherein the PE-*g*-PEO has a molecular weight in the range of 400 to 500 kDa, a Brush Density in the range of 17-18, and an Average EO Units in Brush in the range of 120-125, preferably wherein the PE-*g*-PEO comprises PVOH460-*g*-PEO7.

6. The film of any one of claims 1 to 5, wherein the nitric oxide-releasing agent comprises a diazeniumdiolate.

7. A microbial agent for inclusion in medical devices comprising: an olefin-poly(ethylene oxide) amphiphilic graft copolymer, wherein a portion of the poly(ethylene oxide) comprises end groups converted to a nitric oxide-releasing agent.

8. The microbial agent of claim 7, wherein the nitric oxide-releasing agent comprises a diazeniumdiolate.

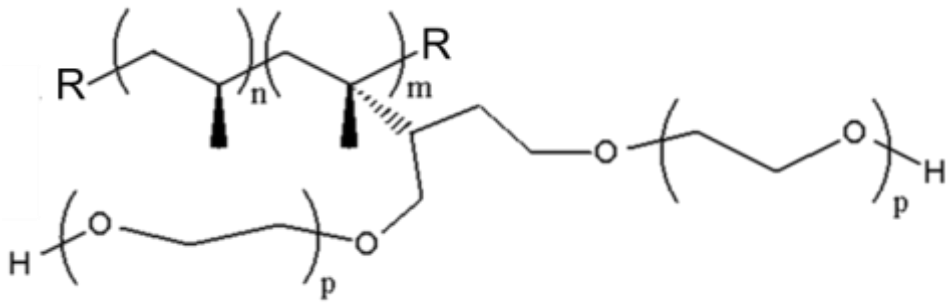
9. The microbial agent of claim 7 or 8, wherein the amphiphilic graft copolymer comprises a polyethylene-poly(ethylene oxide) amphiphilic graft copolymer (PE-*g*-PEO), a polypropylene-poly(ethylene oxide) amphiphilic graft copolymer (PP-*g*-PEO), or mixtures thereof, preferably wherein the amphiphilic graft copolymer comprises a polyethylene-poly(ethylene oxide) amphiphilic graft copolymer (PE-*g*-PEO) that is a product of ethylene oxide ring-opening polymerization of an ethylene vinyl acetate copolymer having from 10 to 40 weight percent of vinyl acetate wherein the PE-*g*-PEO is according to Formula (I):



(I),

wherein R is hydrogen, alkyl, substituted alkyl, vinylic substituted alkyl, hydrocarbyl, substituted hydrocarbyl, or vinylic substituted hydrocarbyl group; the molar value of m is in the range from 2 to 40 mole percent; the molar value of n is in the range from 60 to 98 mole percent; and p is in the range from 5 to 500 ethylene oxide units, and

wherein the amphiphilic graft copolymer comprises a polypropylene-poly(ethylene oxide) amphiphilic graft copolymer (PP-g-PEO) that is a product of a polypropylene-maleic anhydride co-polymer (PP-MA) having from 10-50 weight percent of maleic anhydride wherein the PP-g-PEO is according to Formula (II):



(II),

wherein R is hydrogen, alkyl, substituted alkyl, vinylic substituted alkyl, hydrocarbyl, substituted hydrocarbyl, or vinylic substituted hydrocarbyl group; the molar percentages of grafted maleic anhydride units, m, is in the range from 2 to 10 mole percent; the molar values of propylene units, n, is in the range from 98 to 90 mole percent, and p is in the range of 5 to 500 ethylene oxide units.

10. A wound dressing film comprising a blend of:

a base polymeric formulation comprising polyethylene and poly(ethylene oxide); and

the microbial agent of any of claims 7 to 9;

wherein the film is breathable and provides a microbial barrier.

11. The wound dressing film of claim 10, wherein the nitric oxide-releasing agent comprises a diazeniumdiolate.

12. The wound dressing film of claim 10 or 11 having an air permeability before sterilization in the range of 3.5 to 25 seconds per 100 cm^3 according to Gurley Densometer Air Permeability Measurements and a percent permeation of less than 0.1%.

13. A method of making a medical device comprising:

obtaining a polyethylene-poly(ethylene oxide) amphiphilic graft copolymer (PE-*g*-PEO);

combining the PE-*g*-PEO with a base polymeric formulation comprising a polyethylene and a poly(ethylene oxide) to form a blend, which comprises:

the polyethylene in an amount in the range of 50 to less than 70% by weight;

the poly(ethylene oxide) in an amount in the range of greater than 25 to 50 % by weight;

the PE-*g*-PEO in an amount in the range of 0.01 to 5.0 % by weight;

forming a film from the blend; ; and

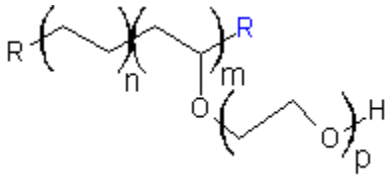
treating the film or the PE-*g*-PEO with a nitric oxide-releasing agent to convert end groups of a portion of the PEO;

wherein the film is both breathable and a microbial barrier.

14. The method of claim 13 wherein the film has an air permeability before sterilization in the range of 3.5 to 25 seconds per 100 cm^3 according to Gurley Densometer Air Permeability Measurements and a percent permeation of less than 0.1%.

15. The method of claim 13 or 14 , wherein the nitric oxide-releasing agent comprises a diazeniumdialate.

16. The method of anyone of claims 13 to 15, wherein the PE-*g*-PEO is a product of ethylene oxide ring-opening polymerization of an ethylene vinyl acetate copolymer having from 10 to 40 weight percent of vinyl acetate, wherein the PE-*g*-PEO is according to Formula (I):



(I),

wherein R is hydrogen, alkyl, substituted alkyl, vinylic substituted alkyl, hydrocarbyl, substituted hydrocarbyl, or vinylic substituted hydrocarbyl group; the molar value of m is in the range from 2 to 40 mole percent; the molar value

of n is in the range from 60 to 98 mole percent; and p is in the range from 5 to 500 ethylene oxide units.