

[CLAIMS]

1. A composite sheet for forming a protective film comprising an adhesive layer on a substrate, and a film for forming a protective film on the adhesive layer, the adhesive layer having active energy ray curability, and the film for forming a protective film having heat curability, wherein

the composite sheet for forming a protective film is used for producing a semiconductor chip with a protective film by affixing the composite sheet to a back surface of a semiconductor wafer via the film for forming a protective film, and then curing the film for forming a protective film by heating to form a protective film, subsequently dicing the semiconductor wafer to produce semiconductor chips, curing the adhesive layer by irradiation with active energy rays, and then picking up the semiconductor chips together with the protective film affixed to a back surface thereof,

the adhesive layer comprises, at least in a layer that contacts the film for forming a protective film, an alkyl (meth)acrylate ester copolymer,

the alkyl (meth)acrylate ester copolymer has a structural unit derived from an alkyl (meth)acrylate ester in which a carbon number of the alkyl group that constitutes the alkyl ester is 8 or greater,

in the composite sheet for forming a protective film, after the film for forming a protective film is cured by heating at 130°C for 2 hours to form the protective film, when the adhesive layer before curing is peeled off from the protective film under conditions of a peel angle of 180°, a temperature of 23°C and a pull speed of 300 mm/minute, the peel strength before adhesive layer curing is at least 2,000 mN/25mm,

in the composite sheet for forming a protective film, after the film for forming a protective film is cured by heating at 130°C for 2 hours to form the protective film and the adhesive layer is cured by irradiating the adhesive layer with ultraviolet rays at an illuminance of 220 mW/cm² and an irradiation dose of 190 mJ/cm², when the adhesive layer after curing is peeled off from the protective film under conditions of a peel angle of 180°, a temperature of 23°C and a pull speed of 300 mm/minute, the peel strength after adhesive layer curing is at least 2,000 mN/25mm,

the ratio of the peel strength before adhesive layer curing relative to the peel strength after adhesive layer curing is at least 1.5,

the film for forming a protective film comprises an acrylic-based resin, an epoxy resin and a heat curing agent,

the monomer that constitutes the acrylic-based resin comprises an alkyl (meth)acrylate esters in which the alkyl group that constitutes the alkyl ester is a chain-like group having a carbon number of 1 to 18, and a hydroxyl group-containing (meth)acrylate ester,

the heat curing agent is a curing agent for the epoxy resin, and

in the film for forming a protective film, the total amount of the epoxy resin and the heat curing agent is 1 to 100 parts by mass when the amount of the acrylic-based resin is 100 parts by mass.

2. The composite sheet for forming a protective film according to Claim 1, wherein the film for forming a protective film comprises an imidazole,

the heat curing agent is a heat curing agent that melts upon heating and exhibits curing activity relative to the epoxy resin.

3. The composite sheet for forming a protective film according to Claim 1 or 2, wherein the carbon number of the structural unit derived from the alkyl (meth)acrylate ester in which the carbon number of the alkyl group that constitutes the alkyl ester is 8 or greater is within a range from 11 to 18.

4. The composite sheet for forming a protective film according to any one of Claims 1 or 3, wherein the adhesive layer comprises
2-hydroxy-1-{4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]phenyl}-2-methyl-propan-1-one as a photopolymerization initiator.

5. A method for producing a semiconductor chip with a protective film using the composite sheet for forming a protective film according to any one of Claims 1 to 4 comprising:

affixing the composite sheet to a back surface of a semiconductor wafer via the film for forming a protective film, and then curing the film for forming a protective film by heating to form a protective film, subsequently dicing the semiconductor wafer to produce semiconductor chips, curing the adhesive layer by irradiation with active energy rays, and then picking up the semiconductor chips together with the protective film affixed to a back surface thereof.