

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0011]

~~An object~~Embodiments of the invention, ~~which has been~~
5 ~~made under the above mentioned circumstances, is seek to~~
provide a method for preparing a composite substrate in a
simple manner while minimizing bonding failures due to
surface roughness and defects of a support substrate, and a
composite substrate.

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SOLUTION TO PROBLEM

[0012]

Making intensive efforts to attain the above object,
the inventors have found that by forming a
15 polysilazane-containing coating and effecting firing
treatment in an oxygen-containing atmosphere at a heating
temperature of 600°C to 1,200°C, there is obtained a SiO₂
insulating film (SOG) having a substantially equivalent
dielectric strength to the thermally oxidized silicon film.
20 It has also been found that since the SiO₂ film resulting
from polysilazane is improved in smoothening capability such
as step coverage, the use of SiO₂ film which has been
converted at the above temperature enables bonding at the
thickness as of firing treatment without a need for surface
25 polishing, that is, bonding is possible in a simple way as
compared with the CVD technique, at a high level of
insulation, and without a need for polishing. It has also
been found that a SiN insulating film can be formed when the
atmosphere of firing treatment is a nitrogen-containing inert
30 atmosphere or vacuum, and in this case too, the insulating
film can be bonded at the thickness as of firing treatment
without a need for polishing. The invention is predicated on
these findings and ensuing investigations.

[0013]

~~Accordingly, the invention provides a method for preparing a composite substrate and a composite substrate, as defined below.~~

5 ~~[1]~~ According to a first aspect, there is provided a
method for preparing a composite substrate, comprising the
steps of bonding a semiconductor substrate to a support
substrate, and thinning the semiconductor substrate for
thereby yielding a composite substrate having a semiconductor
10 layer on the support substrate, ~~characterized in that~~wherein

a polysilazane-containing coating is formed on either
one of the surfaces of the semiconductor substrate and the
support substrate to be bonded, the coating is subjected to
firing treatment of heating at 600°C to 1,200°C to form a
15 silicon-containing insulating film, and thereafter, the
semiconductor substrate is bonded to the support substrate
via the insulating film.

~~[2] The method for preparing a composite substrate of [1]~~
20 ~~wherein~~ Preferably, the polysilazane is a
perhydropolysilazane.

~~[3] The method for preparing a composite substrate of [1]~~
or ~~[2]~~ wherein Preferably, the firing treatment is carried
out in an atmosphere containing oxygen and/or steam.

~~[4] The method for preparing a composite substrate of [1] or~~
25 ~~[2]~~ wherein Preferably, the firing treatment is carried out
in an inert atmosphere containing nitrogen or under reduced
pressure.

~~[5] The method for preparing a composite substrate of any~~
one of ~~[1] to [4]~~ wherein Preferably, the semiconductor
30 substrate and the support substrate are bonded while keeping
the thickness of the insulating film as of the firing
treatment.

[6] — ~~The method for preparing a composite substrate of any one of [1] to [5],~~ Preferably, the method comprisingcomprises the steps of implanting ions into the surface of the semiconductor substrate to form an ion-implanted region,
5 forming the silicon-containing insulating film on the surface of the

support substrate to be bonded, bonding the ion-implanted surface of the semiconductor substrate to the surface of the support substrate via the insulating film, and separating the semiconductor substrate at the ion-implanted region, thus
5 leaving a semiconductor layer on the support substrate.

~~[7]~~ A composite substrate obtained by the method of any one of ~~[1] to [6]~~ as defined in the first aspect.

ADVANTAGEOUS EFFECTS OF INVENTION

10 [0014]

According to the invention, once a polysilazane-containing coating is formed, an insulating film having good insulating properties and amenable to bonding can be formed in a simple manner, and a composite substrate
15 wherein the insulating film and a semiconductor layer are stacked on a support substrate can be produced which is suitable in electronic device application. Even when a substrate has a rough surface, the insulating film is effective for reducing the roughness of the surface. The
20 insulating film can be bonded at the thickness as of firing treatment without a need for polishing or otherwise treating.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

25 [FIG.. 1] FIG. 1 is a schematic view showing steps of the method for preparing a composite substrate according to one embodiment of the invention; (a) being a cross-sectional view of an ion-implanted semiconductor substrate; (b) being a cross-sectional view of a support substrate having a
30 perhydropolysilazane-containing coating; (c) being a cross-sectional view of the support substrate on which an insulating film has been formed by firing treatment; (d) being a cross-sectional view of a bonded structure of

CLAIMS:

1. A method for preparing a composite substrate, comprising the steps of bonding a semiconductor substrate to a support
5 substrate, and thinning the semiconductor substrate for thereby yielding a composite substrate having a semiconductor layer on the support substrate, ~~characterized in that~~ wherein
a polysilazane-containing coating is formed on either one of the surfaces of the semiconductor substrate and the
10 support substrate to be bonded, the coating is subjected to firing treatment of heating at 600°C to 1,200°C to form a silicon-containing insulating film, and thereafter, the semiconductor substrate is bonded to the support substrate via the insulating film.
- 15 2. The method for preparing a composite substrate of claim 1 wherein the polysilazane is a perhydropolysilazane.
3. The method for preparing a composite substrate of claim
20 1 or 2 wherein the firing treatment is carried out in an atmosphere containing oxygen and/or steam.
4. The method for preparing a composite substrate of claim
25 1 or 2 wherein the firing treatment is carried out in an inert atmosphere containing nitrogen or under reduced pressure.
5. The method for preparing a composite substrate of any one of claims 1 to 4 wherein the semiconductor substrate and
30 the support substrate are bonded while keeping the thickness of the insulating film as of the firing treatment.