efficiently cool a resin composition.

[0006] The above object is achieved by the present invention which is specified in the following (1) to (16).

(1) A cooling apparatus comprising:

a conveying means which conveys a resin composition formed into a sheet shape along a direction parallel to a surface of the sheet shaped resin composition; and

a cooling means which cools the resin composition being conveyed by the conveying means,

wherein a temperature of the resin composition just before being cooled by the cooling means is in the range of 40 to 60°C, and

wherein the cooling means has a cooling ability to cool the resin composition such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/min.

[0007] (2) The cooling apparatus described above (1), wherein the cooling means has a fan section having at least one outlet port which discharges cooling air of which temperature is in the range of -40 to 0°C to the resin composition being conveyed.

[0008] (3) The cooling apparatus described above (2), wherein a humidity of the cooling air is equal to or less than 10%.

[0009] (4) The cooling apparatus described above (2) or (3), wherein when the cooling air is discharged from the outlet port, a pressure of the cooling air is equal to or higher than 0.2 MPa.

[0010] (5) The cooling apparatus described in any one of above (2) to (4), wherein the at least one outlet port includes a plurality of outlet ports and the plurality of outlet ports are provided along a conveying direction of the resin composition.

[0011] (6) The cooling apparatus described in any one of above (2) to (5), wherein each outlet port discharges the cooling air to the resin composition from an upper side thereof.

[0012] (7) The cooling apparatus described in any one of above (2) to (5), wherein each outlet port discharges the cooling air to the resin composition from an opposite side with respect to the conveying direction of the resin composition.

[0013] (8) The cooling apparatus described in any one of above (2) to (7), wherein the cooling means is configured to discharge the cooling air to the resin composition from the both sides thereof.

[0014] (9) The cooling apparatus described in any one of above (2) to (8), wherein the cooling means is configured to gradually reduce the temperature of the cooling air.

[0015] (10) The cooling apparatus described in any one of above (1) to (9), wherein the conveying means has a pair of pulleys provided so as to be spaced apart from each other and a belt wrapped around the pair of pulleys, on which the resin composition is placed, conveying the resin composition by rotation of each of the pulleys, and

wherein at least a surface of the belt is constituted of a nonmetallic material.

[0016] (11) The cooling apparatus described above (10), wherein the belt is constituted of a laminated body and an outer layer positioned at an outermost side of the laminated body is constituted of a nonmetallic material.

[0017] (12) The cooling apparatus described in any one of above (1) to (11), further comprising a chamber containing both the resin composition and the belt therein and maintaining a cooling atmosphere obtained by the cooling

means while the resin composition is conveyed by the belt.

[0018] (13) The cooling apparatus described in any one of above (1) to (12), wherein the resin composition is formed into a sheet shape by kneading the resin composition by a kneading device and then pressurizing the kneaded resin composition between a pair of rollers, and

wherein the cooling apparatus is provided at a downstream side of the pair of rollers from which the kneaded and pressurized resin composition is discharged.

[0019] (14) The cooling apparatus described in any one of above (1) to (13), wherein a thickness of the resin composition is equal to or less than 5 mm.

[0020] (15) The cooling apparatus described in any one of above (1) to (14), wherein the resin composition is used as a molding portion constituting an outer packaging of an IC package.

[0021] (16) A cooling method for cooling a resin composition formed into a sheet shape while conveying the resin composition along a direction parallel to a surface of the sheet shaped resin composition,

wherein a temperature of the resin composition just before being cooled by the cooling method is in the range of 40 to 60°C, and

wherein the resin composition is cooled such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/min.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Fig. 1 is a process chart showing a producing process of a resin composition.

Fig. 2 is partial cross section view showing a cooling apparatus according to one embodiment of the present invention and peripheral apparatuses thereof.

What is claimed is:

1. A cooling apparatus comprising:

a conveying means which conveys a resin composition molded into a sheet shape along a direction parallel to a surface of the sheet-shaped resin composition; and

a cooling means which cools the resin composition being conveyed by the conveying means,

wherein a temperature of the resin composition just before being cooled by the cooling means is in the range of 40 to 60°C, and

wherein the cooling means has a cooling ability to cool the resin composition such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/min.

2. The cooling apparatus as claimed in claim 1, wherein the cooling means has a fan section having at least one outlet port which discharges cooling air of which temperature is in the range of -40 to 0°C to the resin composition being conveyed.

3. The cooling apparatus as claimed in claim 2, wherein a humidity of the cooling air is equal to or less than 10%.

4. The cooling apparatus as claimed in claim 2, wherein when the cooling air is discharged from the outlet port, a pressure of the cooling air is equal to or higher than 0.2 MPa.

5. The cooling apparatus as claimed in claim 2, wherein the at least one outlet port include has a plurality of outlet ports and the plurality of outlet ports are provided along a conveying direction of the resin composition.

6. The cooling apparatus as claimed in claim 2, wherein each outlet port discharges the cooling air to the resin composition from an upper side thereof.

7. The cooling apparatus as claimed in claim 2, wherein each outlet port discharges the cooling air to the resin composition from an opposite side with respect to the conveying direction of the resin composition.

8. The cooling apparatus as claimed in claim 2, wherein the cooling means is configured to discharge the cooling air to the resin composition from the both sides thereof.

9. The cooling apparatus as claimed in claim 2, wherein the cooling means is configured to gradually reduce the temperature of the cooling air.

10. The cooling apparatus as claimed in claim 1, wherein the conveying means has a pair of pulleys arranged so as to be spaced apart from each other and a belt wrapped around the pair of pulleys, on which the resin composition is placed, conveying the resin composition by rotation of each of the pulleys, and

wherein at least a surface of the belt is constituted of a nonmetallic material.

11. The cooling apparatus as claimed in claim 10, wherein the belt is constituted of a laminated body and an outer layer positioned at an outermost side of the laminated body is constituted of a nonmetallic material.

12. The cooling apparatus as claimed in claim 1, further comprising a chamber containing both the resin composition and the belt therein and maintaining a cooling atmosphere obtained by the cooling means while the resin composition is conveyed by the belt.

13. The cooling apparatus as claimed in claim 1, wherein the resin composition is molded into a sheet shape by kneading the resin composition by a kneading apparatus and then pressurizing the kneaded resin composition between a pair of rollers, and

wherein the cooling apparatus is provided at a downstream side of the pair of rollers to which the kneaded and pressurized resin composition is discharged.

14. The cooling apparatus as claimed in claim 1, wherein a thickness of the resin composition is equal to or less than 5 mm.

15. The cooling apparatus as claimed in claim 1, wherein the resin composition is used as a molding portion constituting an outer packaging of an IC package.

16. A cooling method for cooling a resin composition molded into a sheet shape while conveying the resin composition along a direction parallel to a surface of the sheet-shaped resin composition,

wherein a temperature of the resin composition just before being cooled by the cooling method is in the range of 40 to 60°C, and

wherein the resin composition is cooled such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/min.

efficiently cool a resin composition.

[0006] The above object is achieved by the present invention which is specified in the following (1) to (14).

(1) A cooling apparatus comprising:

a conveying means which conveys a resin composition formed into a sheet shape along a direction parallel to a surface of the sheet shaped resin composition; and

a cooling means which cools the resin composition being conveyed by the conveying means,

wherein a temperature of the resin composition just before being cooled by the cooling means is in the range of 40 to 60°C, and

wherein the cooling means has at least one outlet port which discharge cooling air of -40 to 0°C to the resin composition such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/ sec and a dehumidification section which is provided at an upstream side of the outlet port and adjusts a humidity of the cooling air to be equal to or less than 10%.

[0009] (2) The cooling apparatus described above (1), wherein when the cooling air is discharged from the outlet port, a pressure of the cooling air is equal to or higher than 0.2 MPa.

[0010] (3) The cooling apparatus described above (1) or (2), wherein the at least one outlet port includes a plurality of outlet ports and the plurality of outlet ports are provided along a conveying direction of the resin composition.

[0011] (4) The cooling apparatus described in any one of above (1) to (3), wherein each outlet port discharges the cooling air to the resin composition from an upper side thereof.

[0012] (5) The cooling apparatus described in any one of above (1) to (4), wherein each outlet port discharges the cooling air to the resin composition from

an opposite side with respect to the conveying direction of the resin composition.

[0013] (6) The cooling apparatus described in any one of above (1) to (5), wherein the cooling means is configured to discharge the cooling air to the resin composition from the both sides thereof.

[0014] (7) The cooling apparatus described in any one of above (1) to (6), wherein the cooling means is configured to gradually reduce the temperature of the cooling air.

[0015] (8) The cooling apparatus described in any one of above (1) to (7), wherein the conveying means has a pair of pulleys provided so as to be spaced apart from each other and a belt wrapped around the pair of pulleys, on which the resin composition is placed, conveying the resin composition by rotation of each of the pulleys, and

wherein at least a surface of the belt is constituted of a nonmetallic material.

[0016] (9) The cooling apparatus described above (8), wherein the belt is constituted of a laminated body and an outer layer positioned at an outermost side of the laminated body is constituted of a nonmetallic material.

[0017] (10)The cooling apparatus described in any one of above (1) to (9), further comprising a chamber containing both the resin composition and the belt therein and maintaining a cooling atmosphere obtained by the cooling means while the resin composition is conveyed by the belt.

[0018] (11)The cooling apparatus described in any one of above (1) to (10), wherein the resin composition is formed into a sheet shape by kneading the resin composition by a kneading device and then pressurizing the kneaded resin composition between a pair of rollers, and

wherein the cooling apparatus is provided at a downstream side of the

pair of rollers from which the kneaded and pressurized resin composition is discharged.

[0019] (12)The cooling apparatus described in any one of above (1) to (11), wherein a thickness of the resin composition is equal to or less than 5 mm.

[0020] (13)The cooling apparatus described in any one of above (1) to (12), wherein the resin composition is used as a molding portion constituting an outer packaging of an IC package.

[0021] (14)A cooling method for cooling a resin composition formed into a sheet shape by a cooling means having at least one outlet port which discharge cooling air to the resin composition and a dehumidification section which is provided at an upstream side of the outlet port and dehumidifies the cooling air while conveying the resin composition along a direction parallel to a surface of the sheet shaped resin composition,

wherein the resin composition is cooled by discharging the cooling air of which temperature is in the range of -40 to 0°C and a humidity is equal to or less than 10% such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/sec.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Fig. 1 is a process chart showing a producing process of a resin composition.

Fig. 2 is partial cross section view showing a cooling apparatus according to one embodiment of the present invention and peripheral apparatuses thereof.

What is claimed is:

1. A cooling apparatus comprising:

a conveying means which conveys a resin composition molded into a sheet shape along a direction parallel to a surface of the sheet-shaped resin composition; and

a cooling means which cools the resin composition being conveyed by the conveying means,

wherein a temperature of the resin composition just before being cooled by the cooling means is in the range of 40 to 60°C, and

wherein the cooling means has at least one outlet port which discharge cooling air of -40 to 0°C to the resin composition such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/sec and a dehumidification section which is provided at an upstream side of the outlet port and adjusts a humidity of the cooling air to be equal to or less than 10%.

2. The cooling apparatus as claimed in claim 1, wherein when the cooling air is discharged from the outlet port, a pressure of the cooling air is equal to or higher than 0.2 MPa.

3. The cooling apparatus as claimed in claim 1 or 2, wherein the at least one outlet port includes a plurality of outlet ports and the plurality of outlet ports are provided along a conveying direction of the resin composition.

4. The cooling apparatus as claimed in any one of claims 1 to 3, wherein each outlet port discharges the cooling air to the resin composition from an upper side thereof.

5. The cooling apparatus as claimed in any one of claims 1 to 4, wherein each outlet port discharges the cooling air to the resin composition from an opposite side with respect to the conveying direction of the resin composition.

6. The cooling apparatus as claimed in any one of claims 1 to 5, wherein the cooling means is configured to discharge the cooling air to the resin composition from the both sides thereof.

7. The cooling apparatus as claimed in any one of claims 1 to 6, wherein the cooling means is configured to gradually reduce the temperature of the cooling air.

8. The cooling apparatus as claimed in any one of claims 1 to 7, wherein the conveying means has a pair of pulleys arranged so as to be spaced apart from each other and a belt wrapped around the pair of pulleys, on which the resin composition is placed, conveying the resin composition by rotation of each of the pulleys, and

wherein at least a surface of the belt is constituted of a nonmetallic material.

9. The cooling apparatus as claimed in claim 8, wherein the belt is constituted of a laminated body and an outer layer positioned at an outermost side of the laminated body is constituted of a nonmetallic material.

10. The cooling apparatus as claimed in any one of claims 1 to 9, further comprising a chamber containing both the resin composition and the belt therein and maintaining a cooling atmosphere obtained by the cooling means while the resin composition is conveyed by the belt.

11. The cooling apparatus as claimed in any one of claims 1 to 10, wherein the resin composition is molded into a sheet shape by kneading the resin composition by a kneading apparatus and then pressurizing the kneaded resin composition between a pair of rollers, and

wherein the cooling apparatus is provided at a downstream side of the pair of rollers to which the kneaded and pressurized resin composition is discharged.

12. The cooling apparatus as claimed in any one of claims 1 to 11, wherein a thickness of the resin composition is equal to or less than 5 mm.

13. The cooling apparatus as claimed in any one of claims 1 to 12, wherein the resin composition is used as a molding portion constituting an outer packaging of an IC package.

14. A cooling method for cooling a resin composition molded into a sheet shape by a cooling means having at least one outlet port which discharge cooling air to the resin composition and a dehumidification section which is provided at an upstream side of the outlet port and dehumidifies the cooling air while conveying the resin composition along a direction parallel to a surface of the sheet-shaped resin composition,

wherein the resin composition is cooled by discharging the cooling air of which temperature is in the range of -40 to 0°C and a humidity is equal to or less than 10% such that a cooling rate of the resin composition is in the range of 0.2 to 5°C/sec.