PROBLEMS TO BE SOLVED

[0006]

In Patent Document 1, the micropore structure of the polyolefin microporous membrane described therein has not been focused.

[0007]

The microporous membrane described in Patent Document 2 has a large membrane thickness, and is insufficient as a separator.

[0008]

Accordingly, an object of the present disclosure is to provide a polyolefin multilayer microporous membrane having a high permeability while having good slip characteristics between membranes and a dense microporous structure.

MEANS FOR SOLVING THE PROBLEMS

[0009]

To solve the problems described above, the polyolefin microporous membrane of the present disclosure has the following constitution in a first aspect:

That is, a polyolefin multilayer microporous membrane comprising: at least first microporous layers which form both surface layers and at least a second microporous layer disposed between the both surface layers, wherein the static friction coefficient of one of the surface layers of the polyolefin multilayer microporous membrane against the other surface layer in longitudinal direction (MD) is 1.1 or less, and wherein the pore density calculated from the average pore radius measured by mercury porosimetry method and the porosity, according to the formula below is 4 or more:

[0010]

Pore density = $(P/A^3) \times 10^4$

wherein A represents the average pore radius (nm) measured by mercury porosimetry method and P represents the porosity (%), wherein the composition of the first microporous layer and the composition of the second microporous layer are different each other, and wherein the layer thickness ratio of the first microporous layer/ the second microporous layer/the first microporous layer is from 0.05/0.9/0.05 to 0.3/0.4/0.3.

CLAIMS

1. A polyolefin multilayer microporous membrane comprising:

at least first microporous layers which form both surface layers and at least a second microporous layer disposed between said both surface layers, wherein the static friction coefficient of one of said surface layers of said polyolefin multilayer microporous membrane against the other surface layer in longitudinal direction (MD) is 1.1 or less, and wherein the pore density calculated from the average pore radius measured by mercury porosimetry method and the porosity, according to the formula below is 4 or more:

$$\text{pore density} = (P/A^3) \times 10^4$$

wherein A represents the average pore radius (nm) measured by mercury porosimetry method and P represents the porosity (%), wherein the composition of the first microporous layer and the composition of the second microporous layer are different each other, and wherein the layer thickness ratio of the first microporous layer/ the second microporous layer/the first microporous layer is from 0.05/0.9/0.05 to 0.3/0.4/0.3.

2. The polyolefin multilayer microporous membrane of claim 1, having a breakdown voltage of 1.4 kV/11.5 μm or more, and an air permeability of 250 seconds/100 cc or less.

3. The polyolefin multilayer microporous membrane of claim 2, having an electrochemical stability of 65 mAh or less.

4. The polyolefin multilayer microporous membrane of any one of claims 1 to 3, wherein said second microporous layer contains 35% by weight or more of ultra high molecular weight polyethylene.

5. The polyolefin multilayer microporous membrane of any one of claims 1 to 4, wherein said first microporous layers contain 5% by weight or more of polypropylene.

6. The polyolefin multilayer microporous membrane of claim 1 or 2, wherein said first microporous layers contain 10% by weight or less of ultra high molecular weight polyethylene, and said second microporous layer contains 35% by weight or more of