CLAIMS

1. A p-type oxide semiconductor, comprising:

a metal oxide containing thallium (Tl), where the metal oxide has been hole doped, and the metal oxide does not contain a transition metal element.

2. The p-type oxide semiconductor according to claim 1, wherein the metal oxide contains at least one selected from the group consisting of magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba), zinc (Zn), cadmium (Cd), boron (B), aluminum (Al), gallium (Ga), silicon (Si), germanium (Ge), and tellurium (Te).

3. The p-type oxide semiconductor according to claim 1 or 2, wherein the metal oxide contains at least one selected from the group consisting of tin (Sn), antimony (Sb), lead (Pb), and bismuth (Bi).

4. The p-type oxide semiconductor according to any one of claims 1 to 3, wherein the metal oxide contains aluminum (Al), or gallium (Ga), or both.

5. The p-type oxide semiconductor according to claim 4, wherein an amount by mole of thallium (Tl) contained in the metal oxide is substantially equal to a total amount by mole of aluminum (Al) and gallium (Ga) contained in the metal oxide.

6. A composition for producing a p-type oxide semiconductor, comprising:

a solvent; and

a Tl-containing compound,

wherein the composition is used for production of the p-type oxide semiconductor according to any one of claims 1 to 5.

7. A method for producing a p-type oxide semiconductor, comprising:

applying a composition onto a support; and

performing a heat treatment after the applying,

wherein the p-type oxide semiconductor is the p-type oxide semiconductor according to any one of claims 1 to 5, and

wherein the composition contains a solvent, and a Tl-containing compound.

8. A semiconductor element, comprising:

an active layer,

wherein the active layer contains the p-type oxide semiconductor according to any one of claims 1 to 5.

9. The semiconductor element according to claim 8, wherein the semiconductor element is a diode, which contains:

a first electrode;

a second electrode; and

the active layer formed between the first electrode and the second electrode.

10. The semiconductor element according to claim 8, wherein the semiconductor element is a field-effect transistor, which

contains:

a gate electrode configured to apply gate voltage;

a source electrode and a drain electrode, both of which are configured to take electric currents out;

the active layer formed between the source electrode and the drain electrode; and

a gate insulating layer formed between the gate electrode and the active layer.

11. A display element, comprising:

a light control element configured to control light output according to a driving signal; and

a driving circuit, which contains the semiconductor element according to claim 8, and is configured to drive the light control element.

12. The display element according to claim 11, wherein the light control element contains an organic electroluminescent element, an electrochromic element, a liquid crystal element, an electrophoretic element, or an electrowetting element.

13. An image display device, which displays an image corresponding to image data, and which comprising:

a plurality of the display elements according to claim 11, arranged in a matrix;

a plurality of lines each configured to separately apply gate voltage to field-effect transistors in each of the display

elements; and

a display control device configured to individually control the gate voltage of each of field-effect transistors through the lines according to the image data.

14. A system, comprising:

the image display device according to claim 13; and

an image data generating device configured to generate image data based on image information to be displayed, and to output the generated image data to the image display device.