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Nanomanufacturing -- Key control characteristics -- Luminescent nanomaterials -- Part 1: Quantum efficiency

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Foreword

The plan of GB/T 37664 "Nanomanufacturing Key Control Characteristics Luminescent Nanomaterials" is divided into the following parts.

---Part 1.Quantum efficiency;

---Part 2.The quality of quantum dot dispersion.

This part is Part 1 of GB/T 37664.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

The translation method used in this part is equivalent to IEC 62607-3-1.2014 "Nanomanufacturing Key Control Characteristics Part 3-1.Luminous Nano

Quantum efficiency of rice materials.

This section has made the following editorial changes.

---Change the standard name to "Nano-manufacturing key control characteristics of luminescent nanomaterials Part 1.Quantum efficiency".

This part was proposed by the Chinese Academy of Sciences.

This part is under the jurisdiction of the National Nanotechnology Standardization Technical Committee (SAC/TC279).

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Introduction

One of the main driving forces in the development of solid state lighting (SSL) field comes from the improvement of the electro-optical conversion efficiency of lighting devices.

high. The efficiency of incandescent lighting devices and fluorescent lighting devices is only about 5% to 30%, and the efficiency of incandescent lighting devices is the lowest. According to

Ming is the main source of electrical energy consumption, so improving the conversion efficiency of lighting devices will greatly affect the world's energy consumption pattern. SSL device

The measurement of luminous efficiency is the key to its overall efficiency measurement. At present, standard methods for these measurements have been established. These methods are very important for manufacturers and consumers.

It is important for consumers to obtain reliable product information. The measurement of luminous efficiency is also important for the luminescent materials that light-emitting diode (LED) manufacturers rely on.

It is very important, but there is no standard for measuring the luminous efficiency of such materials. This section provides a comparison for SSL manufacturers from different

Supplier's general method of luminous efficiency of luminescent nanomaterials, this method can also be used for general LED luminescent materials.

A conventional SSL device contains a blue LED chip and a luminescent material, and the blue LED excites the luminescent material to emit monochromatic light of appropriate color

Or multi-color light to produce the desired white spectrum. This device is called a fluorescence conversion type light-emitting diode (or pc-LED), which first produces blue

Light converts part of the blue light into broadband visible light radiation, and indirectly converts electrical energy into white light. Quantum dots (QDs) or nano phosphors are photoinduced

A new type of luminescent material, this type of material can convert blue LED waves into broad-spectrum visible light. Compared with the traditional size larger than 5µm

Compared with typical phosphor particles, quantum dots and nano phosphors have greater color tunability, narrowband emission spectrum, broadband absorption, and nearly unlimited flocculation.

The characteristics of setting time, not easy to bleach and weak scattering, so the application of QDs and nano phosphors in this field has attracted widespread attention.

QD-based pc-LED is superior to other pc-LEDs on the market in comprehensive performance such as color rendering index, color temperature and lumen efficiency.

In the lighting industry, quantum efficiency is a key parameter of luminescent materials. In this section, the meaning of fluorescence quantum efficiency is the emission of luminescent nanoparticles.

The ratio of the number of emitted photons to the number of absorbed photons is also called fluorescence quantum yield. Because the measurement of relative quantum efficiency is easier, and this

Application of measurement in biomedical imaging (QDs are widely used in the field of biomedical imaging R

Suppliers of luminescent nanomaterials usually only measure the relative quantum efficiency (or quantum yield) in solution. In order to reduce the agglomeration and weight of nanoparticles

The influence of absorption is usually measured at low concentrations. However, the actual concentration of luminescent nanomaterials in the final application

May vary. For example, in order to meet the requirements for luminous flux and color temperature in SSL devices, a high concentration of luminescent nanoparticles may be required

(Solid or liquid) formula products. This section standardizes this method for the first time, whether it is a solution or a solid, as long as a solid state (e.g.,

Luminous nanoparticles embedded in a polymer matrix, coated on optical glass, directly applied to light-emitting diodes, and other forms) and solutions

A test method for the absolute quantum efficiency of samples (e.g., colloidal suspensions of luminescent nanoparticles), suppliers and users can compare different materials

Between performance.