CLAIMS

1. A liquid crystal display device comprising:

an array substrate;

a counter substrate facing the array substrate;

a sealing material which is provided outside a display region and by which the array substrate is bonded to the counter substrate;

a liquid crystal layer in a region surrounded by the sealing material between the array substrate and the counter substrate; and

alignment films each provided on a surface of a corresponding one of the array substrate and the counter substrate facing the liquid crystal layer to cover an area including the display region, wherein

a plurality of grooves are provided in the surface of the array substrate facing the liquid crystal layer to extend along the sealing material, and are spaced apart from each other in a width direction of the sealing material,

each alignment film covers surfaces of some or all of the grooves located from a midway portion of the sealing material in a width direction thereof toward the display region, and is in contact with the sealing material, and

part of the sealing material located from the midway portion in the width direction in a direction away from the display region is directly in contact with the array substrate without the alignment film being provided between the seal material and the array substrate.

2. The liquid crystal display of claim 1, wherein

a plurality of grooves are provided in the surface of the counter substrate facing the liquid crystal layer to extend along the sealing material, and are spaced apart from each other

in a width direction of the sealing material,

each alignment film covers surfaces of some or all of the grooves in the array substrate and the counter substrate located from the midway portion of the sealing material in the width direction thereof toward the display region, and is in contact with the sealing material, and

the part of the sealing material located from the midway portion in the width direction in a direction away from the display region is directly in contact with the array substrate and the counter substrate without the alignment films being provided between the seal material and the array substrate and between the seal material and the counter substrate.

3. The liquid crystal display device of claim 1 or 2, wherein

at least part of an insulating film included in the array substrate is an organic insulating film, and

the plurality of grooves are formed by removing portions of the organic insulating film.

4. The liquid crystal display device of claim 3, wherein

the plurality of grooves are formed by removing the portions of the organic insulating film extending across a thickness of the organic insulating film.

5. The liquid crystal display device of claim 3 or 4, wherein

the organic insulating film is made of an acrylic resin.

6. The liquid crystal display device of claim 2, wherein

the counter substrate includes a color filter layer at least in the display region and a

region provided with the sealing material, and

the grooves are formed in positions which are located in the region provided with the sealing material and from which portions of the color filter layer are removed by a partial or total thickness of the color filter layer.

7. The liquid crystal display device of claim 2, wherein

the counter substrate includes an overcoat layer at least in the display region and a region provided with the sealing material, and

the grooves are formed in positions which are located in the region provided with the sealing material and from which portions of the overcoat layer are removed by a partial or total thickness of the overcoat layer.

8. The liquid crystal display device of any one of claims 1-7, wherein

in a region of the array substrate in which a first interconnect, a first insulating film, a second interconnect, and a second insulating film are sequentially stacked and the grooves overlap the first interconnect when viewed in plan, a stopper layer formed in a layer identical with the second interconnect is provided between the first insulating film and the second insulating film.

9. The liquid crystal display device of claim 8, wherein

a transparent conductive film is provided on surfaces of the grooves to cover at least the stopper layer.

10. The liquid crystal display device of any one of claims 1-9, wherein

the grooves including two to twenty grooves are arranged in parallel in the array substrate.

11. The liquid crystal display device of any one of claims 2, 7 and 8, wherein the grooves including two to twenty grooves are arranged in parallel in the counter substrate.

12. A liquid crystal display device comprising:

an array substrate including a first interconnect, a first insulating film, a second interconnect, and a second insulating film which are sequentially stacked on a substrate body;

a counter substrate facing the array substrate;

an annular sealing material which is provided outside a display region and by which the array substrate is bonded to the counter substrate;

a liquid crystal layer in a region surrounded by the sealing material between the array substrate and the counter substrate;

alignment films each provided on a surface of a corresponding one of the array substrate and the counter substrate facing the liquid crystal layer to extend outside the display region and to cover an area including the display region; and

a plurality of grooves in the surface of the array substrate facing the liquid crystal layer in a region provided with the sealing material, the grooves extending along the sealing material and being spaced apart from each other in a width direction of the sealing material, wherein

part of the sealing material located from the midway portion of the sealing material in the width direction thereof toward the display region fills some or all of the grooves, and is in contact with the alignment layers, and part of the sealing material located from the midway portion of the sealing material in the width direction thereof in a direction away from the display region is directly in contact with the array substrate.

CLAIMS

[Claim 1]

A liquid crystal display device comprising:

an array substrate;

a counter substrate facing the array substrate;

a sealing material which is provided outside a display region and by which the array substrate is bonded to the counter substrate;

a liquid crystal layer in a region surrounded by the sealing material between the array substrate and the counter substrate; and

alignment films each provided on a surface of a corresponding one of the array substrate and the counter substrate facing the liquid crystal layer to cover an area including the display region, wherein

a plurality of grooves are provided in the surface of the array substrate facing the liquid crystal layer to extend along the sealing material, and are spaced apart from each other in a width direction of the sealing material,

each alignment film covers surfaces of some or all of the grooves located from a midway portion of the sealing material in a width direction thereof toward the display region, and is in contact with the sealing material, and

part of the sealing material located from the midway portion in the width direction in a direction away from the display region is directly in contact with the array substrate without the alignment film being provided between the seal material and the array substrate.

[Claim 2]

The liquid crystal display of claim 1, wherein

a plurality of grooves are provided in the surface of the counter substrate facing the liquid crystal layer to extend along the sealing material, and are spaced apart from each other in a width direction of the sealing material,

each alignment film covers surfaces of some or all of the grooves in the array substrate and the counter substrate located from the midway portion of the sealing material in the width direction thereof toward the display region, and is in contact with the sealing material, and

the part of the sealing material located from the midway portion in the width direction in a direction away from the display region is directly in contact with the array substrate and the counter substrate without the alignment films being provided between the seal material and the array substrate and between the seal material and the counter substrate.

[Claim 3]

The liquid crystal display device of claim 1 or 2, wherein

at least part of an insulating film included in the array substrate is an organic insulating film, and

the plurality of grooves are formed by removing portions of the organic insulating film.

[Claim 4]

The liquid crystal display device of claim 3, wherein

the plurality of grooves are formed by removing the portions of the organic insulating film extending across a thickness of the organic insulating film.

[Claim 5]

The liquid crystal display device of claim 3 or 4, wherein

the organic insulating film is made of an acrylic resin.

[Claim 6]

The liquid crystal display device of claim 2, wherein

the counter substrate includes a color filter layer at least in the display region and a region provided with the sealing material, and

the grooves are formed in positions which are located in the region provided with the sealing material and from which portions of the color filter layer are removed by a partial or total thickness of the color filter layer.

[Claim 7]

The liquid crystal display device of claim 2, wherein

the counter substrate includes an overcoat layer at least in the display region and a region provided with the sealing material, and

the grooves are formed in positions which are located in the region provided with the sealing material and from which portions of the overcoat layer are removed by a partial or total thickness of the overcoat layer.

[Claim 8]

The liquid crystal display device of any one of claims 1-7, wherein

in a region of the array substrate in which a first interconnect, a first insulating film, a second interconnect, and a second insulating film are sequentially stacked and the grooves overlap the first interconnect when viewed in plan, a stopper layer formed in a layer identical with the second interconnect is provided between the first insulating film and the second insulating film.

[Claim 9]

The liquid crystal display device of claim 8, wherein

a transparent conductive film is provided on surfaces of the grooves to cover at least the stopper layer.

[Claim 10]

The liquid crystal display device of any one of claims 1-9, wherein

the grooves including two to twenty grooves are arranged in parallel in the array substrate.

[Claim 11]

The liquid crystal display device of any one of claims 2, 7 and 8, wherein

the grooves including two to twenty grooves are arranged in parallel in the counter substrate.

[Claim 12]

A liquid crystal display device comprising:

an array substrate including a first interconnect, a first insulating film, a second interconnect, and a second insulating film which are sequentially stacked on a substrate body;

a counter substrate facing the array substrate;

an annular sealing material which is provided outside a display region and by which the array substrate is bonded to the counter substrate;

a liquid crystal layer in a region surrounded by the sealing material between the array substrate and the counter substrate;

alignment films each provided on a surface of a corresponding one of the array substrate and the counter substrate facing the liquid crystal layer to extend outside the display region and to cover an area including the display region; and

a plurality of grooves in the surface of the array substrate facing the liquid crystal layer in a region provided with the sealing material, the grooves extending along the sealing material and being spaced apart from each other in a width direction of the sealing material, wherein

part of the sealing material located from the midway portion of the sealing material

in the width direction thereof toward the display region fills some or all of the grooves, and is in contact with the alignment layers, and part of the sealing material located from the midway portion of the sealing material in the width direction thereof in a direction away from the display region is directly in contact with the array substrate.