Document WO 2008/107029 describes a method for bonding a first substrate and a second substrate in which, to limit the formation of such edge voids, at least one of the substrates is heated before and while said substrates are brought into contact, so as to control the speed of propagation of the bonding wave.

This heating is localized to the peripheral zone in which the edge voids are concentrated, and is implemented by means of a halogen lamp arranged in a quartz housing facing said zone.

However, the heating tends to degrade the carrier (or “chuck”) which holds the substrates during bonding. Specifically, this carrier is formed of a metal base covered with a polymer coating, which separates from the base and deforms, forming blisters under the effect of overly intense heating. However, this damage to the carrier is liable to generate other defects, in particular non-bonded zones, in the final substrate.

If it is sought to reduce the damage to the carrier by decreasing the duration or the intensity of the heating, the speed of propagation of the bonding wave risks being insufficiently controlled, leading to the formation of edge voids.

Furthermore, this method suffers from a lack of stability over time and is therefore not very reproducible.

Brief description of the invention

Embodiments of the invention seek to to define a method for bonding substrates that can make it possible to minimize the formation of edge voids while being more stable and more reproducible than the existing method, and which may not cause damage to the substrate carrier.

An aspect of the invention provides a method for bonding a first substrate and a second substrate, comprising bringing said first and second substrates into contact and implementing heating of a peripheral zone of at least one of said first and second substrates, said heating being initiated before the substrates are brought into contact and continued at least until the substrates are brought into contact in said zone, said method being characterized in that the first and second substrates are held by a carrier having a peripheral region running around the edge of said substrates, the heating is implemented by means of an infrared lamp configured to emit radiation having an outer boundary corresponding to the edge of said substrates, and arranged so as to heat the peripheral zone of the first and/or of the second substrate while excluding the peripheral region of said carrier.

Due to the type of radiation and the arrangement of the lamp with respect to the substrates, it is possible to more effectively heat the water present at the bonding interface, which strongly influences the bonding kinetics, with lower power, while reducing the heating of the substrates and in particular of the substrate carrier.

In some embodiments, the first and second substrates take a circular shape and the infrared lamp takes the shape of an arc of a circle whose diameter is smaller than or equal to the diameter of said substrates.

In some embodiments, the first and second substrates are held by a carrier having a peripheral region running around the edge of said substrates, the infrared lamp being arranged so as to heat the peripheral zone of the first and/or of the second substrate while excluding the peripheral region of said carrier.

Particularly advantageously, the heating ends at the latest at the end of propagation of the bonding wave between the substrates.

According to one preferred embodiment, the infrared lamp emits radiation in a wavelength range suitable for absorption of said radiation by water present between the substrates.

There is also disclosed a method for producing a semiconductor-on-insulator substrate, by transferring a semiconductor layer from a first semiconductor substrate, called the donor substrate, to a second substrate, called the receiver substrate, comprising:

- forming a weakened zone in the donor substrate, so as to delimit a semiconductor layer to be transferred,

- providing a receiver substrate, at least one of the donor substrate and of the receiver substrate being covered with an electrically insulating layer,

- bonding the first substrate and the receiver substrate using the method as described above, the electrically insulating layer being at the bonding interface,

- detaching the donor substrate along the weakened zone so as to transfer the semiconductor layer to the receiver substrate.

Another aspect of the invention relates to an installation for bonding a first substrate and a second substrate

Said installation comprises a carrier configured to hold the first and second substrates as they are brought into contact, said carrier having a peripheral region running around the edge of said substrates, and a lamp arranged facing a peripheral zone of at least one of said first and second substrates, and is characterized in that the lamp is an infrared lamp configured to emit radiation having an outer boundary corresponding to the edge of said substrates, so as not to expose the peripheral region of the carrier to said radiation.

According to one embodiment, the infrared lamp is designed to emit a fast medium wave. This means that the wavelength of the emitted radiation is longer than 1 μm.

Claims

1. A method for bonding a first substrate and a second substrate, comprising bringing said first and second substrates into contact and implementing heating of a peripheral zone of at least one of said first and second substrates, said heating being initiated before the substrates are brought into contact and continued at least until the substrates are brought into contact in said zone, said method being characterized in that the first and second substrates are held by a carrier having a peripheral region running around the edge of said substrates, the heating is implemented by means of an infrared lamp configured to emit radiation having an outer boundary corresponding to the edge of said substrates, and arranged so as to heat the peripheral zone of the first and/or of the second substrate while excluding the peripheral region of said carrier.

2. The method as claimed in claim 1, in which the first and second substrates take a circular shape and the infrared lamp takes the shape of an arc of a circle whose diameter is smaller than or equal to the diameter of said substrates.

3. The method as claimed in one of claims 1 and 2, in which the carrier is formed of a metal base covered with a polymer coating.

4. The method as claimed in one of claims 1 to 3, in which the heating ends at the latest at the end of propagation of the bonding wave between the substrates.

5. The method as claimed in one of claims 1 to 4, in which the infrared lamp emits radiation in a wavelength range suitable for absorption of said radiation by water present between the substrates.

6. A method for transferring a semiconductor layer from a first semiconductor substrate, called the donor substrate, to a second substrate, called the receiver substrate, comprising:

- forming a weakened zone the donor substrate, so as to delimit a semiconductor layer to be transferred,
- providing a receiver substrate, at least one of the donor substrate and of the receiver substrate being covered with an electrically insulating layer,
- bonding the first substrate and the receiver substrate using the method as claimed in one of claims 1 to 5, the electrically insulating layer being at the bonding interface,

- detaching the donor substrate along the weakened zone so as to transfer the semiconductor layer to the receiver substrate.

7. An installation for bonding a first substrate and a second substrate, comprising a carrier configured to hold said first and second substrates as they are brought into contact, said carrier having a peripheral region running around the edge of said substrates, and a lamp arranged facing a peripheral zone of at least one of said first and second substrates, said installation being characterized in that the lamp is an infrared lamp configured to emit radiation having an outer boundary corresponding to the edge of said substrates, so as not to expose the peripheral region of the carrier to said radiation.

8. The installation as claimed in claim 7, in which the infrared lamp is designed to emit a fast medium wave.

9. The installation as claimed in one of claims 7 and 8, in which the infrared lamp comprises a filament designed to be brought to a temperature of approximately 1600°C during operation of the lamp.

10. The installation as claimed in one of claims 7 to 9, in which the infrared lamp has a power peak for a wavelength of between 1.5 and 2 µm.

11. The installation as claimed in one of claims 7 to 9, in which the carrier is formed of a metal base covered with a polymer coating.