CLAIMS

[Claim 1]

A refrigerator comprising:

a storage compartment for storing an object to be cooled;

a cooling unit configured to supply cool air into the storage compartment; and

a controller configured to control the cooling unit to perform a first process for a first time period and a second process for a second time period repeatedly,

the first process being a process to decrease a temperature of the storage compartment to a first temperature that is lower than a freezing point of the object to be cooled, and

the second process being a process to increase the temperature of the storage compartment to a second temperature that is higher than the freezing point of the object to be cooled, wherein

a time integral value of a temperature difference between the freezing point and a temperature in the storage compartment during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be cooled, and a time integral value of a temperature difference between the freezing point and a temperature in the storage compartment during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled are equal to each other.

[Claim 2]

A refrigerator comprising:

a storage compartment for storing an object to be cooled;

a cooling unit configured to supply cool air into the storage compartment; and

a controller configured to control the cooling unit to perform a first process for a first time period and a second process for a second time period repeatedly,

the first process being a process to decrease a temperature of the storage compartment to a first temperature that is lower than a freezing point of the object to be cooled, and

the second process being a process to increase the temperature of the storage compartment to a second temperature that is higher than the freezing point of the object to be cooled, wherein

the second time period is a length of time taken for a time integral value of a temperature difference between the freezing point and a temperature in the storage compartment during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be cooled, and a time integral value of a temperature difference between the freezing point and a temperature in the storage compartment during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled to be equalized with each other.

[Claim 3]

A refrigerator comprising:

a storage compartment for storing an object to be cooled;

a cooling unit configured to supply cool air into the storage compartment; and

a controller configured to control the cooling unit to perform a first process for a first time period and a second process for a second time period repeatedly,

the first process being a process to decrease a temperature of the storage compartment to a first temperature that is lower than a freezing point of the object to be cooled, and

the second process being a process to increase the temperature of the storage compartment to a second temperature that is higher than the freezing point of the object to be cooled, wherein

a first heat quantity during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be

cooled falls less than a second heat quantity during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled, and the second heat quantity falls less than a total value of the first heat quantity and a third heat quantity,

the first heat quantity is a time integral value of a temperature difference between the freezing point and the temperature in the storage compartment during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be cooled,

the second heat quantity is a time integral value of a temperature difference between the freezing point and the temperature in the storage compartment during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled, and

the third heat quantity is obtained from a difference between the second temperature and the temperature in the storage compartment when supercooling of the object to be cooled is terminated.

[Claim 4]

A refrigerator comprising:

a storage compartment for storing an object to be cooled;

a cooling unit configured to supply cool air into the storage compartment; and

a controller configured to control the cooling unit to perform a first process for a first time period and a second process for a second time period repeatedly,

the first process being a process to decrease a temperature of the storage compartment to a first temperature that is lower than a freezing point of the object to be cooled, and

the second process being a process to increase the temperature of the storage compartment to a second temperature that is higher than the freezing point of the object to be cooled, wherein

the second time period is a length of time in which a first heat quantity during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be cooled falls less than a second heat quantity during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled, and the second heat quantity falls less than a total value of the first heat quantity and a third heat quantity,

the first heat quantity is a time integral value of a temperature difference between the freezing point and the temperature in the storage compartment during a time period in which the temperature in the storage compartment remains lower than the freezing point of the object to be cooled,

the second heat quantity is a time integral value of a temperature difference between the freezing point and the temperature in the storage compartment during a time period in which the temperature in the storage compartment remains higher than the freezing point of the object to be cooled, and

the third heat quantity is obtained from a difference between the second temperature and the temperature in the storage compartment when supercooling of the object to be cooled is terminated.

[Claim 5]

The refrigerator of any one of claims 1 to 4, wherein

the first time period is equal to or less than an allowable freezing time period that is a time period until freezing of the object to be cooled is recognized.

[Claim 6]

The refrigerator of claim 5, wherein

the allowable freezing time period is predetermined according to the first temperature.

[Claim 7]

The refrigerator of claim 6, wherein

the allowable freezing time period is eight hours if the first temperature is set to -3 degrees C.

[Claim 8]

The refrigerator of any one of claims 5 to 7, wherein

the allowable freezing time period is a time period when a number of breaking peaks obtained when the object to be cooled is cut is larger than that obtained at a start of freezing.

[Claim 9]

The refrigerator of any one of claims 1 to 8, wherein

the first process includes:

an introduction process to decrease in stages a set temperature of the storage compartment to the first temperature; and

a low-temperature maintenance process to maintain the set temperature of the storage compartment at the first temperature after the introduction process.

[Claim 10]

The refrigerator of any one of claims 1 to 9, wherein

the cooling unit is provided with a damper configured to adjust an air volume to be supplied to the storage compartment, and

the controller controls the damper in the second process to increase the temperature of the storage compartment to the second temperature.

[Claim 11]

The refrigerator of any one of claims 1 to 9, further comprising a heating unit configured to heat the storage compartment, wherein

the controller controls the heating unit in the second process to increase the temperature of the storage compartment to the second temperature.

[Claim 12]

The refrigerator of any one of claims 1 to 11, wherein

the first temperature is set in a range of -4 to -2 degrees C.