

CLAIMS

1. A semiconductor device comprising:
a gate electrode;
5 an oxide semiconductor film;
a first insulating film between the gate electrode and the oxide semiconductor film; and
a pair of electrodes electrically connected to the oxide semiconductor film,
wherein a film density of the first insulating film is higher than or equal to 2.26
10 g/cm^3 and lower than or equal to 2.63 g/cm^3 , and
wherein, in the first insulating film, a spin density of a signal with a g value of 2.001 is $2 \times 10^{15} \text{ spins/cm}^3$ or less in electron spin resonance.

2. The semiconductor device according to claim 1,
15 wherein the first insulating film comprises silicon oxide or silicon oxynitride.

3. The semiconductor device according to claim 1 further comprising a second insulating film between the gate electrode and the first insulating film.

20 4. A semiconductor device comprising:
a gate electrode;
a first insulating film over the gate electrode;
an oxide semiconductor film over the first insulating film; and
a second insulating film over the oxide semiconductor film,
25 wherein a film density of the first insulating film is higher than or equal to 2.26 g/cm^3 and lower than or equal to 2.63 g/cm^3 ,
wherein, in the first insulating film, a spin density of a signal with a g value of 2.001 is $2 \times 10^{15} \text{ spins/cm}^3$ or less in electron spin resonance,
wherein a film density of the second insulating film is higher than or equal to
30 2.26 g/cm^3 and lower than or equal to 2.63 g/cm^3 , and
wherein, in the second insulating film, a spin density of a signal with a g value

of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance.

5. The semiconductor device according to claim 4,
wherein the first insulating film comprises silicon oxide or silicon oxynitride.

6. The semiconductor device according to claim 4,
wherein the second insulating film comprises silicon oxide or silicon
oxynitride.

7. The semiconductor device according to claim 4 further comprising a third
insulating film between the gate electrode and the first insulating film.

8. The semiconductor device according to claim 4 further comprising a third
insulating film over the second insulating film.

9. A semiconductor device comprising:
an insulating film;
an oxide semiconductor film over the insulating film;
a gate insulating film over the oxide semiconductor film; and
a gate electrode,
wherein a film density of the gate insulating film is higher than or equal to 2.26
g/cm³ and lower than or equal to 2.63 g/cm³,
wherein, in the gate insulating film, a spin density of a signal with a g value of
2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance,
wherein a film density of the insulating film is higher than or equal to 2.26
g/cm³ and lower than or equal to 2.63 g/cm³, and
wherein, in the insulating film, a spin density of a signal with a g value of
2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance.

10. The semiconductor device according to claim 9,
wherein the gate insulating film comprises silicon oxide or silicon oxynitride.

11. The semiconductor device according to claim 9,
wherein the insulating film comprises silicon oxide or silicon oxynitride.

5 12. The semiconductor device according to claim 9 further comprising a pair of
electrodes electrically connected to the oxide semiconductor film,
wherein the pair of electrodes overlaps with the gate electrode.

CLAIMS

1. A semiconductor device comprising:
a gate electrode;
an oxide semiconductor film;
a gate insulating film between the gate electrode and the oxide semiconductor film;
and
a pair of electrodes electrically connected to the oxide semiconductor film,
wherein a film density of the gate insulating film is higher than or equal to 2.26 g/cm³ and lower than or equal to 2.63 g/cm³, and
wherein, in the gate insulating film, a spin density of a signal with a g value of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance.
2. The semiconductor device according to claim 1,
wherein the gate insulating film comprises silicon oxide or silicon oxynitride.
3. The semiconductor device according to claim 1 further comprising an insulating film between the gate electrode and the gate insulating film.
4. A semiconductor device comprising:
a gate electrode;
a gate insulating film over the gate electrode;
an oxide semiconductor film over the gate insulating film; and
a first insulating film over the oxide semiconductor film,
wherein a film density of the gate insulating film is higher than or equal to 2.26 g/cm³ and lower than or equal to 2.63 g/cm³,
wherein, in the gate insulating film, a spin density of a signal with a g value of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance,
wherein a film density of the first insulating film is higher than or equal to 2.26 g/cm³ and lower than or equal to 2.63 g/cm³, and

wherein, in the first insulating film, a spin density of a signal with a g value of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance.

5. The semiconductor device according to claim 4,
wherein the gate insulating film comprises silicon oxide or silicon oxynitride.

6. The semiconductor device according to claim 4,
wherein the first insulating film comprises silicon oxide or silicon oxynitride.

7. The semiconductor device according to claim 4 further comprising a second insulating film between the gate electrode and the gate insulating film.

8. The semiconductor device according to claim 4 further comprising a second insulating film over the first insulating film.

9. A semiconductor device comprising:
an insulating film;
an oxide semiconductor film over the insulating film;
a gate insulating film over the oxide semiconductor film; and
a gate electrode,
wherein a film density of the gate insulating film is higher than or equal to 2.26 g/cm³ and lower than or equal to 2.63 g/cm³,
wherein, in the gate insulating film, a spin density of a signal with a g value of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance,
wherein a film density of the insulating film is higher than or equal to 2.26 g/cm³ and lower than or equal to 2.63 g/cm³, and
wherein, in the insulating film, a spin density of a signal with a g value of 2.001 is 2×10^{15} spins/cm³ or less in electron spin resonance.

10. The semiconductor device according to claim 9,
wherein the gate insulating film comprises silicon oxide or silicon oxynitride.

11. The semiconductor device according to claim 9,
wherein the insulating film comprises silicon oxide or silicon oxynitride.

12. The semiconductor device according to claim 9 further comprising a pair of
electrodes electrically connected to the oxide semiconductor film,
wherein the pair of electrodes overlaps with the gate electrode.

13. The semiconductor device according to claim 4,
wherein one surface of the oxide semiconductor film is in contact with the gate
insulating film, and
wherein another surface of the oxide semiconductor film is in contact with the first
insulating film.

14. The semiconductor device according to claim 4 further comprising a pair of
electrodes electrically connected to the oxide semiconductor film.

15. The semiconductor device according to claim 9 further comprising a pair of
electrodes electrically connected to the oxide semiconductor film.