# DESCRIPTION

TITLE OF THE INVENTION:

ALUMINA POWDER, PROCESS FOR ~~ITS~~ PRODUCTION OF THE SAME, AND RESIN COMPOSITIONS ~~EMPLOYING IT~~CONTAINING THE SAME

## TECHNICAL FIELD

The present invention relates to an alumina powder having a high average circularity and an improved flowability at the time of being highly filled, a process for its production and a resin composition employing it.

## BACKGROUND ART

In recent years, along with the progress in high functionality and high speed of heat-generating electronic components such as IC, the amount of heat generation of electronic devices having such components has been increasing, and a high heat dissipating property is desired also for a sealing material for semiconductors. In order to increase the heat dissipating property of a sealing material for semiconductors, an alumina powder having a high thermal conductivity may be incorporated to a rubber or resin. However, by a common Bayer process alumina powder, it was not possible to sufficiently utilize the thermal conductivity of the alumina, because of a remarkable rising viscosity phenomenon at the time of being highly filled.

In order to solve such a problem, a method has been proposed to spray an aluminum hydroxide powder or an aluminum hydroxide powder slurry into flames from a feed pipe having an intensive dispersing function to obtain spherical alumina powder particles (Patent Document 1). The spherical alumina particles obtained by this method had surface irregularities derived from aluminum hydroxide raw material, even with particles having an average sphericity of at least 0.90, and thus, they are still desired to be improved. Further, also in a case where Bayer process alumina powder is used as a raw material, the product has, on its surface, irregularities derived from the raw material and thus is still desired to be improved.

## PRIOR ART DOCUMENT

### PATENT DOCUMENT

Patent Document 1: JP-A-2001-19425

DISCLOSURE ~~OF THE INVENTION~~

OBJECT TO BE ACCOMPLISHED ~~BY THE INVENTION~~

It is an object of the present ~~invention~~ disclosure to provide an alumina powder having a high average circularity and having an improved flow property at the time of being highly filled, a process for its production, and a resin composition employing it.

MEANS TO ACCOMPLISH THE OBJECT

The present ~~invention~~ disclosure provides the following to accomplish the above object.

In a first aspect of the present disclosure, there is provided an alumina powder which contains an α-phase and a θ-phase as main crystals, and has an α-phase content of at most 40% as measured by the following method, an average circularity of at least 0.95 in each of the particle size range of from 45 to 200 μm and the particle size range of less than 45 μm, and an average particle size of at most 100 μm:

[method for measuring α-phase content]

Powders prepared by mixing α-phase alumina powder and θ-phase alumina powder in mass ratios of 0:10, 5:5 and 10:0, respectively, are subjected to X-ray diffraction measurements, whereupon the integrated intensity of a peak of α-phase detected in the vicinity of 2θ=43° is calculated, and a calibration line of the integrated intensity plotted against the mixing ratio is made; and then, a sample of the alumina powder is subjected to an X-ray diffraction measurement, whereupon the integrated intensity of a peak in the vicinity of 2θ=43° is calculated, and the α-phase content is obtained from the calibration line.

In a second aspect of the present disclosure, there is provided a resin composition containing the alumina powder of the first aspect in a resin or rubber.

In a third aspect of the present disclosure, there is provided a sealing material for semiconductors, employing the resin composition of the second aspect.

In a fourth aspect of the present disclosure, there is provided a heat dissipator employing the resin composition of the second aspect.

The present disclosure also provides the following:

(1) An alumina powder which has an α-phase content of at most 40% as measured by the following method, an average circularity of at least 0.95 in each of the particle size range of from 45 to 200 μm and the particle size range of less than 45 μm, and an average particle size of at most 100 μm:

[method for measuring α-phase content]

Powders prepared by mixing α-phase alumina powder and θ-phase alumina powder in mass ratios of 0:10, 5:5 and 10:0, respectively, are subjected to X-ray diffraction measurements, whereupon the integrated intensity of a peak of α-phase detected in the vicinity of $2\theta=43^{\circ}$ is calculated, and a calibration line of the integrated intensity plotted against the mixing ratio is made; and then, a sample of the alumina powder is subjected to an X-ray diffraction measurement, whereupon the integrated intensity of a peak in the vicinity of $2\theta=43^{\circ}$ is calculated, and the α-phase content is obtained from the calibration line.

(2) A process for producing the alumina powder as defined in the above (1), which comprises heat-treating a pulverized product of fused alumina in flames.

(3) The process for producing the alumina powder according to the above (2), which comprises quenching after the heat-treatment of a pulverized product of fused alumina.

(4) A resin composition containing the alumina powder as defined in the above (1) in a resin or rubber.

(5) The resin composition according to the above (4), wherein the resin is an epoxy resin.

(6) The resin composition according to the above (4), wherein the resin is a silicone

resin.

(7) The resin composition according to the above (4), wherein the rubber is a silicone rubber.

(8) A sealing material for semiconductors, employing the resin composition as defined in the above (4) or (5).

(9) A heat dissipator employing the resin composition as defined in any one of the above (4) to (7).

## ADVANTAGEOUS EFFECTS ~~OF THE INVENTION~~

According to the present ~~invention~~disclosure, it is possible to provide an alumina powder which has a high average circularity and which can maintain the flow property at a high level even at the time of being highly filled in a resin composition and thus is suitable as a filler, and a process for its production. The alumina powder of the present ~~invention~~ disclosure is useful as a sealing material for semiconductors, a heat dissipator, etc.

## BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a schematic view illustrating an embodiment of the process for producing the alumina powder of the present invention.

## BEST MODE FOR CARRYING OUT THE INVENTION

Now, the present invention will be described in detail.

For the alumina powder of the present invention, a fused alumina pulverized product is used as a raw material, whereby it is possible to reduce the surface cracking of alumina powder particles thereby to increase the flowability.

Further, by controlling the α-phase content in the alumina powder to be at most 40%, an improvement can be made also with respect to the surface irregularities of the particles, whereby the flowability can further be increased. The α-phase content should better be close to 0, and it is more preferably at most 30%, particularly preferably from 20 to 0%.

The α-phase content in the alumina powder can be controlled by changing the cooling condition after the heat treatment of a pulverized product of fused alumina. Such cooling can be carried out by spraying water into the furnace at a middle body

CLAIMS:

1. An alumina powder which contains an α-phase and a θ-phase as main crystals, and has an α-phase content of at most 40% as measured by the following method, an average circularity of at least 0.95 in each of the particle size range of from 45 to 200 μm and the particle size range of less than 45 μm, and an average particle size of at most 100 μm:

[method for measuring α-phase content]

Powders prepared by mixing α-phase alumina powder and θ-phase alumina powder in mass ratios of 0:10, 5:5 and 10:0, respectively, are subjected to X-ray diffraction measurements, whereupon the integrated intensity of a peak of α-phase detected in the vicinity of 2θ=43° is calculated, and a calibration line of the integrated intensity plotted against the mixing ratio is made; and then, a sample of the alumina powder is subjected to an X-ray diffraction measurement, whereupon the integrated intensity of a peak in the vicinity of 2θ=43° is calculated, and the α-phase content is obtained from the calibration line.

~~2. A process for producing the alumina powder as defined in Claim 1, which comprises heat-treating a pulverized product of fused alumina in flames.~~

2. The alumina powder according to Claim 1, wherein the α-phase content is at most 30%.

~~3. The process for producing the alumina powder according to Claim 2, which comprises quenching after the heat-treatment of a pulverized product of fused alumina.~~

3. The alumina powder according to Claim 1 or 2, wherein the α-phase content is at most 20%.

4. A resin composition containing the alumina powder as defined in Claim 1 in a resin or rubber.

5. The resin composition according to Claim 4, wherein the resin is an epoxy resin or a silicone resin.

~~6. The resin composition according to Claim 4, wherein the resin is a silicone resin.~~

~~7~~6. The resin composition according to Claim 4, wherein the rubber is a silicone rubber.

~~8~~7. A sealing material for semiconductors, employing the resin composition as defined in Claim 4 or 5.

~~9~~8. A heat dissipator employing the resin composition as defined in any one of Claims 4 to ~~7~~6.