72-2, **73-1**, **73-2**, **74-1**, **74-2** are formed for the impurity doped insulating films **19**, **51**, **61** formed by impurity doping into the insulating film **39** however, the penetrating parts **31-1**, **31-2**, **32-1**, **32-2**, **33-1**, **33-2**, **34-1**, **34-2**, **53-1**, **53-2**, **54-1**, **54-2**, **55-1**, **55-2**, **56-1**, **56-2**, **71-1**, **71-2**, **72-1**, **72-2**, **73-1**, **73-2**, **74-1**, **74-2** may be formed for the insulating film **39** with no impurity doping which have the same shapes as the case as the impurity doped insulating films **19**, **51**, **61**. The present invention may be applied to a semiconductor pressure sensor and the semiconductor pressure sensor manufacturing method, in which the semiconductor pressure sensor includes a resistor formed on a diaphragm, an insulating film formed on the diaphragm and the resistor, a penetrating part exposing part of the top surface of the resistor, a wiring pattern formed to cover the part the top surface of the resistor exposed by the penetrating part through the top surface of the insulating film.

[0180] The present application is based on Japanese Priority Application No. 2007-219997 filed on Aug. 27, 2007, the entire contents of which are hereby incorporated herein by reference.

What is claimed is:

1. A semiconductor pressure sensor comprising:

a diaphragm;

a resistor provided on a top surface of the diaphragm;

an insulating film formed on the diaphragm and the resistor having a penetrating part exposing a top surface of the resistor; and

a wiring pattern formed from the top surface of the resistor exposed by the penetrating part to a top surface of the insulating film;

wherein a distance between a first crossing part where a plane orthogonal to the top surface of the diaphragm meets a top end of a side plane of the penetrating part and a second crossing part where the plane orthogonal to the top surface of the diaphragm meets a bottom of the side plane of the penetrating part is equal or greater than a thickness of the insulating film by a factor of a square root of two.

2. A semiconductor pressure sensor comprising:

a diaphragm;

a resistor provided on a top surface of the diaphragm;

an insulating film formed on the diaphragm and the resistor having a penetrating part exposing a top surface of the resistor; and

a wiring pattern formed from the top surface of the resistor exposed by the penetrating part to a top surface of the insulating film;

wherein the wiring pattern is formed on the top surface of the resistor and a part of the side plane of the penetrating part from which the wiring pattern extends in an extended direction, and a distance at the part of the side plane of the penetrating part between a first crossing part where a plane orthogonal to the top surface of the diaphragm meets a top end of the side plane of the penetrating part and a second crossing part where the plane orthogonal to the top surface of the diaphragm meets a bottom of the side plane of the penetrating part is equal or greater than a thickness of the insulating film by a factor of a square root of two.

3. The semiconductor pressure sensor as claimed in claim **1**, wherein the insulating film includes an impurity and a concentration of the impurity is higher at a top side of the insulating film than the concentration at a bottom side of the insulating film.

4. The semiconductor pressure sensor as F claimed in claim **1**, wherein a protection film is formed to cover the top surface of the insulating film and the wiring pattern.

5. A semiconductor pressure sensor manufacturing method comprising the steps of:

(a) providing a diaphragm and a resistor formed on a top of the diaphragm and a wiring pattern electrically connected to the resistor;

(b) forming the resistor on a top side of a semiconductor substrate to be used for the diaphragm;

(c) forming an insulating film to cover the resistor and the top of the semiconductor substrate;

(d) doping an impurity into the insulating film from a top side of the insulating film to form an impurity doped insulating film formed of the insulating film and the impurity;

(e) forming a resist film having an opening to expose a top surface of the impurity doped insulating film and the opening is positioned to correspond to a formation region of a penetrating part;

(f) etching the impurity doped insulating film by a wet etching process using the resist film as a mask until the resistor is exposed to form the penetrating part;

(g) forming a metallic film to cover a part of the impurity doped insulating film and the resistor exposed by the penetrating part and the top surface of the impurity doped insulating film, after removing the resist film; and

(h) patterning the metallic film to form the wiring pattern.

6. The semiconductor pressure sensor manufacturing method as claimed in claim **5**, wherein in the step of (f), a distance between a first crossing part where a plane orthogonal to the top surface of the diaphragm meets a top end of a side plane of the penetrating part and a second crossing part where the plane orthogonal to the top surface of the diaphragm meets a bottom of the side plane of the penetrating part is equal or greater than a thickness of the insulating film by a factor of a square root of two.

7. The semiconductor pressure sensor manufacturing method as claimed in claim **5**, wherein in the step of (d), when the impurity is doped into the insulating film, the impurity is prevented from being doped into the semiconductor substrate.

8. The semiconductor pressure sensor manufacturing method as claimed in claim **5**, wherein in the step of (d), the impurity is doped into the entire insulating film.

9. The semiconductor pressure sensor manufacturing method as claimed in claim **5**, wherein in the step of (d), the wiring pattern is formed on the top surface of the resistor and a part of the side plane of the penetrating part from which the wiring pattern extends in an extended direction, and the impurity is doped into only the part of the side plane of the impurity doped insulating film.

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