

What is claimed is:

1. A mold release film disposed on a cavity surface of a mold for producing a semiconductor package, the mold release film comprising

a first surface in contact with a curable resin with which a semiconductor element is encapsulated to form a resin-encapsulation portion, and

a second surface in contact with the cavity surface, wherein

at least the first surface is made of a fluororesin, and

the first surface has at least one of an atomic F/Al ratio measured by test method A of from 0.2 to 4 and an atomic F/(C+F+O) ratio measured by test method B of from 0.1 to 0.3:

the test method A measures the F/Al ratio by piling a first 1 mm thick cardboard, the mold release film, a 0.1 mm thick aluminum plate made of A1N30H-H18 material in accordance with JIS H4160, and a second 1 mm thick cardboard in this order to form a pile in which the first surface contacts the aluminum plate, pressing the pile for 5 minutes at 180° C. and under a pressure of 5 MPa, peeling the mold release film off from the aluminum plate, and analyzing the surface of the aluminum plate in contact with the mold release film by an X-ray photoelectron spectroscopy to obtain the F/Al ratio;

the test method B measures the $F/(C+F+O)$ ratio by placing a 100 μm thick aluminum foil of a square shape with a size of 15 cm $\times$ 15 cm on a 3 mm thick first metal plate of a square shape with a size of 15 cm $\times$ 15 cm, placing a 100 mm thick spacer of a square shape with a size of 15 cm $\times$ 15 cm having a rectangular hole of 10 cm $\times$ 8 cm opened at its center on the aluminum foil, placing 2 g of an epoxy resin in the vicinity of the center of the hole, placing thereon the mold release film of a square shape with a size of 15 cm $\times$ 15 cm so that the first surface is on the spacer side, and placing thereon a 3 mm thick second metal plate of a square shape with a size of 15 cm $\times$ 15 cm to prepare a laminated sample; pressing the laminated sample for 5 minutes at 180° C. and under a pressure of 10 MPa to cure the epoxy resin; subsequently removing the second metal plate, the mold release film and the spacer, and analyzing the surface of the cured epoxy resin in contact with the mold release film by an X-ray photoelectron spectroscopy to obtain the $F/(C+F+O)$ ratio, where the epoxy resin is an epoxy granular resin for encapsulating semiconductors with trade name SUMIKON EME G770H type F ver. GR manufactured by Sumitomo Bakelite Co., Ltd.

2. The mold release film according to claim 1, which has a thickness of from 16 to 200 μm .

3. The mold release film according to claim 1, which is a film of a single-layer structure made of the fluororesin.

4. The mold release film according to claim 1, wherein the fluororesin is a fluoroolefin polymer.

5. The mold release film according to claim 4, wherein the fluoroolefin polymer is an ethylene/tetrafluoroethylene copolymer.

6. The mold release film according to claim 5, wherein the ethylene/tetrafluoroethylene copolymer comprises a unit based on tetrafluoroethylene, a unit based on ethylene and a unit based on a third monomer other than tetrafluoroethylene and ethylene, and

a molar ratio of the unit based on tetrafluoroethylene to the unit based on ethylene in the ethylene/tetrafluoroethylene copolymer is from 80/20 to 40/60.

7. The mold release film according to claim 6, wherein the third monomer is hexafluoropropylene, perfluoro(propyl vinyl ether), (perfluoroethyl) ethylene or (perfluorobutyl) ethylene.

8. The mold release film according to claim 6, wherein the third monomer is (perfluorobutyl) ethylene.

9. The mold release film according to claim 5, wherein the ethylene/tetrafluoroethylene copolymer comprises a unit based on tetrafluoroethylene of from 40 to 69.7 mol %, a unit based on ethylene of from 30 to 59.7 mol %, and a unit based on a third monomer other than tetrafluoroethylene and ethylene of from 0.3 to 1.7 mol %, based on all units in the ethylene/tetrafluoroethylene copolymer.

10. The mold release film according to claim 5, wherein the ethylene/tetrafluoroethylene copolymer has a melt flow rate of from 2 to 40 g/10 min.

11. The mold release film according to claim 4, wherein the fluoroolefin polymer is a perfluoro(alkyl vinyl ether)/tetrafluoroethylene copolymer.

12. The mold release film according to claim 1, wherein the mold release film is made of a fluororesin film obtained by contacting a fluororesin film with a solvent to reduce components extractable by the solvent.

13. A process for producing a semiconductor package, the process comprising

disposing the mold release film according to claim 1 on the cavity surface of the mold to be in contact with the curable resin so that the first surface faces the space in the cavity,

forming the resin-encapsulation portion by disposing a substrate having the semiconductor element mounted thereon in the cavity, encapsulating the semiconductor element with the curable resin, and curing the curable resin such that the curable resin is in contact with the mold release film, thereby obtaining an encapsulated product comprising the substrate, the semiconductor element mounted on the substrate, and the resin-encapsulation portion for encapsulating the semiconductor element, and

releasing the encapsulated product from the mold.

14. A process for producing a semiconductor package, the method comprising

disposing the mold release film according to claim 1 on the cavity surface of the mold to be in contact with the curable resin, so that the first surface faces the space in the cavity,

forming the resin-encapsulation portion by disposing a substrate having a semiconductor element mounted thereon in the cavity, encapsulating the semiconductor element with the curable resin, and curing the curable resin such that the curable resin is in contact with the mold release film, thereby obtaining an encapsulated product comprising the substrate, the semiconductor element mounted on the substrate, and the resin-encapsulation portion for encapsulating the semiconductor element,

releasing the encapsulated product from the mold, and forming an ink layer by using an ink on the surface of the resin-encapsulation portion in contact with the mold release film.

15. The mold release film according to claim 1, wherein the first surface has the F/A1 ratio measured by the test method A of from 0.2 to 4.

16. The mold release film according to claim 1, wherein the first surface has the $F/(C+F+O)$ ratio measured by test method B of from 0.1 to 0.3.

17. The mold release film according to claim 1, which is a film of a multilayered structure.

18. The mold release film according to claim 1, wherein at least one of the first and second surfaces has an arithmetic mean roughness Ra of from 1.5 to 2.1 μm .