

CLAIMS

[Claim 1]

A coating liquid for forming an n-type oxide semiconductor film, the coating liquid comprising:

- 5 a Group A element, which is at least one selected from the group consisting of Sc, Y, and Ln;
- a Group B element, which is at least one of In and Tl; and
- a Group C element, which is at least one selected from the group consisting of Group 4 elements, Group 5 elements, Group 6 elements,
- 10 Group 7 elements, Group 8 elements, Group 9 elements, Group 10 elements, Group 14 elements, Group 15 elements, and Group 16 elements;
- wherein the Group C element comprises at least one selected from Ti, Zr, Nb, Mo, W, Re, Os, Ir, Pt, Sn, Sb, and Te.

[Claim 2]

- 15 The coating liquid for forming an n-type oxide semiconductor film according to claim 1,
- wherein a combination of the Group A element and the Group B element is a combination capable of forming a complex oxide having a bixbyite structure.

20 [Claim 3]

The coating liquid for forming an n-type oxide semiconductor film according to claim 1 or 2,

wherein a total number of atoms of the Group A element (NA) and a total number of atoms of the Group B element (NB) satisfy Formula (1) below:

25 [Math. 1]

$$0.02 \leq [\text{NA}/\text{NB}] \leq 0.2 \quad \text{Formula (1)} \quad .$$

[Claim 4]

The coating liquid for forming an n-type oxide semiconductor film

according to any one of claims 1 to 3,

5 wherein a total number of atoms of the Group C element (NC) and a total number of atoms of the Group B element (NB) satisfy Formula (2) below:

[Math. 2]

$$0.0001 \leq [\text{NC}/\text{NB}] \leq 0.05 \quad \text{Formula (2)} \quad .$$

[Claim 5]

10 The coating liquid for forming an n-type oxide semiconductor film

according to any one of claims 1 to 4,

wherein the coating liquid is obtained by dissolving, in the solvent, a

Group A element-including compound including the Group A element, a

Group B element-including compound including the Group B element, and

15 a Group C element-including compound including the Group C element,

wherein the Group A element-including compound comprises at least one selected from the group consisting of inorganic salts, oxides, hydroxides,

organic acid salts, metal alkoxides, organometallics, and metal complexes,

wherein the Group B element-including compound comprises at least one

20 selected from the group consisting of inorganic salts, oxides, hydroxides,

organic acid salts, metal alkoxides, organometallics, and metal complexes,

and

wherein the Group C element-including compound comprises at least one

selected from the group consisting of inorganic salts, oxides, hydroxides,

25 organic acid salts, metal alkoxides, organometallics, and metal complexes.

[Claim 6]

The coating liquid for forming an n-type oxide semiconductor film according to any one of claims 1 to 5, wherein the solvent comprises an organic solvent.

5 [Claim 7]

The coating liquid for forming an n-type oxide semiconductor film according to claim 6, wherein the organic solvent comprises at least one selected from the group consisting of organic acids, organic acid esters, aromatic compounds, diols,
10 glycol ethers, and aprotic polar solvents.

[Claim 8]

A method for producing an n-type oxide semiconductor film, the method comprising:
coating the coating liquid for forming an n-type oxide semiconductor film
15 according to any one of claims 1 to 7 on an object to be coated; and
drying the object and baking the object after the drying.

[Claim 9]

A method for producing a field-effect transistor, the method comprising:
forming a gate electrode on a substrate;
20 forming a gate insulating layer on the gate electrode;
forming a source electrode and a drain electrode on the gate insulating layer to be spaced from each other; and
forming an active layer on the gate insulating layer, and in a channel region between the source electrode and the drain electrode, the active
25 layer being formed of an n-type oxide semiconductor,

wherein the forming the active layer is coating the coating liquid for forming an n-type oxide semiconductor film according to any one of claims 1 to 7 on the gate insulating layer to form the active layer formed of the n-type oxide semiconductor.

5 [Claim 10]

A method for producing a field-effect transistor, the method comprising: forming a source electrode and a drain electrode on a substrate to be spaced from each other;

forming an active layer on the substrate and in a channel region between
10 the source electrode and the drain electrode, the active layer being formed of an n-type oxide semiconductor;

forming a gate insulating layer on the active layer; and

forming a gate electrode on the gate insulating layer,

wherein the forming the active layer is coating the coating liquid for
15 forming an n-type oxide semiconductor film according to any one of claims 1 to 7 on the substrate to form the active layer formed of the n-type oxide semiconductor.

[Claim 11]

The method for producing a field-effect transistor according to claim 9 or
20 10,

wherein, the forming the active layer comprises adjusting, in the coating liquid for forming an n-type oxide semiconductor film, a total number of atoms of the Group A (NA), a total number of atoms of the Group B (NB), and a total number of atoms of the Group C (NC) to control at least one
25 selected from the group consisting of volume resistivity, carrier mobility,

and carrier density of the n-type oxide semiconductor.

[Claim 12]

An n-type oxide semiconductor film, which is a baked product of the coating liquid for forming an n-type oxide semiconductor film according to
5 any one of claims 1 to 7.

[Claim 13]

A semiconductor element comprising
an active layer including the n-type oxide semiconductor film according to
claim 12.

10 [Claim 14]

The semiconductor element according to claim 13,
wherein the semiconductor element is a diode.

[Claim 15]

A field-effect transistor comprising:
15 a gate electrode configured to apply gate voltage;
a source electrode and a drain electrode;
an active layer formed between the source electrode and the drain
electrode, and being formed of an n-type oxide semiconductor film; and
a gate insulating layer formed between the gate electrode and the active
20 layer,
wherein the n-type oxide semiconductor film is the n-type oxide
semiconductor film according to claim 12.