WHAT IS CLAIMED IS:

1. A wafer processing method for dividing a wafer along a plurality of division lines to obtain a plurality of individual device chips, the division lines being formed on a front side of the wafer to thereby define a plurality of separate regions where a plurality of devices are individually formed, the wafer processing method comprising:

a ring frame preparing step of preparing a ring frame having an inside opening for accommodating the wafer;

a polyolefin sheet providing step of positioning the wafer in the inside opening of the ring frame and providing a polyolefin sheet having no adhesive components on a back side or the front side of the wafer and on a back side of the ring frame, such that the polyolefin sheet is in direct contact with the back side or the front side of the wafer and the back side of the ring frame;

a uniting step of heating the polyolefin sheet as applying a pressure to the polyolefin sheet after performing the polyolefin sheet providing step, thereby uniting the wafer and the ring frame through the polyolefin sheet by thermocompression bonding to form a frame unit in a condition where the wafer and a front side of the ring frame are exposed upward;

a dividing step of positioning a focal point of a laser beam inside the wafer, the laser beam having a transmission wavelength to the wafer, and applying the laser beam to the wafer along each division line, thereby forming a modified layer

in the wafer along each division line to divide the wafer into the individual device chips, after performing the uniting step; and

a pickup step of cooling the polyolefin sheet in each of the plurality of separate regions corresponding to each device chip, pushing up each device chip through the polyolefin sheet, then picking up each device chip from the polyolefin sheet after performing the dividing step.

2. The wafer processing method according to claim 1, wherein the uniting step includes a step of applying infrared light to the polyolefin sheet, thereby performing the thermocompression bonding.

3. The wafer processing method according to claim 1, wherein the polyolefin sheet is larger in size than the ring frame, and the uniting step includes an additional step of cutting the polyolefin sheet after heating the polyolefin sheet, thereby removing a part of the polyolefin sheet outside an outer circumference of the ring frame.

4. The wafer processing method according to claim 1, wherein the pickup step includes a step of expanding the polyolefin sheet to thereby increase a spacing between any adjacent ones of the device chips.

5. The wafer processing method according to claim 1, wherein the polyolefin sheet is formed of a material selected from the group consisting of polyethylene, polypropylene, and polystyrene.

6. The wafer processing method according to claim 5, wherein the polyolefin sheet is formed of polyethylene, and the polyolefin sheet is heated in the range of 120°C to 140°C in the uniting step.

7. The wafer processing method according to claim 5, wherein the polyolefin sheet is formed of polypropylene, and the polyolefin sheet is heated in the range of 160°C to 180°C in the uniting step.

8. The wafer processing method according to claim 5, wherein the polyolefin sheet is formed of polystyrene, and the polyolefin sheet is heated in the range of 220°C to 240°C in the uniting step.

9. The wafer processing method according to claim 1, wherein the wafer is formed of a material selected from the group consisting of silicon, gallium nitride, gallium arsenide, and glass.