This method is superior in that a constant amount of a phosphor can be more easily arranged on an LED chip than a method of dispensing a liquid resin, in which a phosphor heretofore put to practical use is dispersed, on an LED chip and curing the resin, and color and brightness of the resulting white LED can be uniform.

[Citation List]

[Patent Literatures]

[0006]

[PTL 1] Japanese Patent Laid-open Publication No. 5-152609

[PTL 2] Japanese Patent Laid-open Publication No. 7-99345

[PTL 3] Japanese Patent Publication No. 4146406

[PTL 4] Japanese Patent Laid-open Publication No. 2010-156528

[PTL 5] Japanese Patent Laid-open Publication No. 2009-235368

[PTL 6] Japanese Patent Laid-open Publication No. 2010-123802

[PTL 7] Japanese Patent Publication No. 2011-102004

[PTL 8] Japanese Patent Laid-open Publication No. 2010-159411

[Summary ~~of Invention~~]

[Technical Problem]

[0007]

In order to apply the LED to general lighting uses, it is required to sustain light emitting of high brightness for a long time. Therefore, light resistance of withstanding long

are problems that brightness is deteriorated or uneven brightness is generated.

[0013]

In view of the above-mentioned problems, it is an object of the~~an~~ embodiments disclosed herein~~of the present invention~~ to provide a sheet to be used for an LED encapsulation material and the like, which is excellent in light resistance. Further, it is an object of the~~another~~ embodiments disclosed herein~~of the present invention~~ to provide a phosphor sheet which has optical properties not impaired and which exhibits excellent thickness uniformity even when containing large-sized phosphor particles in a high concentration.

[Solution to Problem]

[0013a]

In a first aspect, there is provided a phosphor sheet containing a phosphor, a resin, and silicone fine particles wherein the content of the phosphor is 53 weight% or more of the entire sheet.

[0013b]

In a second aspect, there is provided a phosphor sheet containing at least a silicone resin, a phosphor and silicone fine particles, wherein an average particle size of the silicone fine particles is 0.01 μm or more and 2 μm or less.

[0013c]

In a third aspect, there is provided a phosphor sheet containing at least a silicone resin, a phosphor and silicone fine particles, wherein the content of the silicone fine particles is 1 part by weight or more and 20 parts by weight or less with respect to 100 parts by weight of the silicone resin.

[0013d]

In a fourth aspect, there is provided a phosphor sheet containing at least silicone resin, a phosphor and silicone fine particles, wherein the silicone fine particles are made of a silicone resin obtained by condensing organosilane.

[0013e]

In a fifth aspect, there is provided a phosphor sheet containing at least a silicone resin, a phosphor and silicone fine particles, wherein a difference between a refractive index d1 of the silicone fine particles and a refractive index d2 of the silicone resin is smaller than plus or minus 0.10.

[0013f]

In a sixth aspect, there is provided the phosphor sheet as defined herein, which is used for covering the surface of an LED.

[0013g]

In a seventh aspect, there is provided a cured product obtained by curing the phosphor sheet as defined herein.

[0013h]

In an eighth aspect, there is provided an LED having the phosphor sheet as defined herein or a cured product thereof.

[0013h]

In a ninth aspect, there is provided a method for manufacturing an LED comprising a step of bonding the phosphor sheet as defined herein to an LED chip.

[0013i]

In a tenth aspect, there is provided a method for manufacturing an LED comprising a step of bonding the phosphor sheet as defined herein; and a step of curing the phosphor sheet.

[0013j]

In an eleventh aspect, there is provided a light emitting device comprising the LED as defined herein.

[0014]

An embodiment of the present disclosure~~invention~~ is aimed at preventing the degradation of the phosphor sheet due to light generated from an LED chip by increasing the content of the phosphor in the phosphor sheet to a certain level or more. That is, one embodiment of the present disclosure~~invention~~ pertains to a phosphor sheet, wherein the content of a phosphor is 53 weight% or more of the entire sheet.

[0015]

Further, another embodiment of the present disclosure~~invention~~

pertains to a phosphor sheet containing at least a silicone resin, a phosphor and silicone fine particles.

[Advantageous Effects ~~of Invention~~]

[0016]

In accordance with an embodiment of the present disclosure~~invention~~, a phosphor sheet having excellent light resistance can be provided. Further, in accordance with another embodiment of the present disclosure~~invention~~, a phosphor sheet having excellent optical properties and a uniform thickness while containing phosphor particles in a high concentration can be obtained, and an LED light emitting device of high quality, in which there are no irregularities of brightness and color, can be obtained when the phosphor sheet is used as a wavelength-converting sheet of an LED element.

[Brief Description of Drawings]

[0017]

[Fig. 1]

Fig. 1 is a schematic view showing an example of an LED chip of a flip chip type.

[Fig. 2]

Fig. 2 is a schematic view showing an example of an LED chip of a face up type.

[Fig. 3]