CLAIMS

[Claim 1]

A polyolefin porous membrane comprising protrusions of polyolefin having a size (W) within a range of 5 μm $\leq$W $\leq$50 μm and a height (H) within a range of 0.5 μm $\leq$H and randomly disposed on one side of the polyolefin porous membrane in a density not less than 3 /cm^2 and not greater than 200 /cm^2, and the polyolefin porous membrane having a thickness of not greater than 20 μm.

[Claim 2]

A battery separator, wherein a modified porous layer is laminated on at least a side having protrusions of the porous membrane described in claim 1.

[Claim 3]

The battery separator according to claim 2, wherein the modified porous layer comprises polyamideimide resin, polyimide resin, or polyamide resin.

[Claim 4]

The battery separator according to claim 2, wherein the modified porous layer comprises fluorine-based resin.

[Claim 5]

The battery separator according to any one of claims 2 to 4, wherein the modified porous layer comprises inorganic particles or cross-linked polymer particles.

[Claim 6]

The battery separator according to any one of claims 2 to 5, wherein the thickness of the polyolefin porous membrane is not greater than 16 μm.

[Claim 7]

The battery separator according to any one of claims 2 to 5, wherein the thickness of the

polyolefin porous membrane is not greater than 12 μm.

[Claim 8]

A method of manufacturing a porous membrane, the method comprising:

(a) preparing a polyethylene resin solution by adding a forming solvent to a polyethylene resin, the polyethylene resin comprising not less than 2 wt.% and not greater than 40 wt.% of an ultrahigh molecular weight polyethylene having a weight average molecular weight of not less than 5×10^5 and then melt-kneading the solution;

(b) extruding the polyethylene solution through a die, and chilling by a cooling roll having a surface that the forming solvent thereon is removed and a surface temperature of from 20°C to 40°C, to form a gel-like product;

(c) stretching the gel-like product in the machine direction and in the transverse direction to obtain a stretched and molded material;

(d) extracting and removing the forming solvent from the stretched and molded material followed by drying, to obtain a porous molded material; and

(e) treating the porous molded material by heat to obtain a polyolefin porous membrane.

[Claim 9]

The method of manufacturing a polyolefin porous membrane according to claim 8, wherein means to remove the forming solvent in step (b) is a doctor blade.

[Claim 10]

A method of manufacturing a battery separator, the method comprising:

(a) preparing a polyethylene resin solution by adding a forming solvent to a polyethylene resin, the polyethylene resin comprising not less than 2 wt.% and not greater than 40 wt.% of an ultrahigh molecular weight polyethylene having a weight average molecular weight of not less than 5×10^5 and then melt-kneading the solution;

(b) extruding the polyethylene solution through a die, and chilling by a cooling roll having a surface that the forming solvent thereon is removed and a surface temperature of from 20°C to 40°C, to form a gel-like product;

(c) stretching the gel-like product in the machine direction and in the transverse direction to obtain a stretched and molded material;

(d) extracting and removing the forming solvent from the stretched and molded material followed by drying, to obtain a porous molded material;

(e) treating the porous molded material by heat to obtain a polyolefin porous membrane;

(f) coating the polyolefin porous membrane with a varnish, the varnish comprising fluorine-based resin and inorganic particles or cross-linked polymeric particles, and the fluorine-based resin concentration in the components excluding the inorganic particles or cross-linked polymeric particles in the solution being not less than 0.5 wt.% and not greater than 2.5 wt.%;

(g) passing the polyolefin porous membrane coated with the varnish through a low-humidity zone in which the absolute humidity is less than 6 g/m^3;

(h) passing the polyolefin porous membrane passed through the low-humidity zone through a high-humidity zone in which the absolute humidity is not less than 6 g/m^3; and

(i) converting the coating layer containing the fluorine-based resin to a modified porous layer by immersing the polyolefin porous membrane passed through the high-humidity zone into a coagulating bath, washing, and drying to obtain a battery separator.

[Claim 11]

The method of manufacturing a battery separator according to claim 10, wherein means to remove the forming solvent in step (b) is a doctor blade.