What is claimed is:

1. An adhesive sheet for back grinding of a semiconductor wafer having convex portions, comprising a non-adhesive cushion layer and an adhesive layer provided on the cushion layer,

wherein the adhesive layer comprises an opening with a diameter smaller than a diameter of the semiconductor wafer,

the adhesive layer is configured to be attached to an outer periphery of the semiconductor wafer so that the convex portions of the semiconductor wafer are placed in the opening, whereby the convex portions are protected by the cushion layer in a state where the semiconductor wafer is attached to the adhesive layer, and

at least one of the following conditions (1) and (2) is satisfied:

(1) tensile stress of the cushion layer punched out by using a dumbbell according to JISZ1702 is 2 to 30N/10mm when the punched-out cushion layer is stretched by 25% at a distance between gauge lines of 40mm and a tensile speed of 300mm/min; and

(2) the cushion layer is composed of a thermoplastic resin with a melt flow rate (JISK7210, 125 °C/10.0kg load) of 0.2 to 30g/10min and a melting point of 60 to 110 °C.

2. The adhesive sheet according to claim 1, wherein the convex portions are protected by being embedded in the cushion layer.

3. The adhesive sheet according to claim 1, wherein the adhesive layer is attached the semiconductor wafer under reduced pressure.

4. The adhesive sheet according to any one of claims 1 to 3, wherein thickness of the cushion layer is 50 to 300 μm and thickness of the adhesive layer is 1 to 100 μm

5. The adhesive sheet according to any one of claims 1 to 4, wherein the adhesive sheet is used in a state where a curable resin and a support film are laminated onto a cushion layer side of the adhesive sheet.

6. The adhesive sheet according to claim 5, wherein the curable resin has a viscosity of 100 to 3,000 mPa·s before curing and Shore D hardness of 5 to 72 after curing.

7. The adhesive sheet according to claim 5 or 6, wherein when height of the convex portion 5 is Td (μm), thickness of the curable resin is (Td+20) to (Td+200) μm.

8. The adhesive sheet according to any one of claims 5 to 7, further comprising: a curable resin layer containing the curable resin; and the support film,

wherein the curable resin layer is provided on an opposite side of a surface of the adhesive sheet provided with the adhesive layer and between the support film and a surface of the cushion layer.

9. The adhesive sheet according to claim 8, further comprising a cured resin layer so as to surround the curable resin layer.

10. A method for manufacturing a semiconductor wafer using the adhesive sheet according to any one of claims 1 to 9, comprising a frame adhering process, a wafer adhering process, a cutting process, a resin curing process, a grinding process, and a peeling process, wherein

in the frame adhering process, the adhesive sheet is adhered to a ring frame,

in the wafer adhering process, the adhesive sheet is adhered to a surface of the semiconductor wafer having the convex portions on a periphery of the semiconductor wafer under reduced pressure,

in the cutting process, the adhesive sheet is cut along the periphery of the semiconductor wafer,

in the resin curing process, the curable resin is cured in a state where the cushion layer is in contact with the curable resin,

in the grinding process, a backside of the semiconductor wafer is ground,

in the peeling process, the adhesive sheet is peeled off from the semiconductor wafer, and

at least one of the following conditions (A) and (B) is satisfied:

(A) the above condition is satisfied (1); and

(B) the above condition (2) is satisfied, the method further comprises a heating process, and in the heating process, the cushion layer is heated to 60 to 150 °C.

11. The method for manufacturing the semiconductor wafer according to claim 10, wherein tensile stress of the cushion layer punched out by using a dumbbell according to JISZ1702 is 2 to 30 N/10 mm when the punched-out cushion layer is stretched by 25% at a distance between gauge lines of 40 mm and a tensile speed of 300 mm/min.

12. The method for manufacturing the semiconductor wafer according to claim 10 or 11, wherein the curable resin has a viscosity of 100 to 3,000 mPa·s before curing and Shore D hardness of 5 to 72 after curing.

13. The method for manufacturing the semiconductor wafer according to any one of claims 10 to 12 further comprising a pressing process between the wafer adhering process and the resin curing process, wherein, in the pressing process, the curable resin is pressed and spread by moving the adhesive sheet while the adhesive sheet faces the curable resin supplied on the support film.