WHAT IS CLAIMED IS:

1. A method for manufacturing a semiconductor substrate, comprising the steps of:

irradiating each of first to *n*-th ($n \geq 2$) single crystal semiconductor substrates with ions to form embrittlement layers in each of the first to *n*-th single crystal semiconductor substrates;

bonding the first to *n*-th single crystal semiconductor substrates to first to *n*-th base substrates, with insulating layers provided on at least one of the single crystal semiconductor substrates and the base substrates interposed between the first to *n*-th single crystal semiconductor substrates and the first to *n*-th base substrates, respectively;

fixing first to *n*-th single crystal semiconductor layers to the first to *n*-th base substrates by separation of the first to *n*-th single crystal semiconductor substrates, along the embrittlement layers by heat treatment, respectively;

irradiating a plurality of regions in the first single crystal semiconductor layer with laser beams, wherein each of the laser beams has different energy densities from each other;

detecting a plurality of peak values of detection signals of reflected microwaves of the first single crystal semiconductor layer irradiated with the laser beams, by a microwave photoconductivity decay method, wherein one of the energy densities of the laser beams whose peak value is a maximum in the plurality of the peak values is expressed by $E1_{max}$, and

irradiating the second to *n*-th single crystal semiconductor layers with laser beams whose energy density *E* satisfies the following Formula 1:

$$0.90E1_{max} + 3.9\sigma \leq E \leq E1_{max} - 3.9\sigma,$$

wherein σ satisfies the following Formula 2:

$$\sigma = \sqrt{\sigma_t^2 + \sigma_e^2},$$

wherein σ_t represents a standard deviation of energy density whose intensity of a reflected microwave is a maximum in each of *n* pieces of the single crystal semiconductor layers, and

wherein σ_e represents a standard deviation of energy density of each laser beam

with which semiconductor substrates are irradiated.

2. A method for manufacturing a semiconductor substrate, comprising the steps of:

irradiating each of first to n-th ($n \geq 2$) single crystal semiconductor substrates with ions to form embrittlement layers in each of the first to n-th single crystal semiconductor substrates;

bonding the first to n-th single crystal semiconductor substrates to first to n-th base substrates, with insulating layers provided on at least one of the single crystal semiconductor substrates and the base substrates interposed between the first to n-th single crystal semiconductor substrates and the first to n-th base substrates, respectively;

fixing first to n-th single crystal semiconductor layers to the first to n-th base substrates by separation of the first to n-th single crystal semiconductor substrates, along the embrittlement layers by heat treatment, respectively;

irradiating a plurality of regions in the first single crystal semiconductor layer having a median of thicknesses of n pieces of the single crystal semiconductor layers with laser beams, wherein each of the laser beams has different energy densities from each other;

detecting a plurality of peak values of detection signals of reflected microwaves of the first single crystal semiconductor layer irradiated with the laser beams, by a microwave photoconductivity decay method, wherein one of the energy densities of the laser beams whose peak value is a maximum in the plurality of the peak values is expressed by $E1_{max}$; and

irradiating the second to n-th single crystal semiconductor layers with laser beams whose energy density E satisfies the following Formula 3:

$$0.90E1_{max} + 3.9\sigma \leq E \leq E1_{max} - 3.9\sigma,$$

wherein σ satisfies the following Formula 4:

$$\sigma = \sqrt{(2.87\sigma_d)^2 + \sigma_e^2},$$

wherein σ_d represents a standard deviation of thicknesses of n pieces of the single crystal semiconductor layers, and

wherein σ_e represents a standard deviation of the energy density of the laser

beams for irradiation.

3. A method for manufacturing a semiconductor substrate, comprising the steps of:

irradiating each of first to n-th ($n \geq 2$) single crystal semiconductor substrates with ions to form the embrittlement layers in each of the first to n-th single crystal semiconductor substrates;

bonding the first to n-th single crystal semiconductor substrates to first to n-th base substrates, with insulating layers interposed between the first to n-th single crystal semiconductor substrates and the first to n-th base substrates, respectively;

fixing first to n-th single crystal semiconductor layers to the first to n-th base substrates by separation of the first to n-th single crystal semiconductor substrates, along the embrittlement layers by heat treatment, respectively;

irradiating a plurality of regions in the first single crystal semiconductor layer with laser beams having different energy densities from each other, wherein a thickness of the first single crystal semiconductor layer is the same as, or is the closest to a median of thicknesses of n pieces of the single crystal semiconductor layers;

detecting a plurality of peak values of detection signals of reflected microwaves of the first single crystal semiconductor layer irradiated with the laser beams, by a microwave photoconductivity decay method, wherein one of the energy densities of the laser beams whose peak value is a maximum in the plurality of the peak values is expressed by $E1_{max}$; and

irradiating the second to n-th single crystal semiconductor layers with laser beams whose energy density E satisfies the following Formula 3:

$$0.90E1_{max} + 3.9\sigma \leq E \leq E1_{max} - 3.9\sigma,$$

wherein σ satisfies the following Formula 4:

$$\sigma = \sqrt{(2.87\sigma_d)^2 + \sigma_e^2},$$

wherein σ_d represents a standard deviation of thicknesses of n pieces of the single crystal semiconductor layers, and

wherein σ_e represents a standard deviation of the energy density of the laser beams for irradiation.

4. The method for manufacturing a semiconductor substrate according to claim 1, wherein the laser beams are emittied with energy density with which the second to *n*-th single crystal semiconductor layers are in a partially melted state.

5. The method for manufacturing a semiconductor substrate according to claim 2, wherein the laser beams are emittied with energy density with which the second to *n*-th single crystal semiconductor layers are in a partially melted state.

6. The method for manufacturing a semiconductor substrate according to claim 3, wherein the laser beams are emittied with energy density with which the second to *n*-th single crystal semiconductor layers are in a partially melted state.

7. The method for manufacturing a semiconductor substrate according to claim 1, wherein the laser beams are pulsed laser beams.

8. The method for manufacturing a semiconductor substrate according to claim 2, wherein the laser beams are pulsed laser beams.

9. The method for manufacturing a semiconductor substrate according to claim 3, wherein the laser beams are pulsed laser beams.

10. A semiconductor device formed using the semiconductor substrate formed by the manufacturing method according to claim 1.

11. A semiconductor device formed using the semiconductor substrate formed by the manufacturing method according to claim 2.

12. A semiconductor device formed using the semiconductor substrate formed by the manufacturing method according to claim 3.

WHAT IS CLAIMED IS:

1. A method for manufacturing semiconductor substrates, comprising the steps of:

irradiating each of first to *n*-th ($n \geq 2$) single crystal semiconductor substrates with ions to form embrittlement layers in each of the first to *n*-th single crystal semiconductor substrates;

bonding the first to *n*-th single crystal semiconductor substrates to first to *n*-th base substrates, with insulating layers provided on at least one of the single crystal semiconductor substrates and the base substrates and interposed between the first to *n*-th single crystal semiconductor substrates and the first to *n*-th base substrates, respectively;

creating first to *n*-th single crystal semiconductor layers to the first to *n*-th base substrates, respectively by separation of the first to *n*-th single crystal semiconductor substrates, along the embrittlement layers by heat treatment;

irradiating a plurality of regions in the first single crystal semiconductor layer having a median of thicknesses of *n* pieces of the single crystal semiconductor layers with laser beams, wherein each of the plurality of regions is irradiated with a laser beam having different energy density than other laser beams used for irradiation of other regions of the plurality of regions;

detecting a plurality of peak values of detection signals of reflected microwaves of the first single crystal semiconductor layer irradiated with the laser beams, by a microwave photoconductivity decay method, wherein an energy density of a laser beam that corresponds to a maximum peak value of the detected signals is expressed by $E1_{max}$; and

irradiating the second to *n*-th single crystal semiconductor layers with laser beams whose energy density *E* satisfies the following Formula 1:

$$0.90E1_{max} + 3.9\sigma \leq E \leq E1_{max} - 3.9\sigma,$$

wherein σ satisfies the following Formula 2:

$$\sigma = \sqrt{(2.87\sigma_d)^2 + \sigma_e{}^2},$$

wherein σ_d represents a standard deviation of thicknesses of *n* pieces of the single crystal semiconductor layers, and

wherein σ_e represents a standard deviation of the energy density of the laser beams for irradiation.

2. A method for manufacturing semiconductor substrates, comprising the steps of:

irradiating each of first to n-th ($n \geq 2$) single crystal semiconductor substrates with ions to form embrittlement layers in each of the first to n-th single crystal semiconductor substrates;

bonding the first to n-th single crystal semiconductor substrates to first to n-th base substrates, with insulating layers interposed between the first to n-th single crystal semiconductor substrates and the first to n-th base substrates, respectively;

creating first to n-th single crystal semiconductor layers to the first to n-th base substrates, respectively by separation of the first to n-th single crystal semiconductor substrates, along the embrittlement layers by heat treatment;

irradiating a plurality of regions in the first single crystal semiconductor layer with laser beams, wherein each of the plurality of regions is irradiated with a laser beam having different energy density than other, wherein a thickness of the first single crystal semiconductor layer is the same as, or is the closest to a median of thicknesses of n pieces of the single crystal semiconductor layers;

detecting a plurality of peak values of detection signals of reflected microwaves of the first single crystal semiconductor layer irradiated with the laser beams, by a microwave photoconductivity decay method, wherein an energy density of a laser beam that corresponds to a maximum peak value of the detected signals is expressed by $E1_{max}$; and

irradiating the second to n-th single crystal semiconductor layers with laser beams whose energy density E satisfies the following Formula 1:

$$0.90E1_{max} + 3.9\sigma \leq E \leq E1_{max} - 3.9\sigma,$$

wherein σ satisfies the following Formula 2:

$$\sigma = \sqrt{(2.87\sigma_d)^2 + \sigma_e{}^2},$$

wherein σ_d represents a standard deviation of thicknesses of n pieces of the single crystal semiconductor layers, and

wherein σ_e represents a standard deviation of the energy density of the laser beams for irradiation.

3. The method for manufacturing semiconductor substrates according to claim 1, wherein the laser beams are emitted with energy density with which the second to n-th single crystal semiconductor layers are in a partially melted state.

4. The method for manufacturing semiconductor substrates according to claim 2, wherein the laser beams are emitted with energy density with which the second to n-th single crystal semiconductor layers are in a partially melted state.

5. The method for manufacturing semiconductor substrates according to claim 1, wherein the laser beams are pulsed laser beams.

6. The method for manufacturing semiconductor substrates according to claim 2, wherein the laser beams are pulsed laser beams.