CLAIMS

1. A mold base for use in manufacture of a mold that has a porous alumina layer over its surface, comprising:

a base; and

an aluminum alloy layer provided on the base,

wherein the aluminum alloy layer contains aluminum, a non-aluminum metal element, and nitrogen.

2. The mold base of claim 1, wherein

an average grain diameter of crystal grains that form the aluminum alloy layer when viewed in a normal direction of the aluminum alloy layer is not more than 100 nm, and

a maximum surface roughness Rmax of the aluminum alloy layer is not more than 60 nm.

3. The mold base of claim 1 or 2, wherein a content of the nitrogen in the aluminum alloy layer is not less than 0.5 mass% and not more than 5.7 mass%.

4. The mold base of any of claims 1 to 3, wherein

an absolute value of a difference between a standard electrode potential of the metal element and a standard electrode potential of aluminum is not more than 0.64 V, and

a content of the metal element in the aluminum alloy

layer is not less than 1.0 mass% and not more than 1.9 mass%.

5. The mold base of any of claims 1 to 4, wherein the metal element is Ti or Nd.

6. The mold base of any of claims 1 to 5, wherein

the base is a metal base, and

the mold base further comprises an inorganic underlayer provided between the metal base and the aluminum alloy layer.

7. The mold base of claim 6, further comprising an organic insulating layer provided between the metal base and the inorganic underlayer.

8. The mold base of claim 6 or 7, further comprising a buffer layer provided between the inorganic underlayer and the aluminum alloy layer,

wherein the buffer layer contains aluminum, the metal element, and oxygen or nitrogen.

9. The mold base of any of claims 6 to 8, wherein

the metal base has a cylindrical shape, and

the inorganic underlayer is provided over an outer perimeter surface of the cylindrical metal base.

10. A method for manufacturing a mold base that includes a cylindrical base and an aluminum alloy layer provided on the base, the aluminum alloy layer containing aluminum, a non-aluminum metal element, and nitrogen, the method comprising the steps of:

(a) arranging the cylindrical base in a film formation chamber so as to be at least capable of rotating around its own cylindrical axis; and

(b) depositing the aluminum alloy layer over an outer perimeter surface of the base according to a DC magnetron sputtering method, using a target that contains aluminum and a non-aluminum metal element, in an atmosphere in the film formation chamber in which a nitrogen gas is mixed, while the base is kept rotating around its own cylindrical axis.

11. The method of claim 10, wherein

step (a) includes arranging a plurality of cylindrical bases such that each of the plurality of cylindrical bases is capable of rotating around its own cylindrical axis and the axes of the plurality of bases orbit along an identical circumference, and

in step (b), each of the plurality of bases orbits along the circumference while rotating around its own cylindrical axis.

12. The method of claim 11, wherein step (a) includes arranging a shield member between the plurality of bases.

13. A method for manufacturing a mold which has an inverted moth-eye structure over its surface, the inverted moth-eye structure having a plurality of recessed portions whose two-dimensional size viewed in a direction normal to its surface is not less than 10 nm and less than 500 nm, the method comprising the steps of:

(a) providing the mold base as set forth in any of claims 1 to 9;

(b) partially anodizing the aluminum alloy layer to form a porous alumina layer which has a plurality of minute recessed portions;

(c) after step (b), bringing the porous alumina layer into contact with an etching solution, thereby enlarging the plurality of minute recessed portions of the porous alumina layer; and

(d) after step (c), further performing anodization to grow the plurality of minute recessed portions.

14. A mold, comprising:

a base; and

a porous alumina layer provided on the base,

wherein the porous alumina layer has a plurality of

recessed portions whose two-dimensional size viewed in a direction normal to its surface is not less than 10 nm and less than 500 nm and contains nitrogen, the porous alumina layer having an inverted moth-eye structure over its surface.

15. The mold of claim 14, further comprising an aluminum alloy layer provided between the base and the porous alumina layer,

wherein the aluminum alloy layer contains aluminum, a non-aluminum metal element, and nitrogen.

[CLAIMS]

[Claim 1]

A mold base for use in manufacture of a mold that has a porous alumina layer over its surface, comprising:

a base; and

an aluminum alloy layer provided on the base,

wherein the aluminum alloy layer contains aluminum, a non-aluminum metal element, and nitrogen.

[Claim 2]

The mold base of claim 1, wherein

an average grain diameter of crystal grains that form the aluminum alloy layer when viewed in a normal direction of the aluminum alloy layer is not more than 100 nm, and

a maximum surface roughness Rmax of the aluminum alloy layer is not more than 60 nm.

[Claim 3]

The mold base of claim 1 or 2, wherein a content of the nitrogen in the aluminum alloy layer is not less than 0.5 mass% and not more than 5.7 mass%.

[Claim 4]

The mold base of any of claims 1 to 3, wherein

an absolute value of a difference between a standard electrode potential of the metal element and a standard electrode potential of aluminum is not more than 0.64 V, and

a content of the metal element in the aluminum alloy layer is not less than 1.0 mass% and not more than 1.9 mass%.

[Claim 5]

The mold base of any of claims 1 to 4, wherein the metal element is Ti or Nd.

[Claim 6]

The mold base of any of claims 1 to 5, wherein

the base is a metal base, and

the mold base further comprises an inorganic underlayer provided between the metal base and the aluminum alloy layer.

[Claim 7]

The mold base of claim 6, further comprising an organic insulating layer provided between the metal base and the inorganic underlayer.

[Claim 8]

The mold base of claim 6 or 7, further comprising a buffer layer provided between the inorganic underlayer and the aluminum alloy layer,

wherein the buffer layer contains aluminum, the metal element, and oxygen or nitrogen.

[Claim 9]

The mold base of any of claims 6 to 8, wherein

the metal base has a cylindrical shape, and

the inorganic underlayer is provided over an outer perimeter surface of the cylindrical metal base.

[Claim 10]

A method for manufacturing a mold base of any of claims 1 to 9, the mold having a cylindrical shape, the method comprising the steps of:

(a) arranging the cylindrical base in a film formation chamber so as to be at least capable of rotating around its own cylindrical axis; and

(b) depositing the aluminum alloy layer over an outer perimeter surface of the base according to a DC magnetron sputtering method, using a target that contains aluminum and a non-aluminum metal element, in an atmosphere in the film formation chamber in which a nitrogen gas is mixed, while the base is kept rotating around its own cylindrical axis.

[Claim 11]

The method of claim 10, wherein

step (a) includes arranging a plurality of cylindrical bases such that each of the plurality of cylindrical bases is capable of rotating around its own cylindrical axis and the axes of the plurality of bases orbit along an identical circumference, and

in step (b), each of the plurality of bases orbits along the circumference while rotating around its own cylindrical axis.

[Claim 12]

The method of claim 11, wherein step (a) includes arranging a shield member between the plurality of bases.

[Claim 13]

A method for manufacturing a mold which has an inverted moth-eye structure over its surface, the inverted moth-eye structure having a plurality of recessed portions whose two-dimensional size viewed in a direction normal to its surface is not less than 10 nm and less than 500 nm, the method comprising the steps of:

(a) providing the mold base as set forth in any of claims 1 to 9;

(b) partially anodizing the aluminum alloy layer to form a porous alumina layer which has a plurality of minute recessed portions;

(c) after step (b), bringing the porous alumina layer into contact with an etching solution, thereby enlarging the plurality of minute recessed portions of the porous alumina layer; and

(d) after step (c), further performing anodization to grow the plurality of minute recessed portions.

[Claim 14]

A mold, comprising:

a base; and

a porous alumina layer provided on the base,

wherein the porous alumina layer has a plurality of recessed portions whose two-dimensional size viewed in a direction normal to its surface is not less than 10 nm and less than 500 nm and the porous alumina layer contains nitrogen, the porous alumina layer having an inverted moth-eye structure over its surface.

[Claim 15]

The mold of claim 14, further comprising an aluminum alloy layer provided between the base and the porous alumina layer,

wherein the aluminum alloy layer contains aluminum, a non-aluminum metal element, and nitrogen.